VALUE ENGINEERING SUMMARY
OF
I-75 WIDENING
BETWEEN KY 192 AND KY 80
LAUREL COUNTY, KENTUCKY

APRIL 13-17, 1998

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EXECUTIVE SUMMARY

Introduction

This Value Engineering report summarizes the results of the Value Engineering study performed during the week of April 13-17, 1998. This study was conducted as part of a Value Engineering Workshop conducted by Ventry Engineering for the Kentucky Transportation Cabinet.

The subject of the study was the I-75 Widening from KY 192 (Exit 38) to KY 80 (Exit 41) in Laurel County, Kentucky. This project was broken into three separate projects for the workshop: I-75 mainline, KY 192 interchange, and KY 80 interchange. This report covers the Value Engineering study for the I-75 mainline

Project Description

The project studied is the reconstruction of I-75 mainline in Laurel County, Kentucky. This project is one portion of a larger project to widen I-75 between KY 192 and KY 80. The project involves the widening of I-75 and reconstructing the interstate bridge over Parker Road. The Parker Road bridge is currently a two lane RCDG structure. The bridge will be replaced with a eight lane structure with full shoulders. A new section of bridge will be built in between the existing twin structures with traffic being re-routed to the interior while the existing bridges will be demolished.

The estimated construction cost for the project is $18,604,325.12. No additional right of way is anticipated to be needed.

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 Cost
- Maintenance of Traffic

- Construction Time
- Maintenance Cost
- Project Schedule
- Right of Way Impacts
- Service Life
- Salvage Value
- Design Criteria
- Environmental Concerns
- Local Access

Results

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:

Recommendation No. 1 - Bridge over Parker Road

The Value Engineering Team recommends that this VE Alternative be implemented. This alternative shortens the bridge from three span to one span by constructing MSE walls at the abutments.

If this recommendation can be implemented, there is a possible savings of $800,000.

Recommendation No. 2 - Modify Template

The Value Engineering Team recommends that this VE Alternative be implemented. This alternate consists of flattening the slopes and decreasing the inside shoulder from 4.2 meters to 3.6 meters

If this recommendation can be implemented, there is a possible savings of $777,600.

Recommendation No. 3 - Use Department provided temporary barrier wall

The Value Engineering Team recommends that this VE alternative be implemented. This alternate uses temporary barrier wall from the Department's stockpiles with the contractor installing the barrier.

If this recommendation can be implemented, there is a possible savings of $903,111.

Recommendation No. 4 - Use standard height barrier with glare screens in lieu of extended height barrier

The Value Engineering Team recommends that this VE alternative be implemented. This alternate uses temporary barrier wall from the Department's stockpiles with the contractor installing the barrier.

If this recommendation can be implemented, there is a possible savings of $240,592.40.

Recommendation No. 5 - Eliminate guardrail

The Value Engineering Team recommends that this VE alternative be implemented. This alternate uses flattening of the slopes thus eliminating the proposed guardrail.

If this recommendation can be implemented, there is a possible savings of $52,852.00.

Recommendation No. 6 - Use current approved end treatments

The Value Engineering Team recommends that this VE alternative be implemented. This alternate uses updated end treatments for any guardrail that may be necessary,

If this recommendation can be implemented, there is a possible savings of $0.00.

Recommendation No. 7 - Eliminate two strands of perforated pipe under pavement

The Value Engineering Team recommends that this VE alternative be implemented. This alternate eliminates two of the five strands of perforated pipe

If this recommendation can be implemented, there is a possible savings of $828,596.

Recommendation No. 8 - Box Culverts

The Value Engineering Team recommends that this VE alternative be implemented. This alternate recommends not extending the box culverts but warping the fill around the ends.

If this recommendation can be implemented, there is a possible savings of $204,000.

Recommendation No. 9 - Eliminate perforated pipe headwalls

The Value Engineering Team recommends that this VE alternative be implemented. This alternate eliminates the need for perforated pipe headwalls and using granular material.

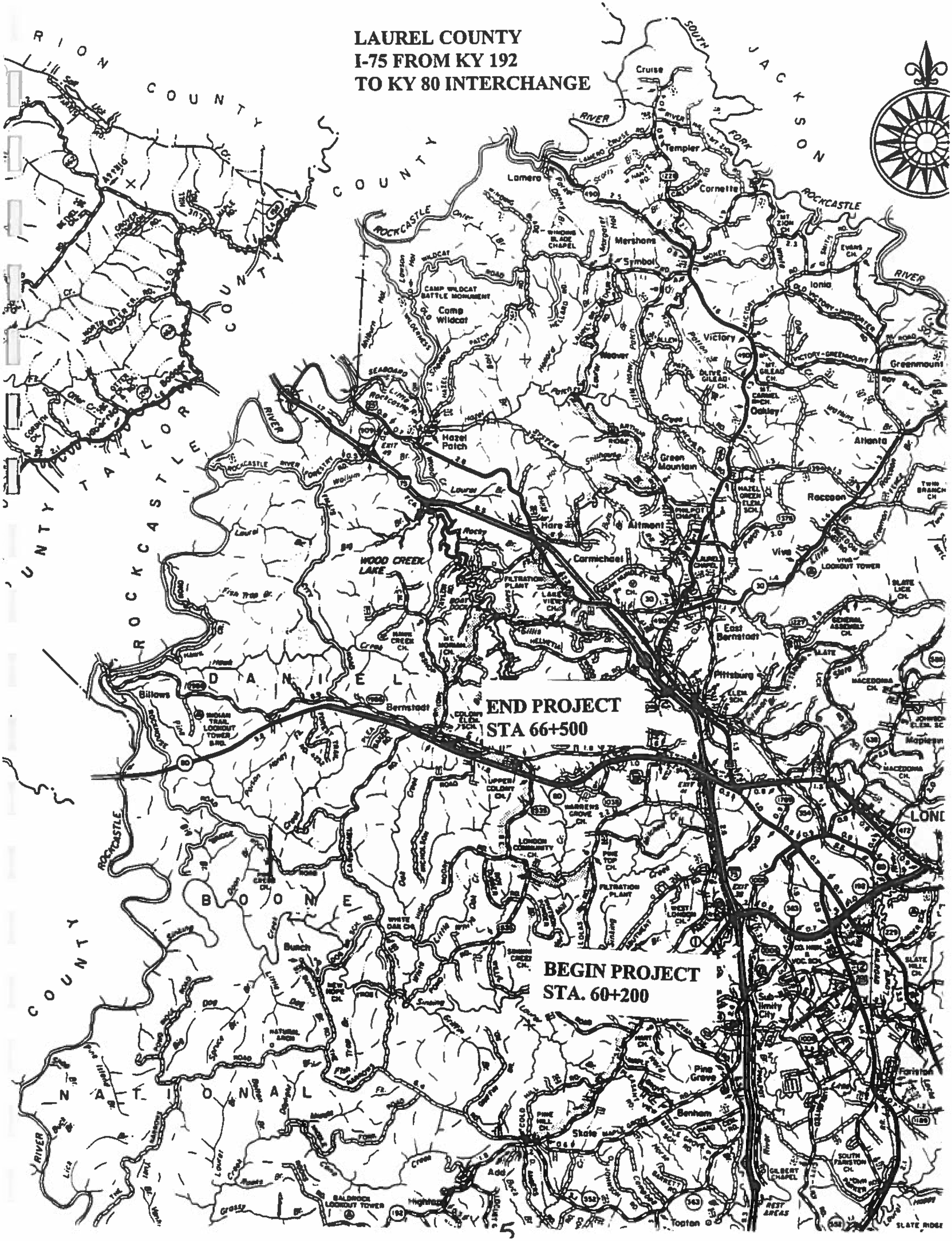
If this recommendation can be implemented, there is a possible savings of $50,000.

Total Possible Savings **$2,189,139.6**

LOCATION OF PROJECT

AND COST ESTIMATE

LAUREL COUNTY
I-75 FROM KY 192
TO KY 80 INTERCHANGE



ITEM NO: 11-008.00
Mainline

COUNTY: Laurel
UPN:
ROAD NAME: I-75
LOCATION: KY 192 to KY 80

FED. NO.:

Class of Road: Interstate
Type of Construction: Grade, Drain, and Surfacing
Net Length, Kilometers: 6.300

Bid Item	Item	Quantity	Unit	Unit Price	Amount	
GRADE & DRAIN						
0462	CULVERT PIPE-450 MM	350	METER	$101.57	$35,549.50	
0464	CULVERT PIPE-600 MM	100	METER	$129.60	$12,960.00	
0466	CULVERT PIPE-750 MM	30	METER	$142.63	$4,278.90	
0468	CULVERT PIPE-900 MM	10	METER	$184.83	$1,848.30	
0469	CULVERT PIPE-1050 MM	10	METER	$224.45	$2,244.50	
1000	PERFORATED PIPE-100 MM	30000	METER	$13.63	$408,900.00	9
1010	NON-PERFORATED PIPE-100 MM	1000	METER	$22.57	$22,570.00	
1432	SLOPED BOX OUTLET TYPE 1-15 IN	10	EACH	$1,322.82	$13,228.20	
1433	SLOPED BOX OUTLET TYPE 1-18 IN	10	EACH	$1,440.33	$14,403.30	
1434	SLOPED BOX OUTLET TYPE 1-24 IN	3	EACH	$1,698.85	$5,096.55	
1450	S & F BOX INLET-OUTLET-18 INCH	5	EACH	$1,695.34	$8,476.70	
1451	S & F BOX INLET-OUTLET-24 INCH	2	EACH	$2,025.79	$4,051.58	
1452	S & F BOX INLET-OUTLET-30 INCH	2	EACH	$2,462.76	$4,925.52	
1453	S & F BOX INLET-OUTLET-36 INCH	4	EACH	$2,937.54	$11,750.16	
1490	DROP BOX INLET TYPE 1	15	EACH	$1,836.32	$27,544.80	
1615	MEDIAN BARRIER BOX	35	EACH	$4,000.00	$140,000.00	
1988	CONC MEDIAN BARRIER TYPE 355C1	6150	METER	$137.80	$847,470.00	6
1991	TEMP CONC MED BARRIER TY 230M	13000	METER	$88.58	$1,151,540.00	4
2200	ROADWAY EXCAVATION	150000	CU M	$6.00	$900,000.00	5
2261	R/W FENCE-WOVEN WIRE	12800	METER	$10.26	$129,276.00	
2351	GUARDRAIL-STEEL W BEAM-S FACE	3000	METER	$30.34	$91,020.00	
2369	GUARDRAIL END TREATMENT TY 2A	10	EACH	$381.44	$3,814.40	
2373	GUARDRAIL END TREATMENT TYPE 3	10	EACH	$461.55	$4,615.50	
2376	GUARDRAIL CON TO BR END TYPE B	4	EACH	$591.11	$2,364.44	
2483	CHANNEL LINING CLASS II	2000	MTON	$15.78	$31,560.00	
2650	MAINTAIN AND CONTROL TRAFFIC	1	LP SU	$150,000.00	$150,000.00	
? 2651	DETOUR CONSTRUCTION	1	LP SU	$20,000.00	$20,000.00	
2671	VAR MESSAGE SIGN-PORT 3 LINE	4	EACH	$19,272.73	$77,090.92	
2726	STAKING	1	LP SU	$150,000.00	$150,000.00	
# ? 2775	FLASHING ARROW	6	EACH	$4,196.23	$25,177.38	
2894	CRASH CUSHION TYPE VI-T	8	EACH	$15,262.16	$122,097.28	
5966	SEED AND PROTECT, METHOD 2	436000	SQ M	$0.24	$104,640.00	
6500	PAVE STRIPING-102 MM TEMPORARY	30000	METER	$1.11	$33,300.00	
? 8100	CONCRETE-CLASS A	30	CU M	$359.24	$10,777.20	
8150	STEEL REINFORCEMENT	3000	KGRAM	$1.15	$3,450.00	
9826	PERF PIPE HEADWALL	50	EACH	$1,000.00	$50,000.00	
X	PARKER ROAD BRIDGE	1	LS	$1,225,000.00	$1,225,000.00	3
X	RCBC STA. 64+627	1	LS	$200,000.00	$200,000.00	
X	RCBC STA. 63+089	1	LS	$40,000.00	$40,000.00	
X	EROSION CONTROL	1	LP SU	$50,000.00	$50,000.00	
	SUB - TOTAL GRADE & DRAIN:				$8,141,021.13	
SURFACING						
0001	D G A BASE	130000	M TON	$15.60	$2,028,000.00	2
0100	BITUMINOUS SEAL AGGREGATE	420	MTON	$29.83	$12,528.60	
0120	BIT CONC BASE CLASS I	190000	MTON	$33.33	$6,332,700.00	1
0190	BIT MIX FOR LEVELING & WEDGING	10000	MTON	$32.73	$327,300.00	11
0244	BIT CONC SURFACE CLASS AK/A	24500	MTON	$34.34	$841,330.00	7
0291	EMULSIFIED ASPHALT RS-2	50	MTON	$302.40	$15,120.00	
0356	BITUMINOUS MATERIAL FOR TACK	100	MTON	$256.36	$25,636.00	
2107	BREAKING AND SEATING PAVEMENT	90000	SQ M	$0.87	$78,300.00	
	SUB - TOTAL SURFACING:				$9,660,914.60	
	SUB - TOTAL GRADE, & DRAIN & SURFACING:				$15,801,935.73	
MISCELLANEOUS						
2568	MOBILIZATION	1	LP SU	$474,058.07	$474,058.07	8
2569	DEMOBILIZATION	1	LP SU	$237,029.04	$237,029.04	
X	MISCELLANEOUS	1	LP SU	$400,000.00	$400,000.00	10
				SUB - TOTAL:	$16,913,022.84	
				10% ENGR. & CONTG:	$1,691,302.28	
				GRAND TOTAL:	$18,604,325.12	
				Cost Per Kilometer Grade & Drain:	$974,765.26	
				Cost Per Kilometer G & D & Surf:	$2,953,067.48	

Last Revision:
Estimated By: Ben Stratton DATE: 3/27/98 TIME: 1:59:00 PM

TEAM MEMBERS, PROJECT DESCRIPTION, AND PERSONS CONTACTED

Team Members

NAME	AFFILIATION	EXPERTISE	PHONE
Robert Semones	C.O. Design	Roadway Design	502-564-3280
Eric Larson	District 3 Design	Roadway Design	502-746-7898
Bill Pfalzer	C.O. Geotechnical Branch	Geotechnical	502-564-2374
Daryl Price	District 3, Construction	Resident Engineer	502-746-7898
Robert Martin	District 4 Construction	Resident Engineer	502-766-5066
Jeff Wolfe	C. O. Traffic	Traffic	502-564-3020

Project Description

The project studied is the reconstruction of I-75 mainline in Laurel County, Kentucky. This project is one portion of a larger project to reconstruct the ramps and bridges at KY 80 and KY 192. The project involves widening from four lanes to six lanes south of the KY 192 interchange and transitioning to eight lanes just north of the KY 192 interchange and extending the eight lane corridor to the KY 80 interchange for a total distance of 6.3 km. This project also involves the widening of an interstate bridge over Parker Road.

The estimated construction cost for the project is $18,604,352.12 No additional right of way is anticipated to be needed.

Persons Contacted

Name	Affiliation	Phone
Dan Byers	WMB, Inc.	606-299-5226
Art Duncan	WMB, Inc.	606-299-5226
Gary Sharpe	KYTC - Highway Design	502-564-3280
ADS, W.C. Thomson	Advanced Drainage Systems	606-272-5753
Jim King	KYTC - Bridge Design	502-564-4560
Mark Hite	KYTC - Bridge Design	502-564-4560
Bill Hornbeck	KYTC - Bridge Design	502-564-4560

INVESTIGATION PHASE

Cost/Function of Major Design Elements

Item	Cost	Function
Bridge over Parker Road	$1,210,000	Span Road
Temp. Concrete Median Barrier	$1,200,000	Protect Workers
Concrete Median Barrier	$137.80/meter	Re-direct vehicles
Roadway Excavation	$6/ cubic meter	Establish Grade
Perforated Pipe	$409,900	Conveys water
Perforated Pipe Headwalls	$50,000	Protect Pipe Ends
Guardrail	$102,000	Absorb Momentum
Box Culverts	$240,000	Convey Water
Variable Message Board	$77,090	Inform Public
Culvert Headwalls	$14,000	Protects Pipe Ends

Functional Analysis Worksheet

Item	Function Verb	Function Noun	Type	Cost	Worth	Value Index
Bridge over Parker Road	Span	Road	B	$1,225,000	$500,000	2.45
Pavement	Support	Vehicle	B	$9,660,915	$9,660,915	1.00
Temporary Conc. Median Barrier	Protect	Workers	B	$1,151,540	$40,000	28.79
Conc. Median Barrier	Re-direct	Vehicle	B	$137.80/m	$12.26	11.24
Roadway Excavation	Establish	Grade	B	$6/m	$5.50/m	1.09
Perforated Pipe	Convey	Water	B	$409,900	$245,940	1.67
Perforated Pipe Hdwl.	Protect	Pipe	B	$50,000	$375.00	133.33
Guardrail	Absorb	Momentum	B	$102,000	$18,950	5.38
Box Culv. Sta. 64+627	Convey	Water	B	$200,000	$100,000	2.00
Box Culv. Sta. 63+089	Convey	Water	B	$40,000	$20,000	2.00

Investigation

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

- Bridge over Parker Road
- Temporary Concrete Median Barrier
- Concrete Median Barrier
- Roadway Excavation
- Perforated Pipe
- Guardrail
- Perforated Pipe Headwalls
- Box Culverts

SPECULATION

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

1. Bridge over Parker Road
    - Shorten bridge using MSE walls
    - Alternate route
    - Steel bridge
    - Box culvert
    - Steel truss
    - Rehab existing piers
    - Use single span bridge
2. Concrete Median Barrier
    - Re-use temporary barrier with glare shields
    - Double face guardrail
    - Standard height New Jersey Barrier
    - Raised Median
    - Sheet Pile Wall
    - Plastic barrier filled with concrete
3. Roadway Excavation
    - Verify quantities
    - Raise grade/vertical alignment
    - Urban template
    - Change typical
    - Minimize clear zone
    - Change lane width
    - Steeper cut slopes
    - Change bridge length
4. Guardrail
    - Flatten slopes
    - Reuse temporary concrete barrier
    - Eliminate hazards
    - Use barrier wall
5. Temporary Concrete Median Barrier
    - Crossover
    - Barrels
    - T.M.A.
    - Tubular markers
    - Hard hat and vest
    - Increase lateral buffer zone
    - Minimize tapers
    - Water filled barriers
    - State owned Barrier
    - Barricade
    - Temporary guardrail

6. Box Culverts
    - Warp slope to fit existing outlet
    - Extend height of headwall or parapet
    - Extend culvert
7. Perforated Pipe
    - Daylight drainage blanket to slope
    - Eliminate Pipe
    - Fabric wrapped stone
    - Impervious surface
8. Perforated Pipe Headwalls
    - Eliminate headwall by eliminating pipe
    - Eliminate headwall by using channel lining
    - Modify slope
    - Use collector pipe system

EVALUATION

Alternatives

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

I. Bridge over Parker Road
   - A. Build a one span bridge with MSE abutments
   - B. Replace superstructure and rehab center pier
   - C. Use steel beams

II. Roadway Excavation
   - A. Flatten slopes where possible
   - B. Reduce inside shoulder width

III. Temporary Conc. Median Barrier
   - A. Use state owned barrier
   - B. Crossover
   - C. Minimize tapers

IV. Concrete Median Barrier
   - A. Standard Wall
   - B. Re-use Temp Conc. Barrier with glare panels
   - C. Double ply guardrail

V. Perforated Pipe
   - A. Daylight drainage blanket and eliminate

VI. Perforated Pipe Headwall
   - A. Smaller headwall
   - B. Channel Lining

VII. Guardrail
   - A. Flatten Slopes
   - B. Re-use Temporary Concrete Barriers
   - C. Different End Treatments

VIII. Box Culverts
   - A. Warp slopes
   - B. Extend height of parapet

Evaluation

I. Bridge over Parker Road

"As Proposed - Three Span Bridge"

Advantages

- Use existing substructure units
- Minimizes excavation

Disadvantages
- Requires removal of existing superstructure
- Requires more maintenance over time
- More costly for superstructure

Conclusion
Carry forward for Matrix Evaluation

A. ***Value Engineering Alternate - Build one span bridge with MSE abutments***

Advantages
- Lower cost
- Shorter construction time
- Less maintenance over time
- Leave old abutments and piling in ground
- Use same maintenance of traffic plan

Disadvantages
- Requires partial removal of substructure units
- Requires wall
- Requires additional excavation and special backfill

Conclusion
Carry forward for Matrix Evaluation

B. Value Engineering Alternate - Eliminate Bridge

Advantages
- No structure to maintain
- Low maintenance cost
- Shorten construction time
- Eliminating roadside hazard

Disadvantages
- Reroute local traffic for Parker Road
- Removal of existing structure

Conclusion
Carry forward for Matrix Evaluation

C. Value Engineering Alternate - Use Steel Beams

Advantages

- Reduces beam height
- Fewer beams required
- Shorter Construction Time

Disadvantages

- Requires more maintenance
- Pouring sequence on deck is critical
- Less available material
- Steel more expensive

Conclusion

Carry forward for Matrix Evaluation

SEE NEXT PAGE FOR MATRIX EVALUATION OF BRIDGE

Figure 2

Bridge

Alternates	Weight	Objectives or Criteria: Const. Cost	Maint. Cost	Aesthetics	Safety	Constr-uctability	Meet Specs.	X-Road Performance	Time	Total	Rank	Modify How?
		9	7	3	6	7	5	10	2			
As Proposed		1	2	2	2	4	3	4	2			
		9	14	6	12	28	15	40	4	128	3	N.A.
V.E. 1		4	4	2	2	3	3	1	1			
		36	28	6	12	21	15	10	2	130	2	Eliminate
V.E. 2		3	3	2	2	3	3	4	4			
		27	21	6	12	21	15	40	8	150	1	Shorten Span
V.E. 3		2	1	2	2	2	3	4	4			
		18	7	6	12	14	15	40	8	120	4	Steel Span

Excellent=4
Good=3
Fair=2
Poor=1

II. Roadway Excavation

"As Proposed"

Advantages
- Eliminates guardrail
- Provides waste area
- Aesthetics
- Safety

Disadvantages
- Possible additional right of way
- Lengthen culverts for flattening of slopes due to excavation

Conclusion
Carry forward for further evaluation

See matrix evaluation at end of this section

III. Temporary Concrete Median Barrier

"As Proposed" - Use 13,000 meters at $88.58 per meter

A. *Value Engineering Alternate 1 - Use cross over*

Advantages
- Safety of workers
- Construction time
- Simplifies traffic control

Disadvantages
- Hauling and Availability

Conclusion
Carry forward for Matrix Evaluation

See matrix evaluation at end of this section

B. *Value Engineering Alternate 2 - Minimize tapers*

Advantages
- Lower pavement cost

Disadvantages
- Less area of pavement for maneuverability

Conclusion
Carry forward for Matrix Evaluation

See matrix evaluation at end of this section

C. ***Value Engineering Alternate - Use state owned barrier***

Advantages
- Lower cost

Disadvantages
- Hauling and Availability

Conclusion
Carry forward for Matrix Evaluation

See matrix evaluation at end of this section

IV. Concrete Median Barrier

"As Proposed" - 6,150 meters at $137.80 per meter

A. ***Value Engineering Alternate - Use standard wall with glare panels***

Advantages
- Lower initial cost
- Same glare reduction

Disadvantages
- Maintenance of panels
- Reduced effects on trucks
- Aesthetics

Conclusion
Carry forward for further evaluation.

See matrix evaluation at end of this section

B. ***Value Engineering Alternate - Re-use temporary barrier with panels***

Advantages
- Low cost
- Use state supply

Disadvantages
- Reduced effects on trucks
- Does not meet Department standards

Conclusion
Carry forward for Matrix Evaluation.

See matrix evaluation at end of this section

V. Perforated Pipe

"As Proposed" - 5 strands - 30,000 meters

Advantages
- No problem with availability
- Uniform wall sections

Disadvantages
- Higher cost

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

A. ***Value Engineering Alternate - Daylight drainage blanket and eliminate***

Advantages
- Less maintenance cost
- Fewer tie in to boxes

Disadvantages
- More drainage blanket

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

VI Perforated Pipe Headwalls

"As Proposed" - 50 quantity at $1,000 each

Advantages
- Protects pipe end

Disadvantages
- Higher cost

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

A. *Value Engineering Alternate - Use channel lining in lieu of headwalls*

Advantages
- Easier to construct
- Already required
- Lower cost

Disadvantages
- Possible maintenance problem

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

B. *Value Engineering Alternate - Use smaller headwalls*

Advantages
- Lower cost

Disadvantages
- Does not meet standard drawing criteria
- May be more expensive if custom made

Conclusion

Carry forward for further consideration.

See matrix evaluation at end of this section

VII Guardrail

"As Proposed" - 50 quantity at $1,000 each

Advantages
- Steeper slopes, less possible right of way to purchase

Disadvantages
- Higher cost
- Creates traffic hazard
- Increased maintenance

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

A. *Value Engineering Alternate - Flatten Slopes*

Advantages
- Eliminate guardrail
- Safety for motorists

Disadvantages
- May have to purchase right of way
- May have to lengthen culverts

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

B. *Value Engineering Alternate - Reuse Temporary Barrier*

Advantages
- Lower cost

Disadvantages
- Traffic hazard for motorists
- Difficult to haul and handle

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

C. *Value Engineering Alternate - Different End Treatments*

Advantages
- Provide a safer end treatment

Disadvantages
- More expensive
- Creates a traffic hazard

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

VIII Box Culverts

"As Proposed" - Lengthen two (2) box culverts

Advantages
- Flatter slopes

Disadvantages
- Higher cost to extend culverts

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

A. ***Value Engineering Alternate - Warp Slopes around headwalls***

Advantages
- Eliminates the need for lengthening culverts
- Less fill material

Disadvantages
- May be more expensive to maintain

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

B. ***Value Engineering Alternate - Extend height of parapet***

Advantages
- Accommodates flatter slope

Disadvantages
- Have to modify end of box culverts and add wing walls

Conclusion
Carry forward for further consideration.

See matrix evaluation at end of this section

Roadway Excav.

	Objectives or Criteria						
	Const. Cost	Maint. Cost	Aesthetics	Meet Specs			
Alternates Weight	8	5	4	5	Total	Rank	Modify How?
Plan	2 16	2 10	2 8	3 15	49	2	N.A.
V.E. 1	3 24	3 15	3 12	3 15	66	1	Change Template

Excellent=4
Good=3
Fair=2
Poor=1

Temp. Conc. Barrier

	Objectives or Criteria							
	Const. Cost	Safety	L.O.S.	Const. Maint.	Time			
Alternates **Weight**	**6**	**8**	**8**	**4**	**6**	**Total**	**Rank**	**Modify How?**
Plan	2	3	2	3	2			
	12	24	16	12	12	76	3	N.A.
V.E. 1	3	4	1	4	4			
	18	32	8	16	24	98	1	Crossover
V.E. 2	2	3	2	3	2			
	12	24	16	12	12	76	3	Minimize Tapers
V.E. 3	3	3	2	3	2			
	18	24	16	12	12	82	2	State-owned Barrier

Excellent=4
Good=3
Fair=2
Poor=1

Conc. Med. Barrier

	Objectives or Criteria									
	Const. Cost	Performance	Glare	Maint.	Aesthetics	Safety	Meet Specs.			
Alternates Weight	8	8	5	5	3	7	5	Total	Rank	Modify How?
Plan	2	4	4	3	3	3	3			
	16	32	20	15	9	21	15	128	2	N.A.
V.E. 1	4	4	2	3	3	3	3			
	32	32	10	15	9	21	15	134	1	Standard Wall
V.E. 2	3	4	3	2	2	3	2			
	24	32	15	10	6	21	10	118	3	Reuse Temp. Barrier with Panels
V.E. 3	4	3	1	1	2	2	1			
	32	24	5	5	6	14	5	91	4	Double-Ply Guardrail

Excellent=4
Good=3
Fair=2
Poor=1

Perf. Pipe

	Objectives or Criteria					
	Const. Cost	Maint. Cost	Performance			
Alternates Weight	7	5	9	Total	Rank	Modify How?
Plan	2	1	3			
	14	5	27	46	2	N.A.
V.E. 1	4	2	2			
	28	10	18	56	1	Daylight Drainage Blanket & Eliminate

Excellent=4
Good=3
Fair=2
Poor=1

Perf. Pipe HW

	Objectives or Criteria							
	Const. Cost	Meet Specs.	Maint. Cost	Maint. Freq.	Performance			
Alternates Weight	**6**	**5**	**4**	**4**	**8**	**Total**	**Rank**	**Modify How?**
Plan	2	3	2	3	4			
	12	15	8	12	32	79	2	N.A.
V.E. 1	4	1	1	2	2			
	24	5	4	8	16	57	3	Channel Lining
V.E. 2	4	2	2	3	4			
	24	10	8	12	32	86	1	Smaller HW

Excellent=4
Good=3
Fair=2
Poor=1

Guardrail

	Objectives or Criteria							
	Const. Cost	Maint. Cost	Aesthetics	Safety	Meet Specs.			
Alternates Weight	8	6	2	10	3	Total	Rank	Modify How?
Plan	2	2	2	2	2			
	16	12	4	20	6	58	3	N.A.
V.E. 1	4	3	4	4	3			
	32	18	8	40	9	107	1	Flatten Slopes
V.E. 2	1	2	2	2	2			
	8	12	4	20	6	50	4	Reuse Temp. Barrier
V.E. 3	2	2	2	3	3			
	16	12	4	30	9	71	2	Different End Treats

Excellent=4
Good=3
Fair=2
Poor=1

Box Culverts

	Objectives or Criteria						
	Const. Cost	Maint. Cost	Meet Specs.	Aesthetics			
Alternates Weight	9	5	7	3	Total	Rank	Modify how?
Plan	1	3	3	3			
	9	15	21	9	54	3	N.A.
V.E. 1	4	2	2	3			
	36	10	14	9	69	1	Warp Slopes
V.E. 2	3	3	3	3			
	27	15	21	9	72	2	Extend Height HW

Excellent=4
Good=3
Fair=2
Poor=1

Project No. 11-008.0 4-17-98

ITEM	FUNCTION	COST	COMPARATIVE	WORTH	VALUE INDEX
Pavement	Support Vehicles	$9,660,915.00	Less Inside Shldr	$9,660,915.00	1.00
Bridge	Span Road	$1,225,000.00	New bridge w/ MSE walls	$500,000.00	2.45
Rdwy. Excav.	Achieve Profile	$6.00	Flatten fill slopes	$5.50	1.09
Temp Conc Med Barrier	Protect Workers	$1,151,540.00	Barrels	$40,000.00	28.79
Conc. Med. Barrier	Redirect Vehicle	$137.80	Use temp wall move only. no high wall	$12.26	11.24
Perf. Pipe	Remove Water	$409,900.00	No perf. pipe	$1.00	409900.00
Perf. Pipe HDWL	Protect pipe-end	$50,000.00	No HW, use Ch Lin	$375.00	133.33
Guardrail	Absorb momentum	$102,000.00	Flatten Slopes	$18,950.00	5.38
Box Culv. 64+627	Convey water	$200,000.00	No extension Retain wall	$100,000.00	2.00
Box Culv. 63+089	Convey water	$40,000.00	No extension Retain wall	$20,000.00	2.00
VMB	Inform public	$77,090.00	Use state owned	$20,000.00	3.85
Culv. HW	Protects pipe end.	$14,000.00	No HW, use Ch Lin	$1,500.00	9.33

Functional Analysis Worksheet Information Phase

DEVELOPMENT PHASE

I.A. Value Engineering Alternate - One Span Bridge

As Proposed

The proposed bridge is a three span (15.02 m-15.24 m-15.02 m) Type II PCIB with pile end bents. The proposed new construction will consist of phase construction. The interior bridge will be constructed in between the existing twin span structures. Once the interior bridge is completed, the superstructure from the existing bridges will be removed and replaced with new Type II PCI beams utilizing the existing substructure units.

VE Alternate

The VE alternate is a one span Type III PCIB bridge with Mechanically Stabilized Earth (MSE) walls at the abutments. The length of the spans will decrease from 45.28 meters as above to 22.2 meters. Portions of the old substructure can be left in the ground.

Calculations

As Proposed bridge = (46.21 m wide) (45.28 m long) = 2092.5 sq m
Lump sum cost = $1,225,000.00

Type III PCIB - 18 required, 22 meters each cost = $279.00 per meter
Cost of Beams = 18x22x279 = $111,000

Deck Area = 1,017 m2 of deck
Total volume Class "AA" = 225 m3 at $445 /m3 = $100,125
Reinforcement = $30,000

Abutments 1.5x1.5x46.21 = 104 m3 x 2 x 359.24/m3 = $74,722.00
Reinforcement = $15,000
Wings = $15,000

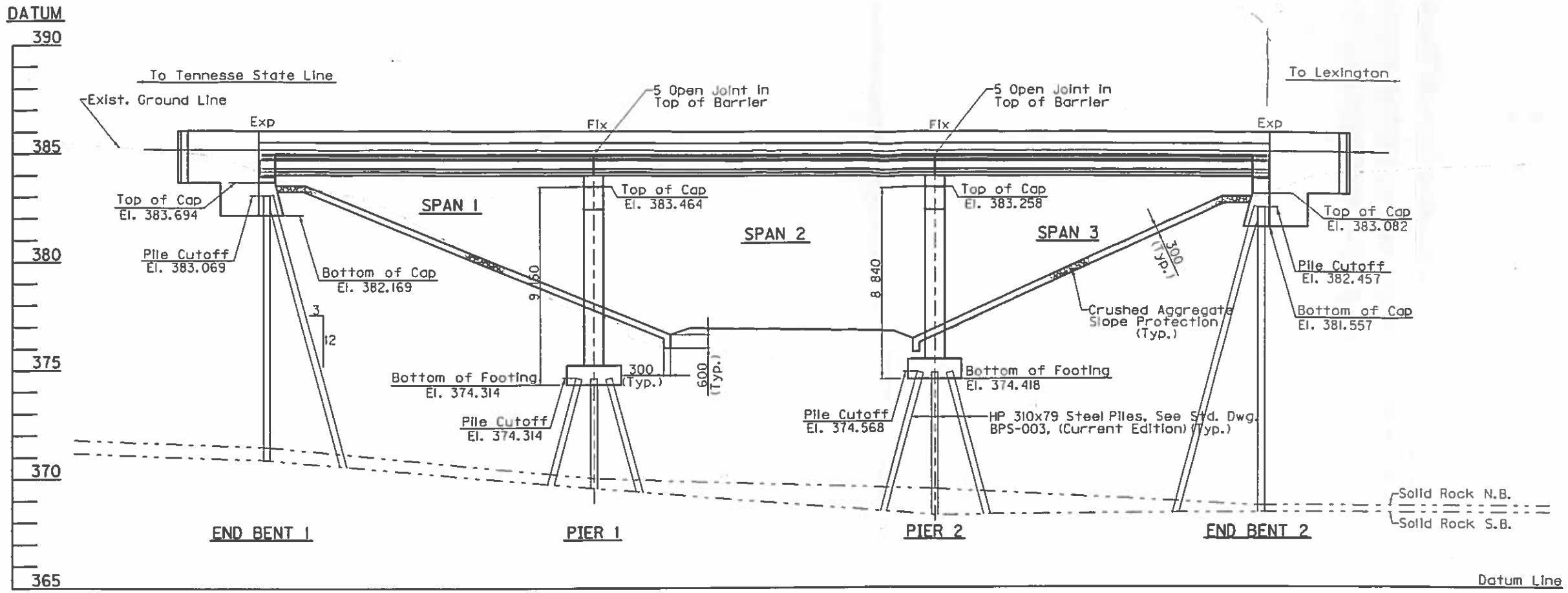
MSE Wall and Structure Backfill = $231,000 + $95,000.00 = $326,000.00

Common Excavation 110m2 x 46.21 = $112,000
Remove concrete masonry $100,000
Piling = 20x12.45x$97.00/m = $24,158.00

Total = $ 908,000
Cost Difference from proposed = $317,000

Discussion

There will also be need for sheet piling around the retained back of the MSE wall. This sheet piling could remain in place after the project is completed.

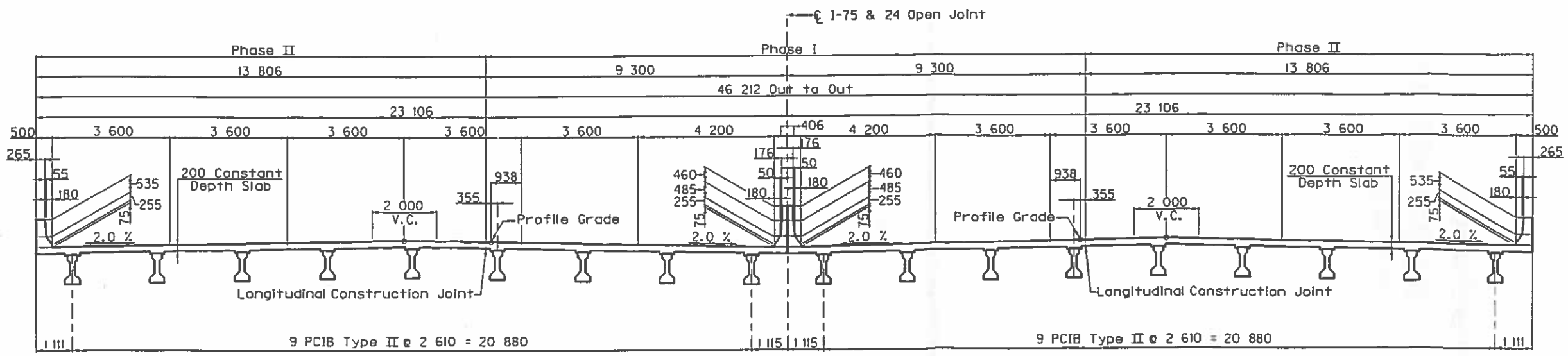


V.C. = 274 320
-2.7193% +0.5000%
P.I. Sta. 63+078.360
El. = 383.530

PROFILE GRADE

ELEVATION

15.020m, 15.240m, 15.020m Prestressed
Concrete I-Beam Type II Continuous
for live load only, HS25 loading Roadway
Varies, N.J. Barriers, o° Skew, Shoulders
Varies, 1:2 Fill Slopes



TYPICAL SECTION THRU DECK

REVISION	
DATE: Feb-1998	CHECKED B
DESIGNED BY:	
DETAILED BY:	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAY

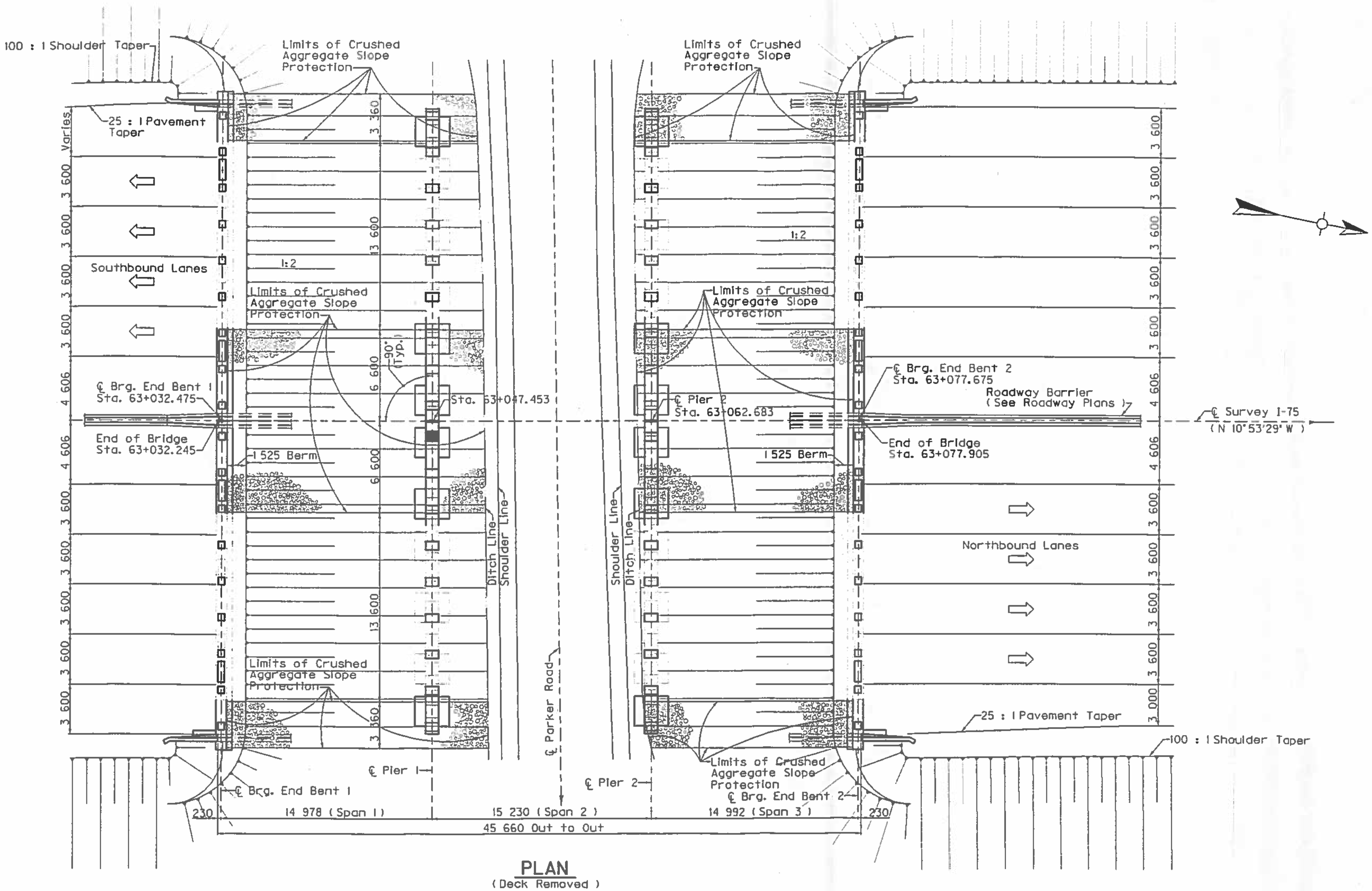
COUNTY: LAUREL

ROUTE: I - 75 | CROSSING: PARKER ROAD

LAYOUT

PREPARED BY

LAYOUT



PLAN
(Deck Removed)

LAYOUT

REVISION	DATE
DATE: Feb-1998	CHECKED BY
DESIGNED BY:	
DETAILED BY:	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY: LAUREL

ROUTE: I - 75

CROSSING: PARKER ROAD

LAYOUT

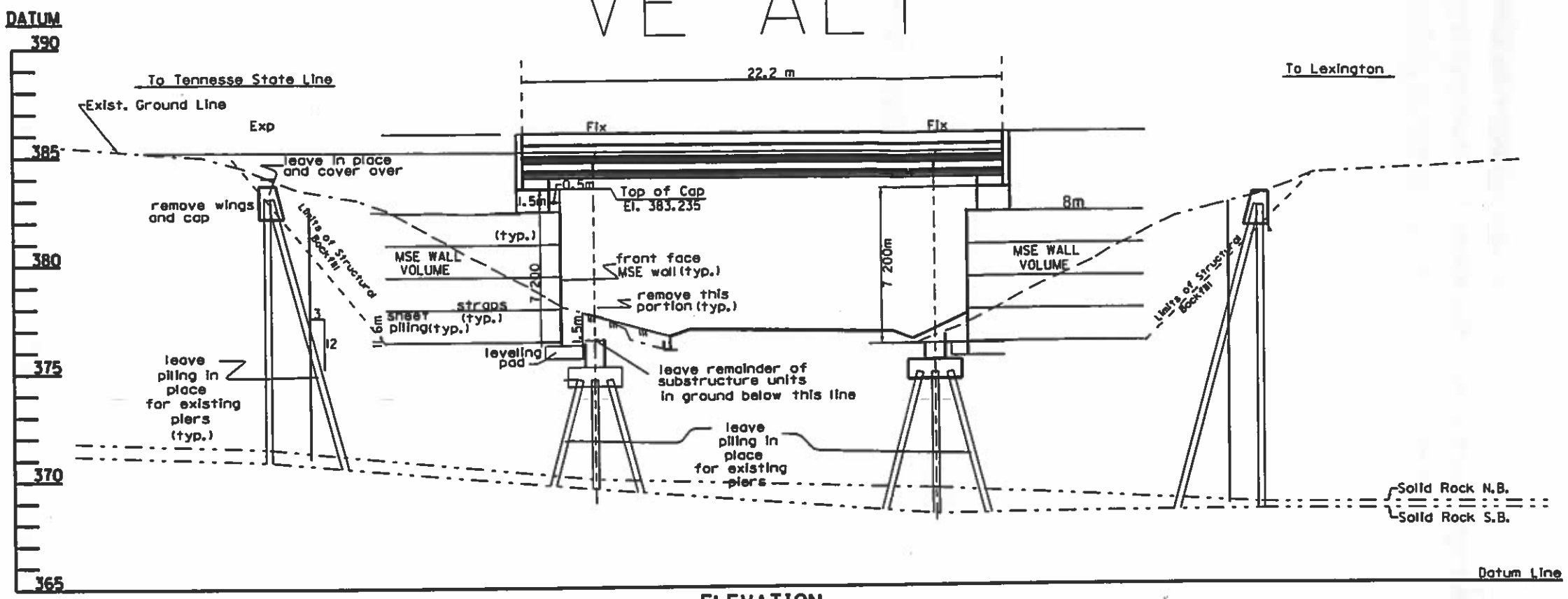
PREPARED BY

SHEET NO.

DRAWING NO.

Parker Road Bridge

VE ALT

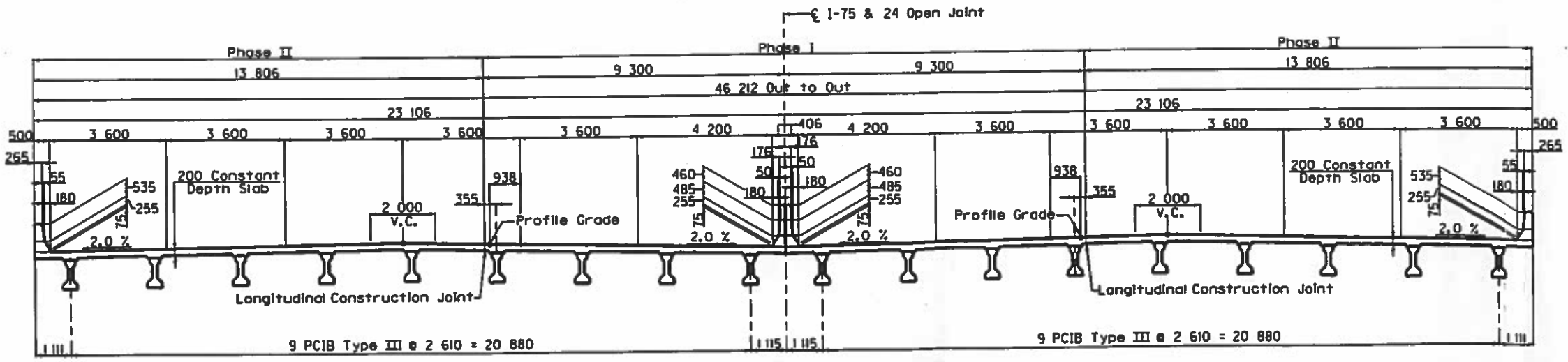


ELEVATION

SIMPLE 22m Prestressed
Concrete I-Beam Type III Continuous
for live load only, HS25 loading Roadway
Varies, N.J. Barriers, 0° Skew, Shoulders
Varies, 1:2 Fill Slopes

V.C. = 274 320
-2.7193% +0.5000%
P.I. Sta. 63+078.360
El. = 383.530

PROFILE GRADE



TYPICAL SECTION THRU DECK

LAYOUT

REVISION	DATE
DATE: Feb-1998	CHECKED BY
DESIGNED BY: A.D.	B.K.
DETAILED BY: D.W.W.	A.D.

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY: LAUREL

ROUTE: I – 75 | CROSSING: PARKER ROAD

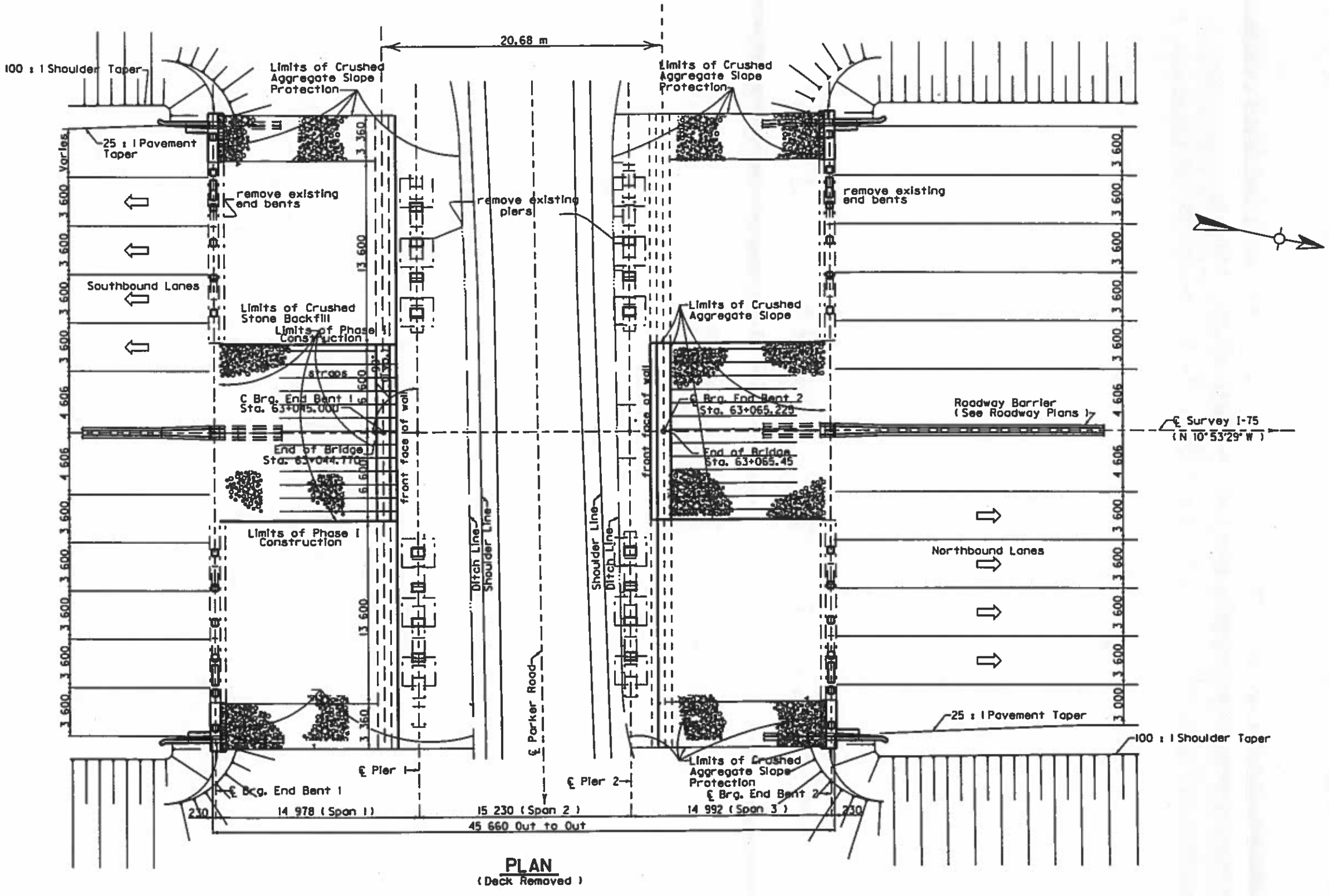
LAYOUT

PREPARED BY: WMB INC., ENGINEERS

SHEET NO. 5

DRAWING NO.

DATE: FEB. - 1998
USERNAME: D.W.W.
SHEET LOCATION: 345,300 FILE NAME: Lay-1.dgn



PLAN
(Deck Removed)

VALUE D VE ALTERNATE

LAYOUT

REVISION	DATE
DATE: Feb-1998	CHECKED BY
DESIGNED BY:	
DETAILED BY:	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY: LAUREL

ROUTE: I - 75

CROSSING: PARKER ROAD

LAYOUT

PREPARED BY

SHEET NO.

DRAWING NO.

DATE: FEB-1998

USERNAME: D.W.W.

SHEET LOCATION: 345,300 FILE NAME: Lay.dgn

II.A. Value Engineering Alternate - Modify Template and Roadway Excavation

As Proposed

The as proposed for the I-75 mainline at the beginning station is six, 3.6 meter lanes with two, 4.2 meter inside shoulders while the template consists of an eight lane section between the KY 80 and KY 192 interchange.

VE Alternate 1

The VE alternate is to reduce the inside shoulder width from 4.2 m to 3.6 m and flatten the embankment slopes to a desirable 4:1.

Calculations

See next two sheets

Discussion

The Value Engineering Proposal Number 1 recommends reducing the inside shoulder width from 4.2m to 3.6m. No documentation could be found in the "Roadside Design Guide" which supported the need for the additional shoulder width.

VE Alternate 2

Calculations

See next two sheets

Discussion

The Value Engineering Proposal Number 2 recommends flattening the embankment to the desired slope of 4:1 with the limits of the clear zone. This proposal would eliminate the need for guardrail and minimizes the waste material to be hauled off the job. Based upon the available cross sections, this alternate can be performed at seven different locations without the need for any additional right of way.

Change Template

Proposals:

1) Reduce inside shoulder width from 4.2M to 3.6M
2) Flatten embankment slopes to desirable (4:1) &
   Utilize the "Clear Zone"

Benifits:

1) Reduces Pavement Costs
2) Reduces Roadway Excavation & reduces waste material to be hauled from the Job
3) Eliminates need for guardrail, end treatments & maintenance costs
4) Allows use of desirable slopes without additional Right of Way

Change Template V.E. #1

Recommendation: Reduce inside shoulder width from 4.2M to 3.6M

Cost Reductions Resulting From This Change:

Item:	Quantity	Price		Savings
Bit. Base	7000	$ 33.33	$	233,310.00
Bit. Surf.	675	$ 34.34	$	23,179.50
DGA	2790	$ 15.60	$	43,524.00
DB Typ. 2	1618	$ 29.05	$	47,002.90
Total Savings Pavement Qty's			**$**	**347,016.40**
Roadway Excavation	20400	$ 6.00	$	122,400.00

Total Savings for this V.E. Proposal **$ 469,416.40**

Change Template V.E. #2

Recommendations: Flatten slopes to desirable & utilize "Clear Zone"

Cost Reductions Resulting From This Change:

Items	Stat.	End Treat.	Quantity	Price	Savings
Guardrail	Rt 61+000		380	30.34	11529.20
		2A	1	381.44	381.44
		Typ 1	1	3500.00	3500.00
	Ramp A		180	30.34	5461.20
	KY 192	2A	1	381.44	381.44
		Typ 1	1	3500.00	3500.00
	Lt 62+260		148	30.34	4490.32
		2A	1	381.44	381.44
		Typ 1	1	3500.00	3500.00
	Rt 62+480		100	30.34	3034.00
		2A	1	381.44	381.44
		Typ 1	1	3500.00	3500.00
	Rt 63+800		70	30.34	2123.80
		2A	1	381.44	381.44
		Typ 1	1	3500.00	3500.00
	Lt 64+900		210	30.34	6371.40
		2A	1	381.44	381.44
		Typ 1	1	3500.00	3500.00
	Rt 65+100		170	30.34	5157.80
		2A	1	381.44	381.44
		Typ 1	1	3500.00	3500.00
					$ 65,337.80

Quantity of Guardrail eliminated based only on what is presently in place. New installation would require more.

Savings to the Department due to "elimination of maintenance" and "updating end treatments" estimated @ 1/2 value = $ 32,668.70

Type 3 End Treatments currently proposed would require additional drainage work not currently included in plans. Type 1 more realistic alternative.

Cost of additional pipe to flatten slopes= $6335.00 (see sheet)

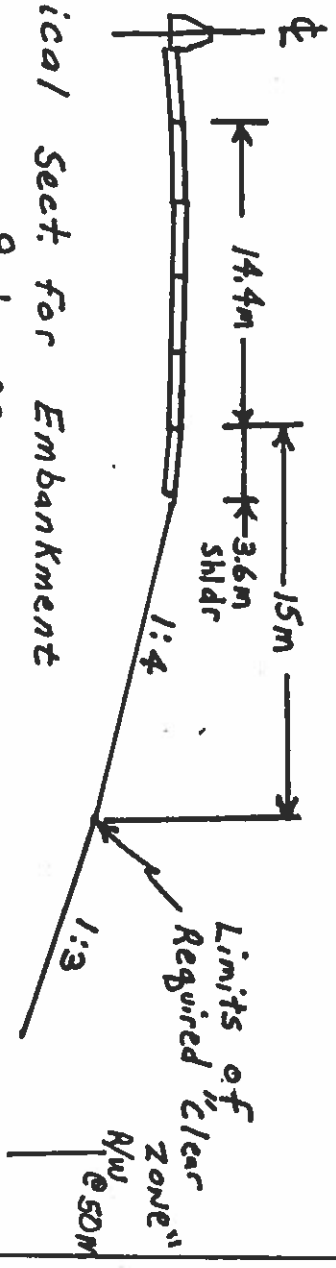
Total savings $ 91,671.70

SKETCH OF PROPOSED DESIGN, IF APPLICABLE:

Change Template V.E. #2

Additional Pipe Cost Due to Flattened Slopes

Size	Length	Price	Cost
375mm	7m	100.00	700.00
450mm	20m	101.60	2032.00
600mm	19m	129.58	2462.00
750mm	8m	142.63	1141.00
			#6335.00



Typical Sect. for Embankment 8 Lanes Per V.E. 2 Proposal

COUNTY OF	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
LAUREL			

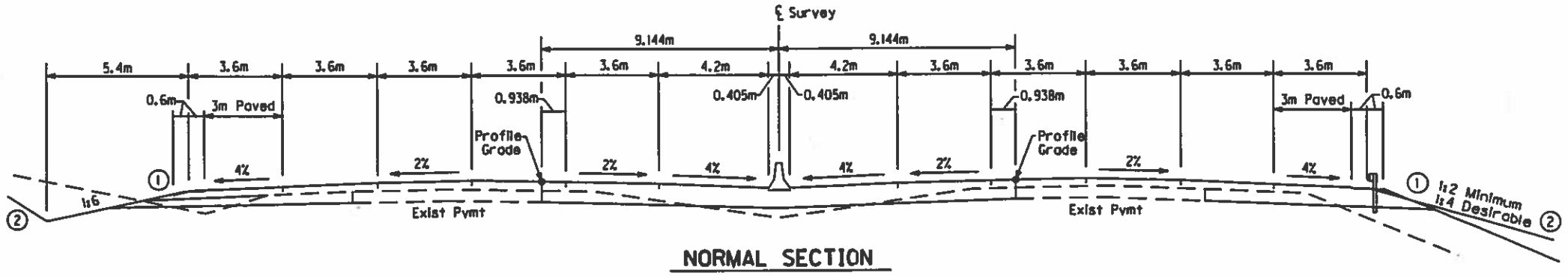
TENN. ST. LINE - LEXINGTON RD. (I-75)
ITEM NO 99-2025.00

TYPICAL SECTIONS

As Proposed

I-75

STA 62+000 TO STA 65+300



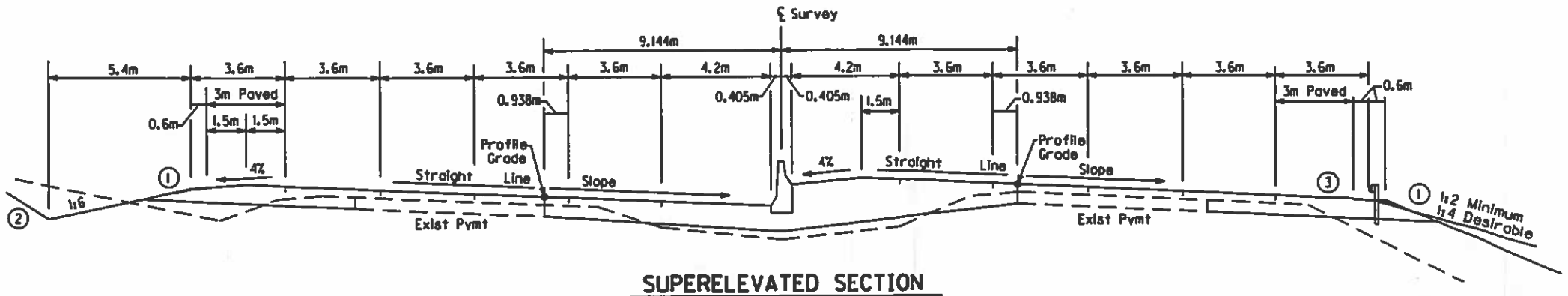
NORMAL SECTION

8 LANE

① BIT. SEAL FOR SHOULDERS FROM OUTSIDE EDGE OF PAVEMENT TO A POINT 0.6m DOWN THE DITCH OR FILL SLOPE.

② SEE CROSS SECTIONS FOR SLOPES OUTSIDE THE LIMITS OF THE SHOULDER.

③ SUPERELEVEATED SHOULDERS. CONSTRUCT TO STANDARD SUPERELEVATION EXCEPT NOT FLATTER THAN SLOPES INDICATED FOR NORMAL SHOULDERS.



SUPERELEVATED SECTION

8 LANE

DESIGNED BY ___ DATE ___
CHECKED BY ___ DATE ___
APPROVED BY ___

FILE: TYP.DGN
DATE: 25-MAR-98 16:11
USERNAME: DAN

6-93
FORM NO. 2-

COUNTY OF	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
LAUREL			

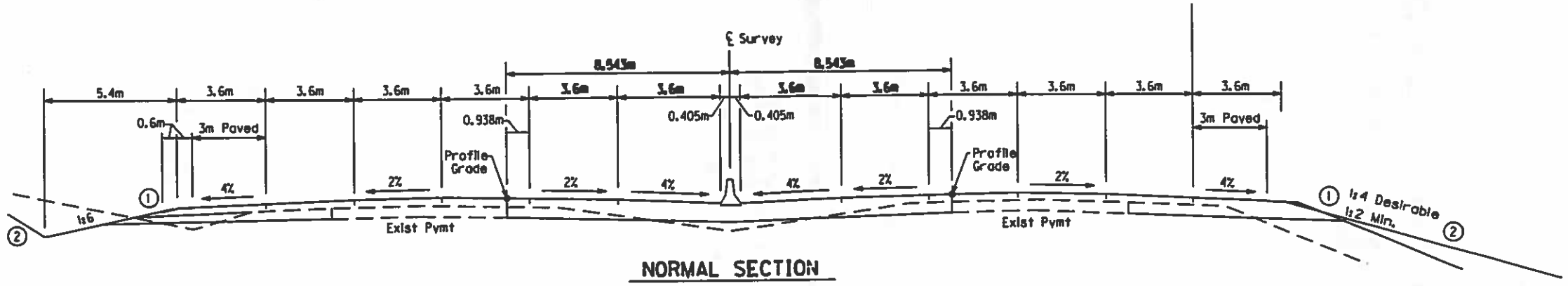
TENN. ST. LINE - LEXINGTON RD. (I-75)
ITEM NO 99-2025.00

TYPICAL SECTIONS

V.E. 1 Alternate

I-75

STA 62+000 TO STA 65+300



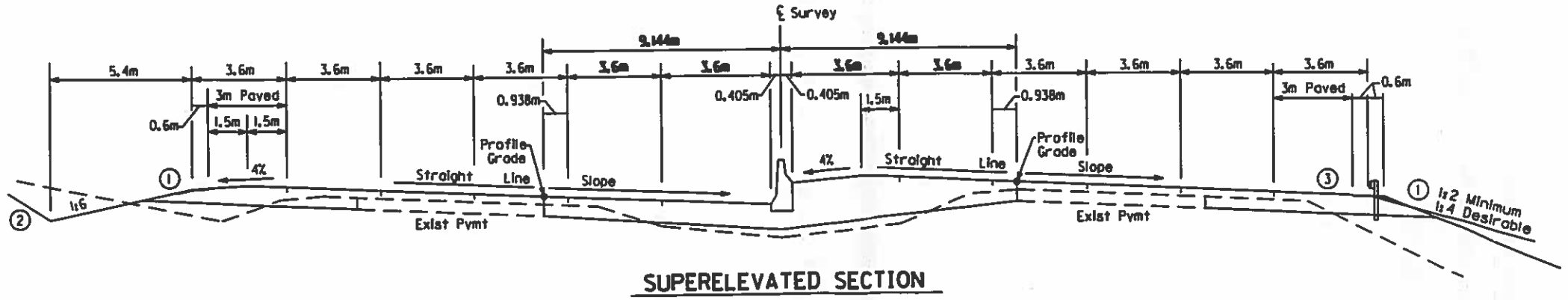
NORMAL SECTION

8 LANE

① BIT. SEAL FOR SHOULDERS FROM OUTSIDE EDGE OF PAVEMENT TO A POINT 0.6m DOWN THE DITCH OR FILL SLOPE.

② SEE CROSS SECTIONS FOR SLOPES OUTSIDE THE LIMITS OF THE SHOULDER.

③ SUPERELEVEATED SHOULDERS. CONSTRUCT TO STANDARD SUPERELEVATION EXCEPT NOT FLATTER THAN SLOPES INDICATED FOR NORMAL SHOULDERS.



SUPERELEVATED SECTION

8 LANE

DATE
PREPARED BY
DATE
CHECKED BY
DATE
APPROVED BY

FILE: TYP.DGN
DATE: 25-Mar-98 16:11
USERNAME: DAN

6-93
FORM NO. 2m

COUNTY OF	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
LAUREL			

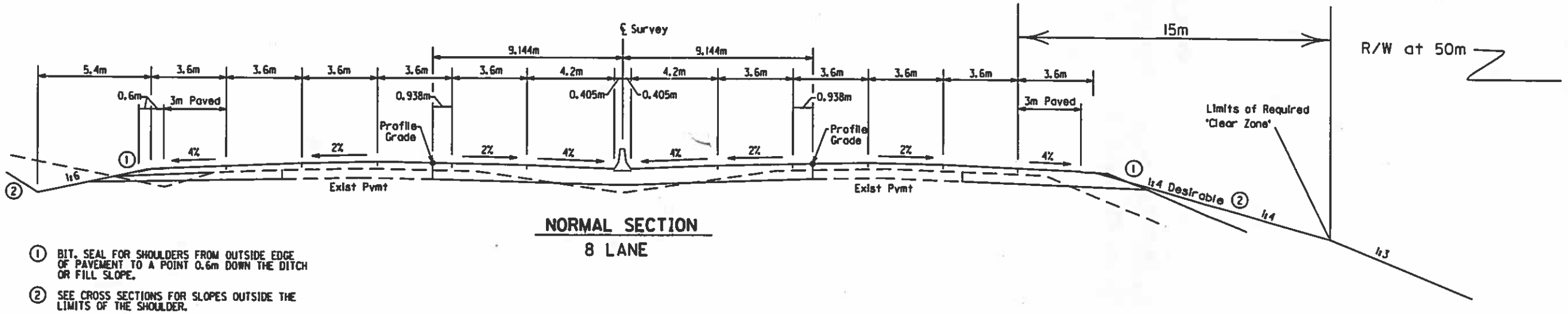
TENN. ST. LINE - LEXINGTON RD. (I-75)
ITEM NO 99-2025.00

TYPICAL SECTIONS

V.E. 2 Alternate

I-75

STA 62+000 TO STA 65+300



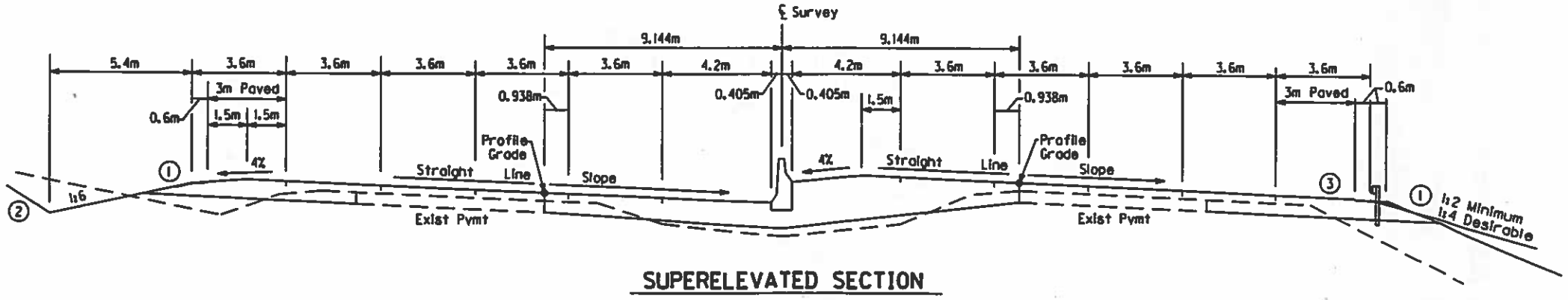
NORMAL SECTION

8 LANE

① BIT. SEAL FOR SHOULDERS FROM OUTSIDE EDGE OF PAVEMENT TO A POINT 0.6m DOWN THE DITCH OR FILL SLOPE.

② SEE CROSS SECTIONS FOR SLOPES OUTSIDE THE LIMITS OF THE SHOULDER.

③ SUPERELEVEATED SHOULDERS, CONSTRUCT TO STANDARD SUPERELEVATION EXCEPT NOT FLATTER THAN SLOPES INDICATED FOR NORMAL SHOULDERS.



SUPERELEVATED SECTION

8 LANE

PREPARED BY _____ DATE _____
CHECKED BY _____ DATE _____
APPROVED BY _____ DATE _____

FILE: TYP.DGN
DATE: 25-Mar-98 16:11
USERNAME: DAN

6-93
FORM NO. 2m

II.B. Value Engineering Alternate - Use Temporary Concrete Median Barrier Wall

As Proposed

The as proposed design consists of using new temporary concrete median barrier wall along the length of the project. Construction will require an amount twice the length of the project as construction will be occurring simultaneously in both directions. Once construction is complete on the inside median, the wall will be relocated one time. After the outside lanes have been constructed, the temporary barrier wall will be removed. The proposed estimate includes the installation, relocation, and removal of the barrier wall

VE Alternate 1

The Value Engineering alternate involves using state owned barrier wall in lieu of new temporary concrete median barrier wall. The same amount of barrier wall will be used no matter which method is used. The savings will result from not paying for the initial cost of the temporary barrier wall. Installation, relocation, and removal for both types of the wall should remain the same. However, the use of this barrier wall is dependent on the availability of barrier wall from the state stockpiles.

Calculations

See Calculations

IV. Permanent Concrete Median Barrier

As Proposed

Use modified barrier with a height of 1.275 m for glare reduction.

VE Alternate

Use standard barrier wall except in areas of superelevated sections.

Calculations

See Calculations

Discussion

As previously detailed, there is no advantage to using a wall with the increased height and thickness. In addition, savings can be found by utilizing the Temporary Barrier section as part of

the permanent barrier wall. Life cycle costs are not applicable to this recommendation since the permanent structure is identical in function and maintenance.

The Value Engineering alternate recommends constructing a Permanent Concrete Median Barrier wall with a 230 mm top width with an 815 mm height. (same as the standard New Jersey Wall Shape). The wall will also be constructed by relocating portions of the Temporary Concrete Barrier Wall used to maintain traffic and setting it permanently in the median. It is further recommended combining this with our recommendations concerning the use of state owned sections of wall for the Temporary Concrete Median Barrier.

PROJECT NO: 11-008.0

STUDY SUMMARY
DEVELOPMENT PHASE
COST COMPARISON

TEMPORARY CONCRETE BARRIER WALL

Data:

Item	Quantity	Unit	Unit Price
Temporary Concrete Median Barrier Wall	13,000	meter	88.58

Project Estimate Sheet

Bid Item (code)	Unit	Unit Price
Temporary Concrete Median Barrier Install (1992)	meter	40.2128
Temporary Concrete Barrier Wall Relocation (9463)	meter	29.25727

KTC 1997 Average Unit Bid Prices

Calculations:

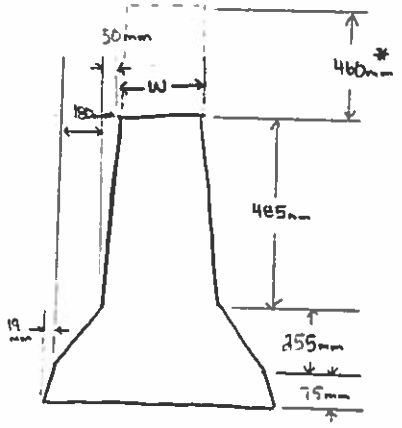
As proposed
Total Cost = Quantity x Unit Price = 13,000 x 88.58 = $1,151,540

V.E. Alt. 1 (use state owned barrier wall)
Total Cost = Quantity x (Cost to Install + Cost to Relocate) = 13,000 x (40.18 +29.26) = $903,111

Savings = ($1,151,540 - $902,685) = $248,429

PROJECT NO: 11-008.00	STUDY SUMMARY
	DEVELOPMENT PHASE
	DESIGN ELEMENT SELECTED FOR STUDY - -SKETCH AND DESCRIPTION

Permanent Concrete Median Barrier



W = 230mm = 9"
or
= 355mm = 14"

* Extra height w/ vert. slope for glare protection.

See Exhibits PCMB 1 and PCMB 2 for more detailed drawings of the 355C1 wall.

Designed feature is New Jersey shape Concrete Barrier wall w/extra height to provide headlight glare protection. Designated as Type 355C1, it is 355mm wide at the top and the base height is suitable for bit. surface application.

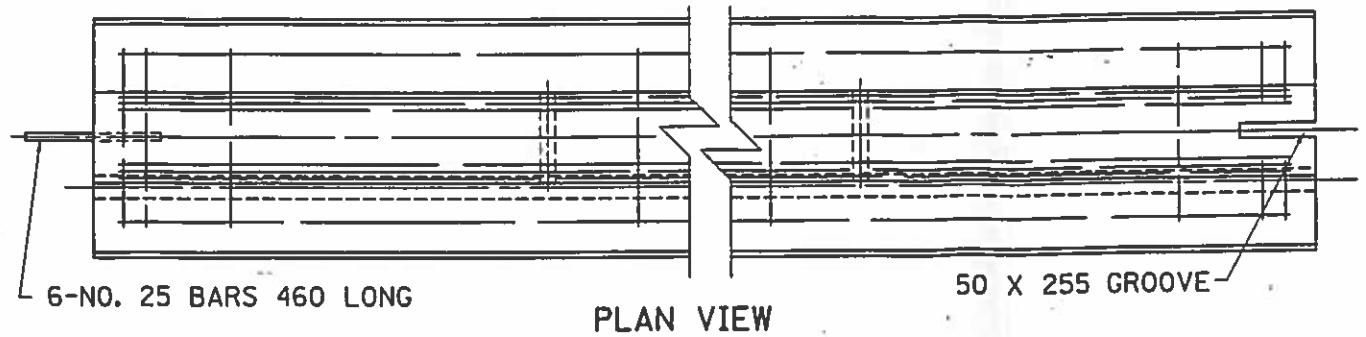
Bid Price $137.80/meter (6150m)

The Bid Price for Temp. Concrete Median Barrier Type 230M = $88.58/meter (13,000m)

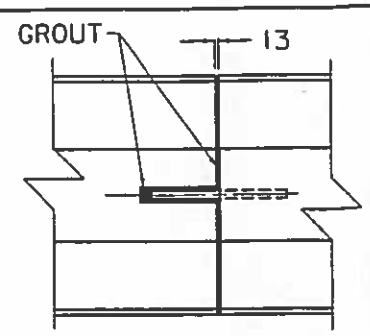
DRAWING SCALE:
SCALE: 1"=1'-0"
ASYMMETRICAL 3/4"=1'-0"

Exhibit PCMB1

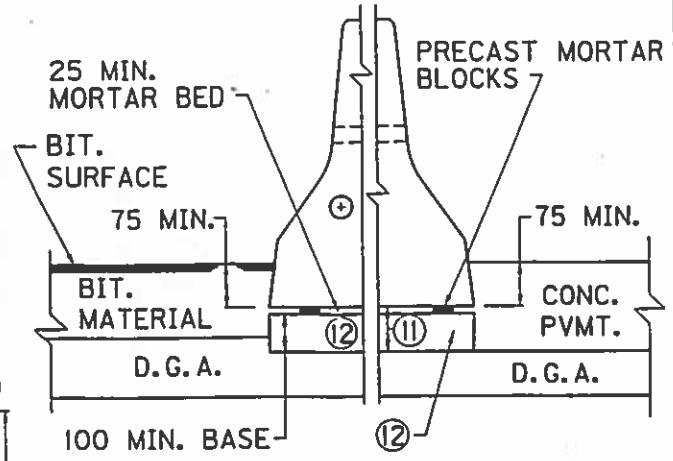
COUNTY OF	FISCAL YEAR	SHEET NO.	TOTAL SHEETS



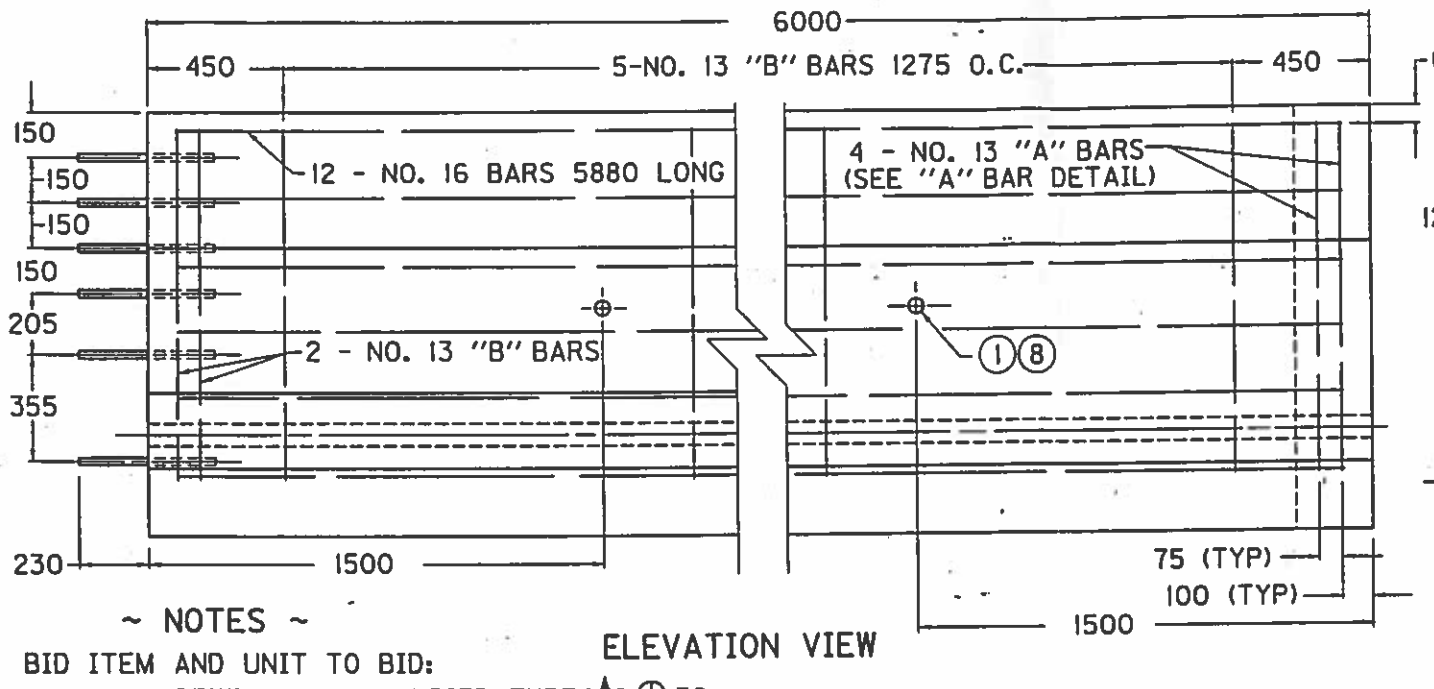
PLAN VIEW



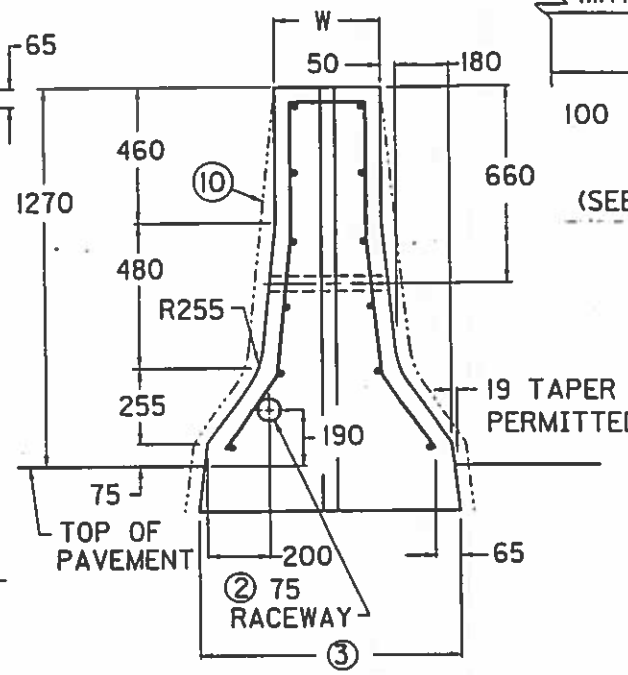
CONNECTION DETAIL



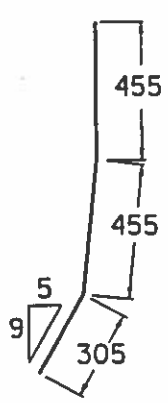
PAVEMENT DETAIL
(SEE RIGHT ELEVATION FOR DIMENSIONS)



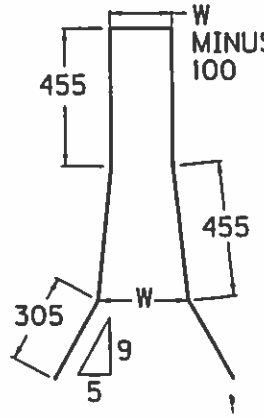
ELEVATION VIEW



RIGHT ELEVATION VIEW



DETAIL OF "A" BAR



DETAIL OF "B" BAR

~ NOTES ~

BID ITEM AND UNIT TO BID:

A. CONCRETE MEDIAN BARRIER TYPE ☆ ⊕ 50.
☆ 300 OR 350 DEPENDING ON W. ⊕ A OR C DEPENDING ON PAVEMENT TYPE.

B. WITH FLEXIBLE PAVEMENT THE CONTRACT UNIT PRICE PER METER SHALL INCLUDE THE BASE, ALL CONCRETE, LABOR, REINFORCING STEEL AND ALL OTHER INCIDENTALS NECESSARY TO COMPLETE THE PERMANENT INSTALLATION.

C. WITH RIGID PAVEMENT THE CONTRACT UNIT PRICE PER METER SHALL INCLUDE, THE BASE, ALL CONCRETE, LABOR, REINFORCING STEEL AND ALL OTHER INCIDENTALS NECESSARY TO COMPLETE THE PERMANENT INSTALLATION.

① 50 MM DIA. LIFTING HOLE - 2 REQUIRED EACH SECTION. FORMED WITH 50 MM P.V.C. PIPE OR EQUAL.

② THE RACEWAY SHALL BE TIED TO EACH OF THE A AND B BARS TO PREVENT SAG. SEE ELSEWHERE IN THE PLANS FOR LOCATION AND PAYMENT FOR RACEWAY WHEN REQUIRED.

③ 300 MM W WITH 760 MM WIDE BASE OR 350 MM W WITH 810 MM BASE. (TAPER NOT INCLUDED IN BASE WIDTH).

4. PLACE ALL STEEL REINFORCEMENT A CLEAR DISTANCE OF 50 MM MIN. FROM OUTSIDE FACE OF WALL, EXCEPT WHERE SHOWN OTHERWISE.

5. SHOP DRAWINGS SHALL BE APPROVED PRIOR TO MANUFACTURE.

⑥ WHEN THE "X" DIMENSION EQUALS 255 MM THE BAR SHALL BE TURNED DOWN 150 MM ("Z" DIMENSION) AND AN ADDITIONAL LONGITUDINAL BAR SHALL BE ADDED AT THE BOTTOM OF THE TURN DOWN ("Z" DIMENSION) AND TO THE "Y" PORTION OF THE BAR. FOR EACH 150 MM INCREMENT OF THE "X" DIMENSION ABOVE 255 MM AN ADDITIONAL LONGITUDINAL BAR SHALL BE ADDED IN THE "Z" AND "Y" PORTION OF THE BAR.

⑦ THE "Z" DIMENSION SHALL INCREASE MM FOR MM WHEN THE "X" DIMENSION EXCEEDS 255 MM.

⑧ LIFTING BARS SHALL BE REQUIRED TO PREVENT SPALDING OF CONCRETE AROUND HOLES.

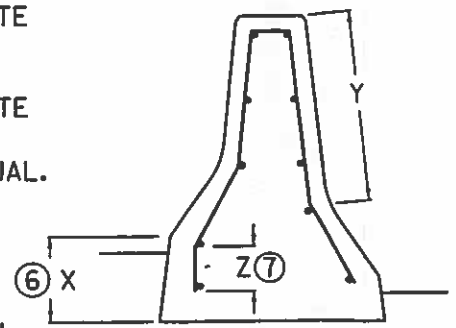
⑨ THE LIFTING HOLES SHALL BE FILLED WITH GROUT WHEN COMPLETE.

⑩ WALL MAY BE FORMED AS DEPICTED BY PHANTOM LINES.

⑪ PAVEMENT THICKNESS MINUS 75 MM.

⑫ SEE ELSEWHERE IN PLANS FOR BASE REQUIREMENTS.

13. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SHOWN OTHERWISE.



STEEL PLACEMENT FOR ASYMMETRICAL WALL SECTION

APPROX. REINF./6000 MM SECTION
134 KG.

APPROX. CU. M. CONC./METER
300 WIDE TOP = 0.57
350 WIDE TOP = 0.65

APRROX. WEIGHT/6000 MM SECTION BASED ON 2403 KG./CU. M.
300 WIDE TOP = 8.4 M TONS
350 WIDE TOP = 9.4 M TONS

KENTUCKY DEPARTMENT OF HIGHWAYS

CONCRETE MEDIAN BARRIER PRECAST (PERMANENT)

SUBMITTED William S. Haskins ASS'T. DIRECTOR DIVISION OF DESIGN 2-8-1993 DATE
APPROVED ____ STATE HIGHWAY ENGINEER ____ DATE

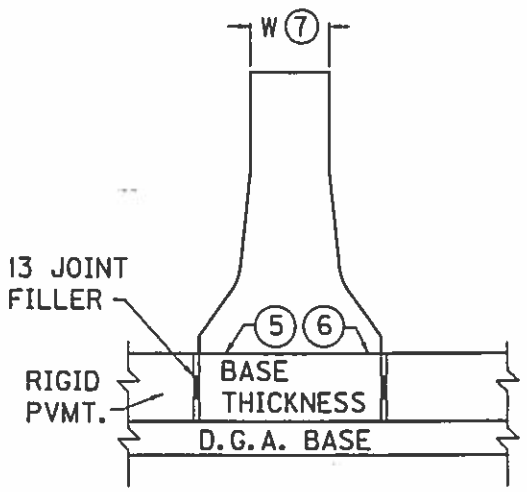
DATE FEB.-3-93
DRAWN ____
CHECKED D.H.M.
RECOMMENDED ____
APPROVED F.H.W.A. ____

STD DWG FORM : TALLWALL
GRAPHICS FILE NUMBER MC
XY=1058,1000

DRAWING SCALE:
SCALE: 1"=1'-0"
ASYMMETRICAL 3/4"=1'-0"

Exhibit
PCMB2

COUNTY OF	FISCAL YEAR	SHEET NO.	TOTAL SHEETS



TYPE A BARRIER
(NEW RIGID PAVEMENT)

~ NOTES ~

THE CONTRACT UNIT PRICE PER METER FOR "CONCRETE MEDIAN BARRIER TYPE ☆ ⊕ 50" SHALL BE FULL COMPENSATION FOR ALL MATERIALS, EQUIPMENT, LABOR AND INCIDENTALS NECESSARY TO COMPLETE THE WORK.

☆ 300 OR 350 DEPENDING ON W.

⊕ A, B OR C DEPENDING ON PAVEMENT TYPE.

① LONGITUDINAL CONSTRUCTION JOINT WITHOUT TIE BARS IS REQUIRED AND SHALL BE PLACED AT THE LOCATION SHOWN OR MAY BE INSTALLED AT THE CORRESPONDING POINT ON THE OPPOSITE SIDE OF THE BARRIER, AT THE OPTION OF THE CONTRACTOR. IT SHALL BE REQUIRED ON THE LOW SIDE OF A SUPERELEVATED SECTION.

② NO. 25 DOWEL BARS SPACED 1200 MM O.C. AND STAGGERED 600 MM.

③ 75 MM RACEWAY (TYPICAL) SEE ELSEWHERE IN THE PLANS FOR LOCATION AND PAYMENT FOR RACEWAY WHEN REQUIRED.

④ WALL MAY BE FORMED AS DEPICTED BY PHANTOM LINES.

⑤ WHEN A CONSTRUCTION JOINT IS USED, DOWEL BARS WILL BE REQUIRED AS SHOWN WITH TYPE B BARRIERS.

⑥ CONSTRUCTION JOINT PERMITTED WHEN FIXED FORMS OR SLIP FORMS ARE USED.

⑦ A 350 MM WALL IS REQUIRED ONLY WHEN THE ROADWAY WILL BE LIGHTED FROM THE MEDIAN.

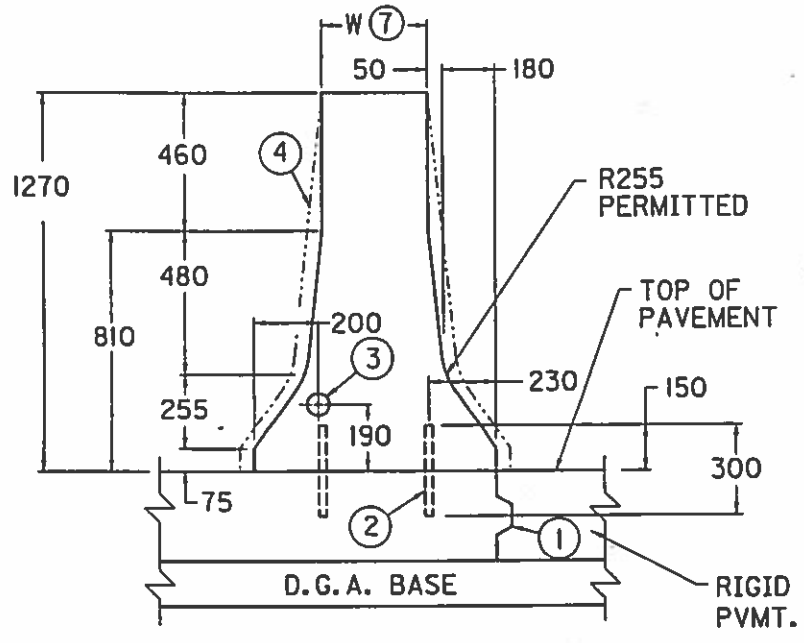
8. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SHOWN OTHERWISE.

APPROX. QUANTITIES PER METER

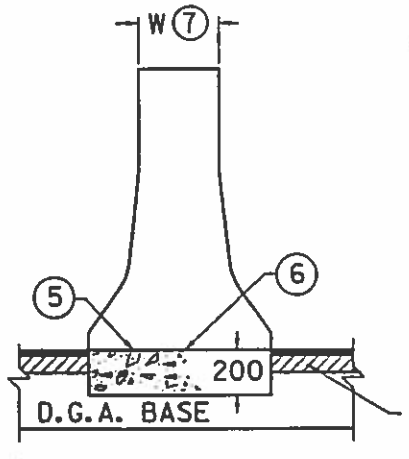
TYPE	300 WALL		350 WALL	
	CONC. IN CU. M.	STEEL IN KG.	CONC. IN CU..M.	STEEL IN KG.
A	0.67	△1.99	0.75	△1.99
B	0.53	1.99	0.57	1.99
C	0.67	△1.99	0.75	△1.99

△ WHEN REQUIRED

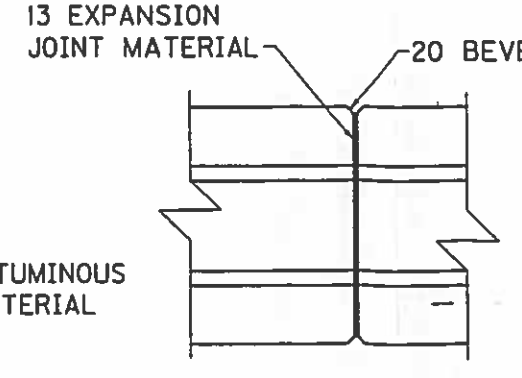
CONCRETE QUANTITIES SHOWN INCLUDE 200 MM BASE THICKNESS FOR TYPE A AND TYPE C.



TYPE B BARRIER
(NEW RIGID PAVEMENT)



TYPE C BARRIER
(NEW FLEXIBLE PAVEMENT)



EXPANSION JOINT DETAIL

STD DRG FORM = TALLWALL
GRAPHICS FILE NUMBER= MC
XY=1050, 1050

DATE FEB.-3-93
DRAWN
CHECKED D.H.M.
RECOMMENDED
APPROVED F.H.W.A.

KENTUCKY
DEPARTMENT OF HIGHWAYS

CONCRETE MEDIAN BARRIER
FIXED-FORM OR SLIP-FORM
(PERMANENT)

SUBMITTED William J. Hollid ASS'T. DIRECTOR DIVISION OF DESIGN 2-8-1993 DATE
APPROVED _____ STATE HIGHWAY ENGINEER _____ DATE

PROJECT NO: 11-008.0	STUDY SUMMARY
	DEVELOPMENT PHASE
	RECOMMENDED ALTERNATIVE - - SKETCH AND DESCRIPTION

Perm. Conc. Barrier Wall.

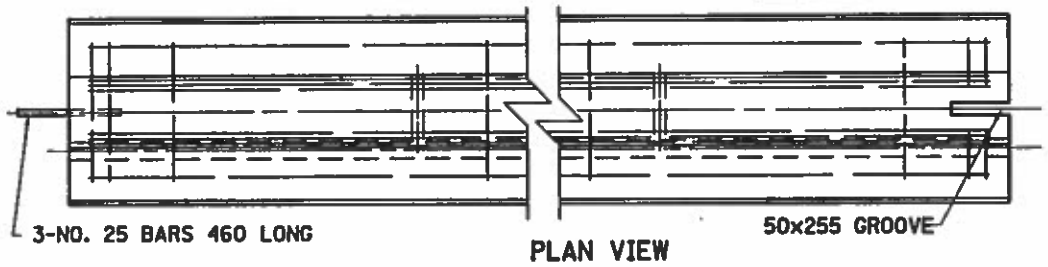
KTC 1997 Aug. Bid Prices,

Item 1992 Install Temp. Conc. Barrier Ty 9M (230m) = $12.26/ft = $40.22m
Item 9119 Relocate " " " " " (") : $15/meter
Item 1991 Conc. Median Barrier Ty 230 = $95.10/m

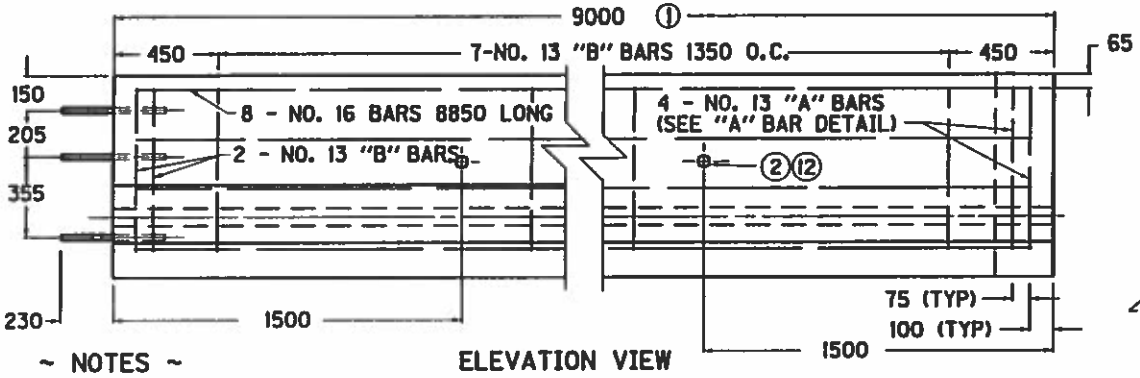
Along the increased height from 815mm to 1270 mm does provide glare protection from the 3.5' (1070mm) driver's eye height, we do not feel it is warranted for this project. It is our understanding that no study was done on this and it was implemented by preference only. We propose to do several things:

1) Reduce thickness to 9". There is no foreseen advantage to the increased thickness.
2) Use Std. height on wall of 815mm.
3) Relocate the Temp. Barrier wall and install Permanently. This may be incorperated with our proposal Per the Temp. Barrier wall in which State owned units were used.

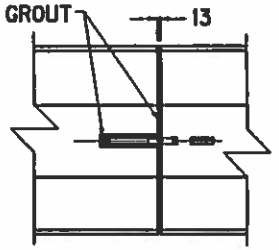
See Exhibits PCMB 3 & 4



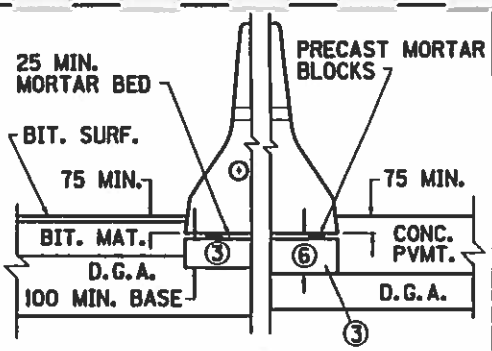
PLAN VIEW



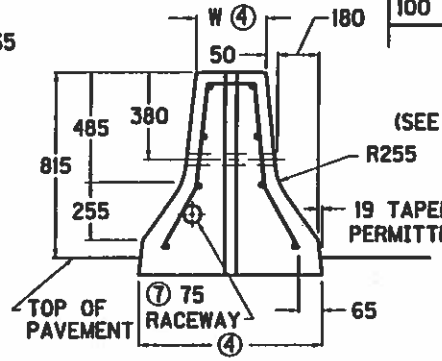
ELEVATION VIEW



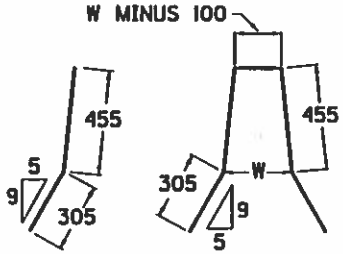
CONNECTION DETAIL



PAVEMENT DETAIL ⑤
(SEE RIGHT ELEVATION FOR DIMENSIONS)

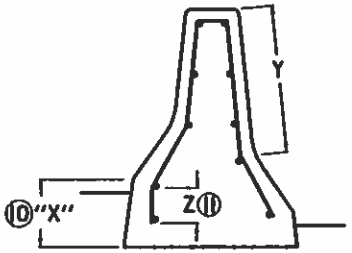


RIGHT ELEVATION VIEW



DETAIL OF "A" BAR

DETAIL OF "B" BAR



STEEL PLACEMENT FOR ASYMMETRICAL WALL SECTION

~ NOTES ~

BID ITEM AND UNIT TO BID:

A. CONCRETE MEDIAN BARRIER TYPE ⊕ ⊕ .

⊕ 150 OR 230 OR 300 OR 350 DEPENDING ON W.

⊕ A OR C DEPENDING ON PAVEMENT TYPE (SEE CUR. STD. DWG. RBM-001 FOR TYPE).

B. WITH FLEXIBLE PAVEMENT THE CONTRACT UNIT PRICE PER METER SHALL INCLUDE THE BASE, ALL CONCRETE, LABOR, REINFORCING STEEL AND ALL OTHER INCIDENTALS NECESSARY TO COMPLETE THE PERMANENT INSTALLATION.

C. WITH RIGID PAVEMENT THE CONTRACT UNIT PRICE PER METER SHALL INCLUDE, THE BASE, ALL CONCRETE, LABOR, REINFORCING STEEL AND ALL OTHER INCIDENTIALS NECESSARY TO COMPLETE THE PERMANENT INSTALLATION.

FOR ILLUSTRATION PURPOSES, THE PAVEMENT DETAIL ABOVE DEPICTS THE INSTALLATION OF A CONCRETE MEDIAN BARRIER (PRECAST) WITH NEW RIGID PAVEMENT ON ONE SIDE AND NEW FLEXIBLE

① SHORTER SECTIONS MAY BE PERMITTED IF APPROVED IN WRITING BY THE ENGINEER.

② 50 MM DIA. LIFTING HOLE - 2 REQUIRED EACH SECTION. FORMED WITH 50 MM P.V.C. PIPE OR EQUAL.

③ SEE ELSEWHERE IN THE PLANS FOR BASE REQUIREMENTS.

④ 150 MM WIDE TOP WITH 610 MM WIDE BASE OR 230 MM WIDE TOP WITH 690 MM WIDE BASE, OR 300 MM WIDE TOP WITH 760 MM WIDE BASE OR 350 MM WIDE TOP WITH 810 MM WIDE BASE. (TAPER NOT INCLUDED IN BASE WIDTH).

⑤ OTHER METHODS OF ANCHORAGE WILL BE ACCEPTABLE IF APPROVED IN WRITING BY THE ENGINEER.

⑥ PAVEMENT THICKNESS MINUS 75 MM.

⑦ THE RACEWAY SHALL BE TIED TO EACH OF THE "A" AND "B" BARS TO PREVENT SAG. SEE ELSEWHERE IN THE PLANS FOR SIZE, LOCATION, AND PAYMENT FOR RACEWAY WHEN REQUIRED.

8. PLACE ALL STEEL REINFORCEMENT A CLEAR DISTANCE OF 50 MM MIN. FROM OUTSIDE FACE OF WALL, EXCEPT WHERE SHOWN OTHERWISE.

9. SHOP DRAWINGS SHALL BE APPROVED PRIOR TO MANUFACTURE.

⑩ WHEN THE "X" DIMENSION EQUALS 255 MM THE BAR SHALL BE TURNED DOWN 150 MM ("Z" DIMENSION) AND AN ADDITIONAL LONGITUDINAL BAR SHALL BE ADDED AT THE BOTTOM OF THE TURN DOWN ("Z" DIMENSION) AND TO THE "Y" PORTION OF THE BAR. FOR EACH 150 MM INCREMENT OF THE "X" DIMENSION ABOVE 255 MM, AN ADDITIONAL LONGITUDINAL BAR SHALL BE ADDED IN THE "Z" AND "Y" PORTION OF THE BAR.

⑪ THE "Z" DIMENSION SHALL INCREASE MM FOR MM WHEN THE "X" DIMENSION EXCEEDS 255 MM.

⑫ LIFTING BARS SHALL BE REQUIRED TO PREVENT SPALDING OF CONCRETE AROUND HOLES.

13. WHEN THE PRECAST WALL IS USED IN PERMANENT CONSTRUCTION THE LIFTING HOLES SHALL BE FILLED WITH GROUT.

14. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SHOWN OTHERWISE.

APPROX. REINF./9000 SECTION
131 KGS

APPROX. CU. M CONC./METER
150 WIDE TOP = 0.33
230 WIDE TOP = 0.40
300 WIDE TOP = 0.45
350 WIDE TOP = 0.50

APRROX. WEIGHT/9000 SECTION
BASED ON 2403 KG/CU. M
150 WIDE TOP = 7.1 MTONS
230 WIDE TOP = 8.9 MTONS
300 WIDE TOP = 10.1 MTONS
350 WIDE TOP = 11.0 MTONS

USE WITH CUR. STD. DWG. RBM-001

KENTUCKY
DEPARTMENT OF HIGHWAYS

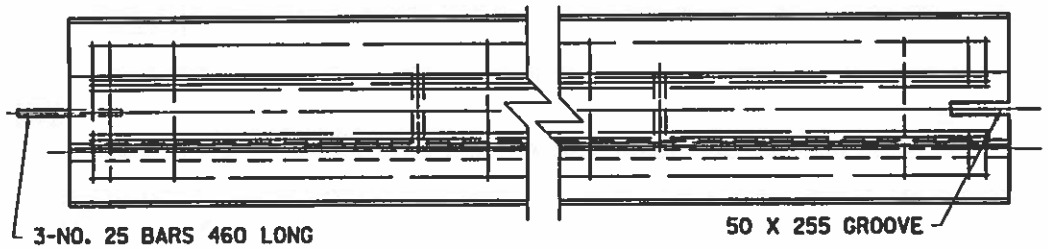
CONCRETE MEDIAN BARRIER PRECAST (PERMANENT)

STANDARD DRAWING NO. RBM-003-08

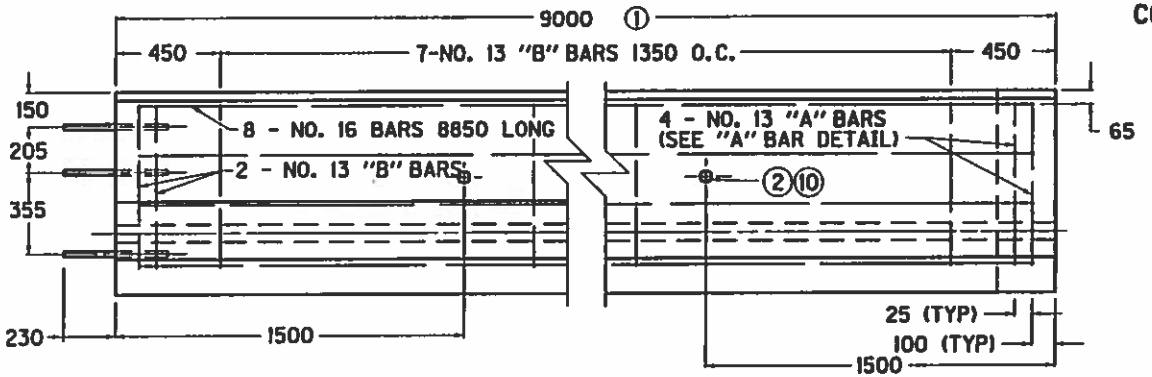
SUBMITTED _____ 05-30-07
DATE

APPROVED _____ 05-30-07
STATE HIGHWAY ENGINEER DATE

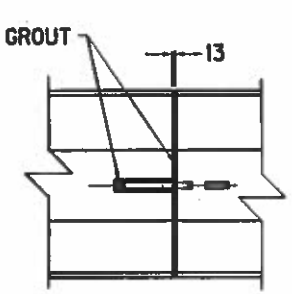
Exhibit 3 CMB



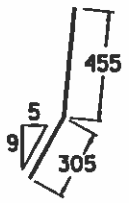
PLAN VIEW



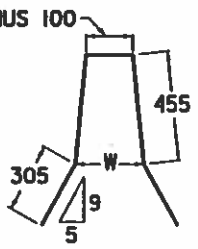
ELEVATION VIEW



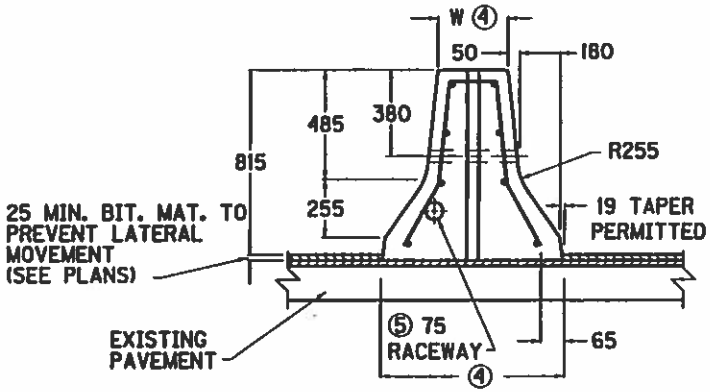
CONNECTION DETAIL



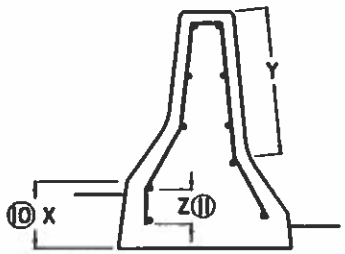
DETAIL OF "A" BAR



DETAIL OF "B" BAR



RIGHT ELEVATION VIEW



STEEL PLACEMENT FOR ASYMMETRICAL WALL SECTION

APPROX. REINF./9000 SECTION
131 KG

APPROX. CU. M CONC./METER
150 WIDE TOP = 0.30
230 WIDE TOP = 0.35
300 WIDE TOP = 0.40
350 WIDE TOP = 0.43

APRROX. WEIGHT/9000 SECTION BASED ON 2403 KG/CU. M
150 WIDE TOP = 5.99 M TONS
230 WIDE TOP = 7.35 M TONS
300 WIDE TOP = 8.80 M TONS
350 WIDE TOP = 9.62 M TONS

~ NOTES ~

BID ITEM AND UNIT TO BID:
A. CONCRETE MEDIAN BARRIER TYPE ⊕__ ⊕__ .
⊕ 150 OR 230 OR 300 OR 350 DEPENDING ON W.
⊕ D OR E DEPENDING ON PAVEMENT TYPE.

① SHORTER SECTIONS MAY BE PERMITTED IF APPROVED IN WRITING BY THE ENGINEER.
② 50 MM DIA. LIFTING HOLE - 2 REQUIRED EACH SECTION. FORMED WITH 50 MM P.V.C. PIPE OR EQUAL.
3. SEE ELSEWHERE IN THE PLANS FOR BASE REQUIREMENTS.
④ 150 MM WIDE TOP WITH 610 MM WIDE BASE OR 230 MM WIDE TOP WITH 690 MM WIDE BASE OR 300 MM WIDE TOP WITH 760 MM WIDE BASE, 350 MM WIDE TOP WITH 810 MM WIDE BASE. (TAPER NOT INCLUDED IN BASE WIDTH).
⑤ THE RACEWAY SHALL BE TIED TO EACH OF THE A AND B BARS TO PREVENT SAG. SEE ELSEWHERE IN THE PLANS FOR SIZE, LOCATION, AND PAYMENT FOR RACEWAY WHEN REQUIRED.
6. PLACE ALL STEEL REINFORCEMENT A CLEAR DISTANCE OF 50 MM MIN. FROM OUTSIDE FACE OF WALL, EXCEPT WHERE SHOWN OTHERWISE.
7. SHOP DRAWINGS SHALL BE APPROVED PRIOR TO MANUFACTURE.
⑧ WHEN THE "X" DIMENSION EQUALS 255 MM THE BAR SHALL BE TURNED DOWN 150 MM ("Z" DIMENSION) AND AN ADDITIONAL LONGITUDINAL BAR SHALL BE ADDED AT THE BOTTOM OF THE TURN DOWN ("Z" DIMENSION) AND TO THE "Y" PORTION OF THE BAR. FOR EACH 150 MM INCREMENT OF THE "X" DIMENSION ABOVE 255 MM AN ADDITIONAL LONGITUDINAL BAR SHALL BE ADDED IN THE "Z" AND "Y" PORTION OF THE BAR.
⑨ THE "Z" DIMENSION SHALL INCREASE MM FOR MM WHEN THE "X" DIMENSION EXCEEDS 255 MM.
⑩ LIFTING BARS SHALL BE REQUIRED TO PREVENT SPALDING OF CONCRETE AROUND HOLES.
11. WHEN THE PRECAST WALL IS USED IN PERMANENT CONSTRUCTION THE LIFTING HOLES SHALL BE FILLED WITH GROUT.
12. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SHOWN OTHERWISE.

USE WITH CUR. STD. DWG. RBM-001

KENTUCKY
DEPARTMENT OF HIGHWAYS

CONCRETE MEDIAN BARRIER PRECAST (PERMANENT)

STANDARD DRAWING NO. RBM-006-07

SUBMITTED John B. Smallwood 05-30-97
APPROVED [signature] 05-30-97

Exhibit RCMB4

PROJECT NO: 11-008.00	STUDY SUMMARY
	DEVELOPMENT PHASE
	COST COMPARISON

Perm.
Concrete Median Barrier Wall. 6150m - 1208 m (curves) = 4942m

As Designed:

1208m x 137.80 = $166,462.40

6150m x $137.80/m = $847,470.00

Using the Contractor supplied Temp Barrier Wall:

$88.58/m + $15/m = $103.58/m x 4942m = $511,892.36 + $166,462.40 = $678,354.76

Savings of $169,115.24

Using State owned barrier units:

$40.22/m + $15/m = $55.22/m x 4942m = $272,897.24 + 166,462.40 = $439,359.64

Savings of $408,110.36

Savings above the Temp. Median Barrier Wall:

$15/m to relocate vs. $137.80/m to construct,

$15 x 4942 = $74,130 + 166,462.40 = $240,592.40 vs. $137.80 x 6150 = $847,470.00

Savings of $606,877.60

Percent Savings of 71.6%

Once installed, the life expectancy and maintenance costs are identical, therefore only the present worth of const. costs are different.

V. Perforated Pipe

As Proposed

The proposed design used 5 strands of 100 mm drainage pipe for a total of 30,000 meters.

VE Alternate A

The Value Engineering alternate proposes 3 strands of 100 mm pipe instead of 5 strands.

Calculations

Proposed: 30,000m x $13.63/m = $408,900

VE alternate: 20,000m x $13.63/m = $272,600

Difference = $136,300

Discussion

The Value Engineering alternate eliminated the perforated pipe next to the existing pavement and the proposed pavement.

V. Perforated Pipe Headwalls

As Proposed

50 each at $1,000 each = $50,000

VE Alternate 1

Use smaller headwalls for 2:1 or 3:1 fill slopes

VE Alternate 2

Replace headwalls with rip rap material.

Calculations

VE Alternate 1

3:1, use 0.137 m3 x 50 headwalls = 6.85 m3 x $360.00/m3 = $2,466.00

VE Alternate 2

Use existing rock for each pipe end and use rodent cap with bolts.

Supplier cost = $3.50 + labor ($6.50) = $10.00 each x 50 headwalls = $500.00

COUNTY OF	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
LAUREL			

TENN. ST. LINE - LEXINGTON RD. (I-75)
ITEM NO 99-2025.00

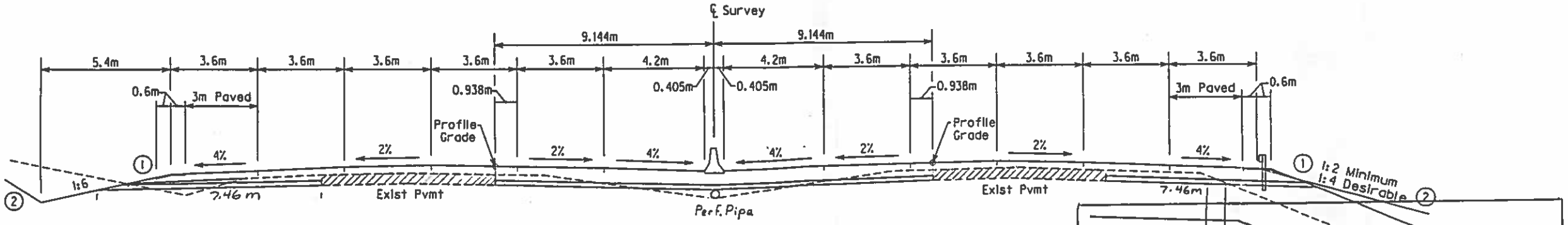
40 mm Surface		
240 mm B. B.		
350 mm PCC	150 mm G. B.	Drainage Blanket / D.B.
150 mm DGA	100 mm TY II ASPH	
	150 mm D.G.A.	
Exist	Proposed	

Pavement Detail

TYPICAL SECTIONS

I-75

STA 62+000 TO STA 65+300

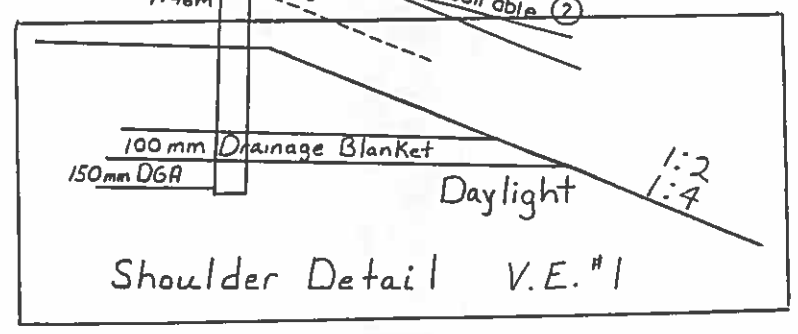


NORMAL SECTION
8 LANE

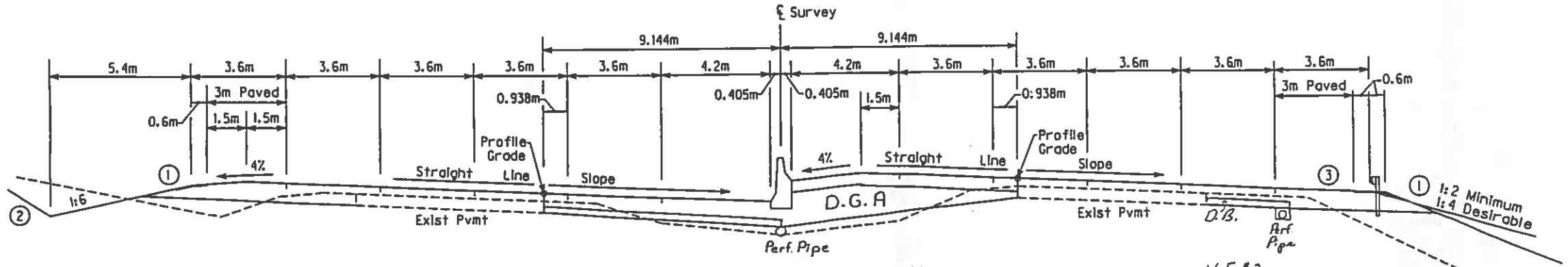
① BIT. SEAL FOR SHOULDERS FROM OUTSIDE EDGE OF PAVEMENT TO A POINT 0.6m DOWN THE DITCH OR FILL SLOPE.

② SEE CROSS SECTIONS FOR SLOPES OUTSIDE THE LIMITS OF THE SHOULDER.

③ SUPERELEVEATED SHOULDERS, CONSTRUCT TO STANDARD SUPERELEVATION EXCEPT NOT FLATTER THAN SLOPES INDICATED FOR NORMAL SHOULDERS.



Shoulder Detail V.E. #1



SUPERELEVATED SECTION
8 LANE

V.E. #2

1

Super = 62+ [illegible] 8-lane
[illegible]
553.76 m

PC 51+382.157
Super = 61+ [illegible] = -lane
452.08 m

Normal

Project
End 66+500
[illegible] 60+200
6.3

6-Lane	8-Lane	6-Lane
[illegible]+000	62+000	65+300
60+200	65+[illegible]	66+500
1 800 m	3 300 m	1 200 m
− 452 m	− 554 m	
1 348	2 746 m	

Total 6-Lane	8-Lane	Normal Crown
1348		
1200		
2548 m	2746 m	

11+2

Drainage Blanket / Sewer elev. 3 Lane

Center	Shoulder	
9.144 m	3.6[illegible] - .153 =	3.663 m
.405 m		3.60 m
.405 m		3.60 m
1.144 m		3.60 m
19.1 m		- 0.15 m Concrete
		1.2 m slope
		7.45 m

Total Width = 26.6 m

Drainage Blanket / Sewer elev. 3 Lane

Center	Shoulder
9.144 m	
0.405 m	
9.549 m	7.46 m

Total Width = 17.0 m

Drainage Blanket / Normal Crown 6-Lane

Center	Shoulder
19.1 m	3.6 - 0.938 = 2.66 m
	= -7.2
	3.6
	3.6
	1.2 m
	3.86 m

Total width = 19.1 + 3.86 + 3.86 = 26.82 m

Drainage Blanket / Supercelev. 6-Lane

Center	Shoulder
9.144	
.405	
9.549 m	3.86 m

Total width = 13.41 m

Interior Drainage District

Super 3

554 m x 17.0 m x 100 mm x 2.14/1000 = 2,015.5

Super 6

452 m x 13.71 m x 100 mm x 2.14/1000 = 1,217.1 m

Normal 8

2746 m x 36.6 m x 100 mm x 2.14/4000 = 15,631.3 m

Normal 6

2548 m x 26.82 m x 100 mm x 2.14/1000 = 14,624.2 m

33,563.1 m

V.E. #1

$975,153.16

Super

Length 554 m
452 m
1006 m

Sh
0.6
0.6
1.2
3.0 m
5.4 m

1006 m × 5.4 m × 100 mm × 2.14/1000 = 1,162.5 t

Normal

width
5.4 + 5.4 = 10.8 m

Length
2548 m 6-Lane
2746 m 3-Lane
5294 m

5294.0 m × 10.8 m × 100 mm × 2.14/1000 = 12,235.5 t

Total m Ton O.B. Asph. II

Subtract O.B II — 13,398. Ton x $29.05/ton = $389,212

Add Pipe

1006 m Super 1,006
5294 m x 2 Normal 10,588
11,594.0 m Pip

$13.63/m x 11,594 m = $158,026

Project Qty D.B.

33,563.1 M ton Day light

13,393.0 M ton E. M.

20,170.1 M ton

29.05 /mton X 20,170.1 M ton = $585,941.4

Perf. Pipe $403,900.00

994,841.00

V. E. #1

1 Line Perf. Pipe 6300 m x 13.63/m = $85,869

+ D.B. = $975,153

$1,061,022

V. E. #2

	Center	Normal	Super
3 Lines Perf. Pipe	6300 m	2(5294) m	+ 1005 m

= 17,803 m

Pipe $13.63/m x 17,803 m = $242,655

+

D.B. $975,153.16 - 389,212 = $585 941

$828,596

Subsurface Drainage

Proposed
30,000 Meter Perf. Pipe
Drainage Blanket

V.E.I
7,000 Meter Perf. Pipe (Median) See Drawing

Daylight Drainage Blanket at Shoulders.

This alternate eliminated all proposed pipe except the extended drainage blanket to the shoulder edge.

V.E. II

This alternate stops the drainage Blanket at the Edge of Metal on each shoulder. There will be three strings of Perf. Pipe. One in the median and one in each shoulder.

PROJECT NO:	STUDY SUMMARY
	DEVELOPMENT PHASE
	DESIGN ELEMENT SELECTED FOR STUDY - -SKETCH AND DESCRIPTION

1.) Build as Proposed

2.) Make Headwall smaller.

3.) Eliminate Headwall and use Rodent Cap and Rock.

(2.) V.E. # 1

See Attached Drawing of Headwall

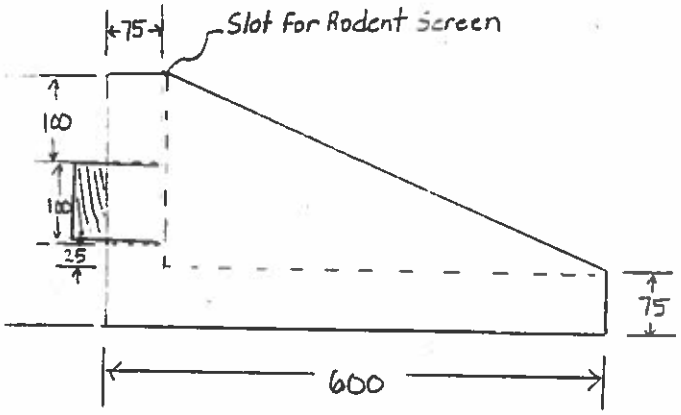
Headwall requires 0.137 Cu. Meters of Cl "A" Concrete. This headwall will match either 2:1 or 4:1 slope. It is built at a 3:1 slope will serve as rodent defense and keep mize From being ruched.

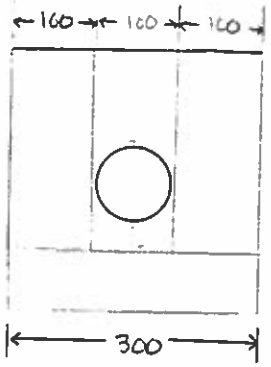
(3.) V.E. # 2

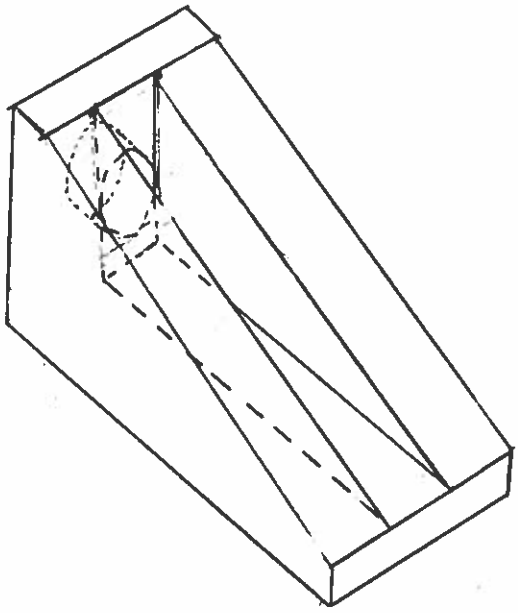
Rock will replace the Headwall and a Rodent Cap will keep the pipe clean. This cap is used by Agriculture industry.

Recomend V.E. # 2

PROJECT NO:	STUDY SUMMARY
	DEVELOPMENT PHASE
	RECOMMENDED ALTERNATIVE - - SKETCH AND DESCRIPTION



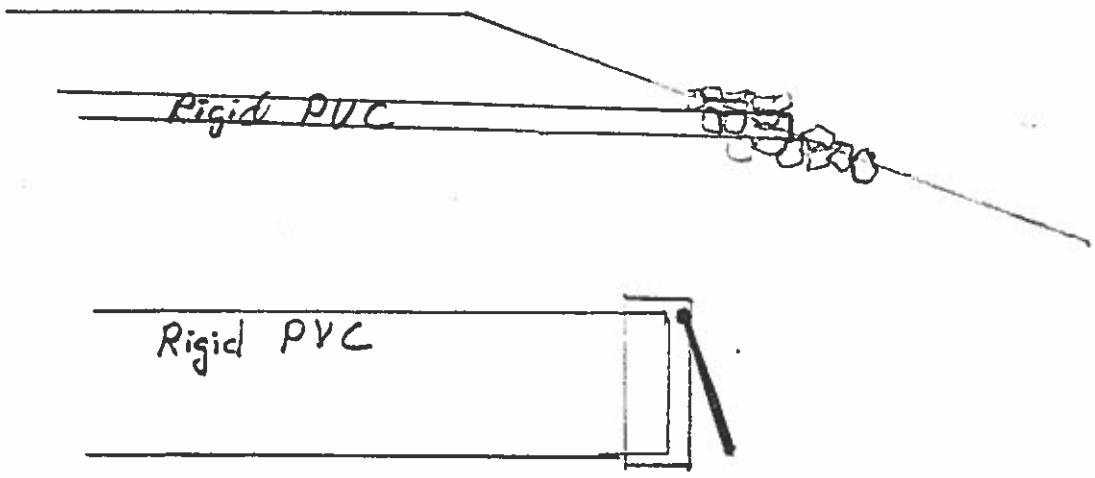




Will Fit 2:1 or 3:1 slopes.

Class "A" Concrete / 0.137 Cu. Meter

PROJECT NO: I-75 Mainline	STUDY SUMMARY
	DEVELOPMENT PHASE
	RECOMMENDED ALTERNATIVE - - SKETCH AND DESCRIPTION



Rodent Trap

PROJECT NO:	STUDY SUMMARY
	PRESENTATION PHASE
	OUTLINE FOR ORAL PRESENTATION

1.) Proprosed
Precast Headwalls (50 Headwalls)
2:1 / 0.29 Cu. Meter
4:1 / 0.43 Cu. Meter
Total Cost = $50,000

2.) V.E. I Smaller Precast Headwall
3:1 / 0.137 Cu. Meter
50 Headwalls x 0.137 Cu. Meter = 6.85 Cu. Meter
cost. / $360.00/cum x 6.85 Cu. Meter = $2,466
Total Cost = $ 2,466

3.) V.E. II No Headwall
Use existing Rock for each pipe End.
Rodent Cap / Bolts on to pipe.
Supplier cost $3.50 + Labor $6.50 = $10.00/each
50 Ends x $10.00
Total Cost
$500.00

VI. Box Culverts

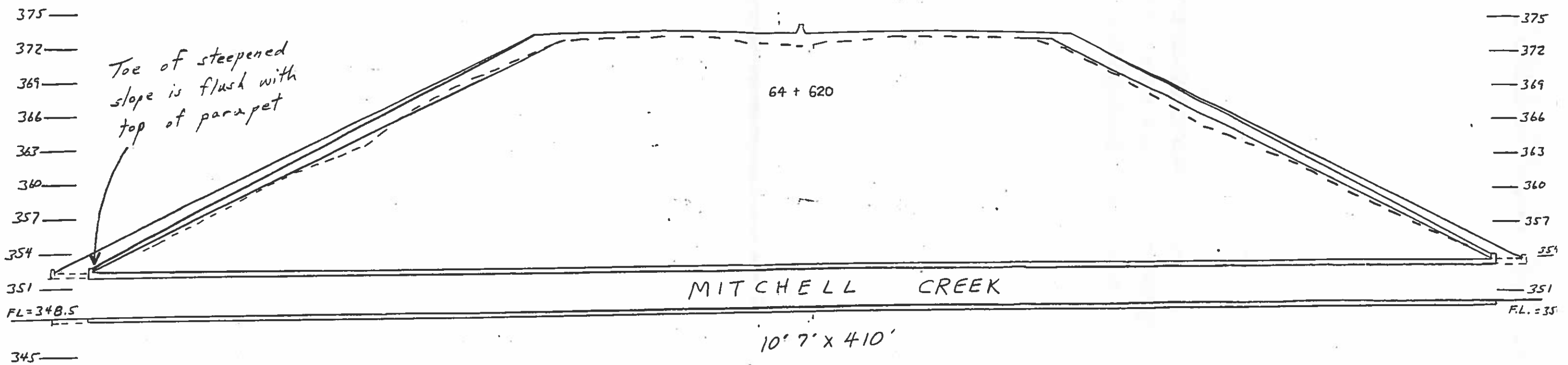
Proposed : Extend two box culverts located at Sta. 64+627 and Sta. 63+089
Proposed $240,000

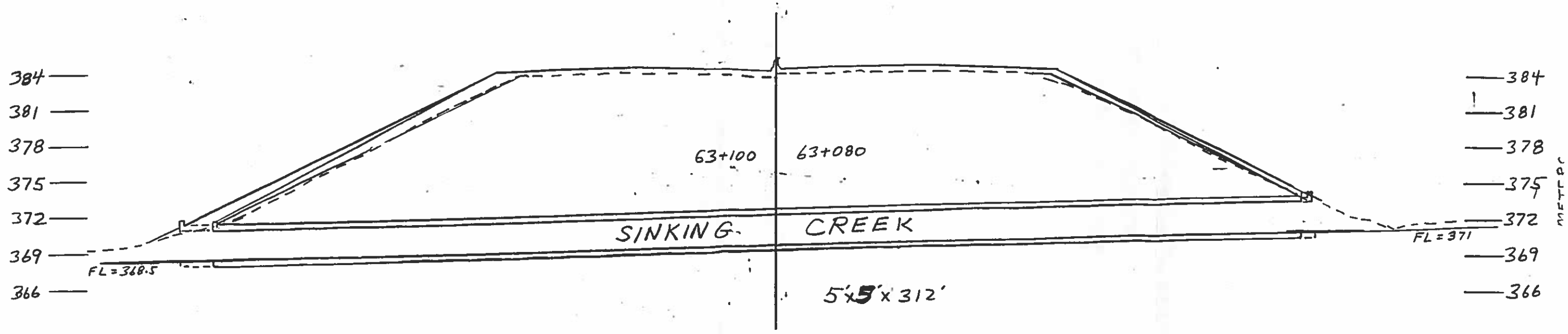
VE Alternate

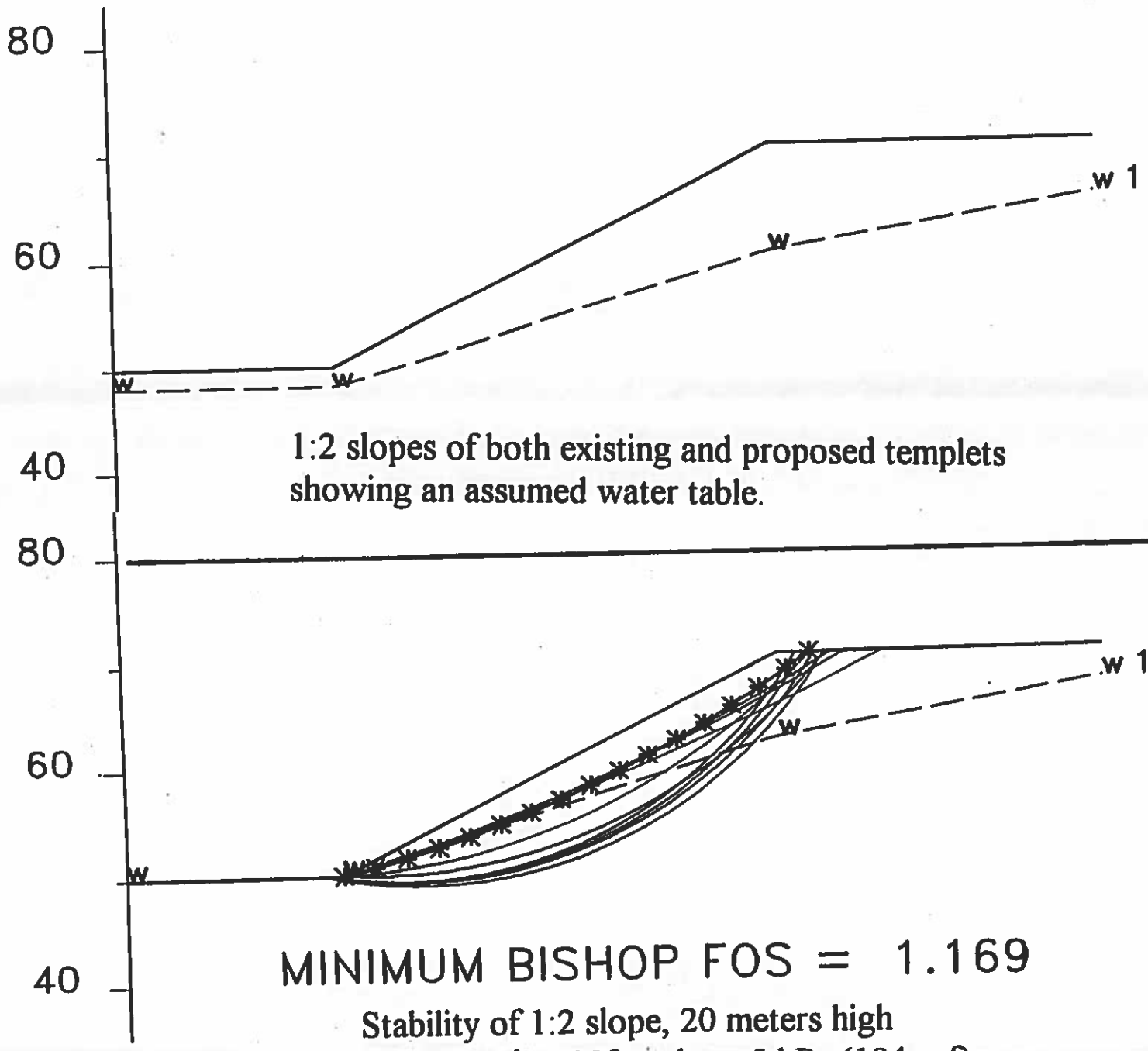
Steepen side slopes of proposed template to allow for wider crown without extending culverts. The toe of the proposed slope could be flush with the top of the existing parapet and culvert wings so that the amount of steepened slopes is held to a minimum.

Discussion:

Stability analysis was performed for the left slope of the culvert at Sta. 64+627. This is probably the most critical section. The embankment is approximately 20m in height and a 1.5m of additional material is being added. The "Proposed" change in slope angle is from 1:2 to 1:1.8. Assuming soil strength parameters of phi = 28° and c= 5kPa, the factor of safety of the 1:2 slope is 1.17. The steepened slope for the same soil strength parameters fell, but only to 1.084. Thus, assuming that stability of the embankment currently is only marginal, steepening the slope does not have great impact upon stability. Although there is some risk involved (the safety factor lower), the proposed change is safe unless the existing configuration is also at imminent failure. The cost to benefits ratio seems to favor steepening the slopes to eliminate the culvert extensions.


375
372
369
366
363
360
357
354
351
FL=348.5
345
Toe of steepened slope is flush with top of parapet
64 + 620
MITCHELL CREEK
10' 7' x 410'
375
372
369
366
363
360
357
354
351
FL.=35

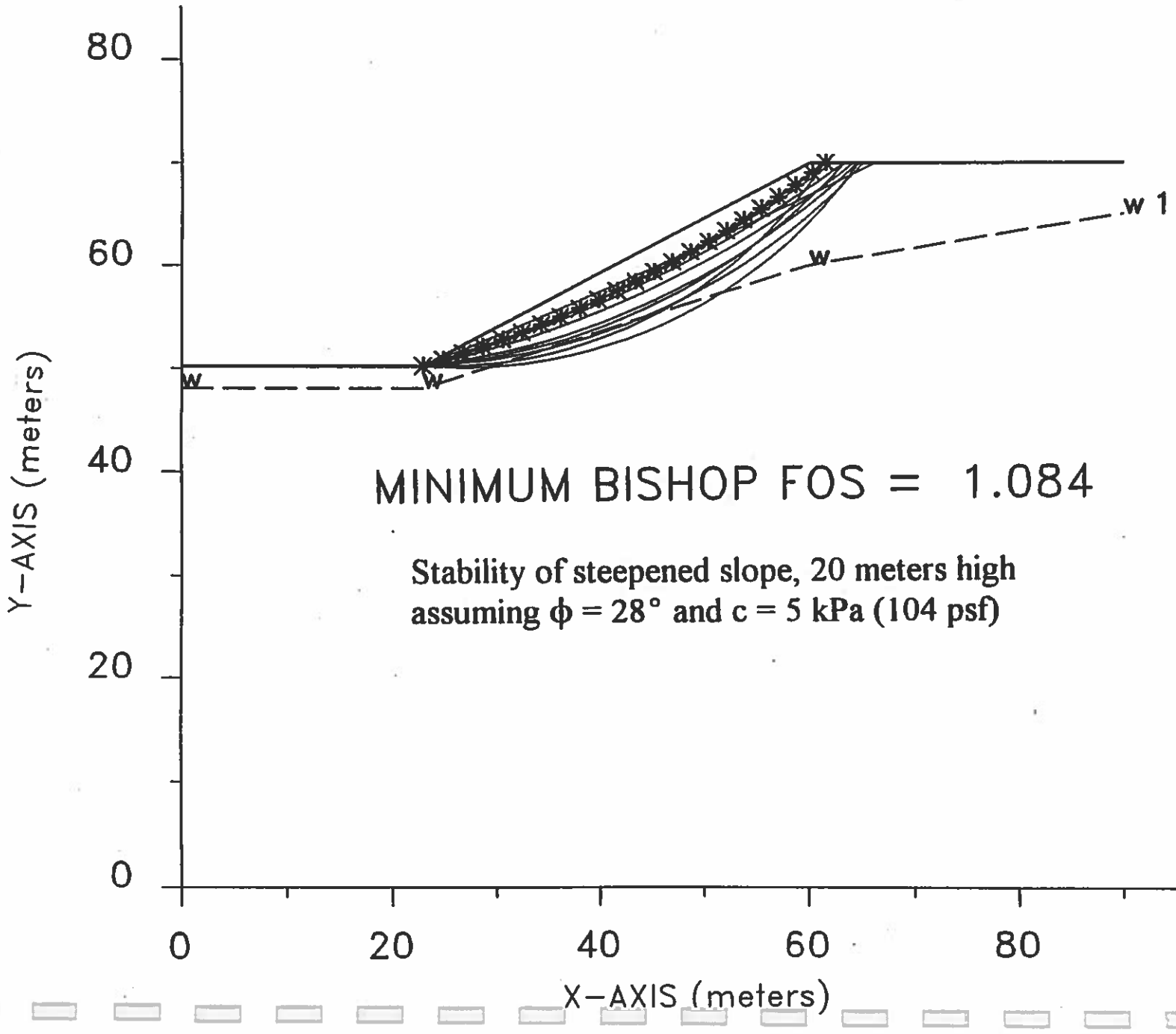

384
381
378
375
372
369
366
63+100
63+080
SINKING CREEK
FL=368.5
5'x5'x312'
FL=371
384
381
378
375
372
369
366
METRIC



1:2 slopes of both existing and proposed templets showing an assumed water table.

MINIMUM BISHOP FOS = 1.169

Stability of 1:2 slope, 20 meters high assuming $\phi = 28°$ and $c = 5$ kPa (104 psf)



MINIMUM BISHOP FOS = 1.084

Stability of steepened slope, 20 meters high assuming $\phi = 28°$ and $c = 5$ kPa (104 psf)

Summary of Recommendations

Recommendation No. 1 - Bridge over Parker Road

The Value Engineering Team recommends that this VE Alternative be implemented. This alternative shortens the bridge from three span to one span by constructing MSE walls at the abutments.

If this recommendation can be implemented, there is a possible savings of $800,000

Recommendation No. 2 - Modify Template

The Value Engineering Team recommends that this VE Alternative be implemented. This alternate consists of flattening the slopes and decreasing the inside shoulder from 4.2 meters to 3.6 meters

If this recommendation can be implemented, there is a possible savings of $777,600.

Recommendation No. 3 - Use Department provided temporary barrier wall

The Value Engineering Team recommends that this VE alternative be implemented. This alternate uses temporary barrier wall from the Department's stockpiles with the contractor installing the barrier.

If this recommendation can be implemented, there is a possible savings of $903,111.

Recommendation No. 4 - Use standard height barrier with glare screens in lieu of extended height barrier

The Value Engineering Team recommends that this VE alternative be implemented. This alternate uses temporary barrier wall from the Department's stockpiles with the contractor installing the barrier.

If this recommendation can be implemented, there is a possible savings of $240,592.40

Recommendation No. 5 - Eliminate guardrail

The Value Engineering Team recommends that this VE alternative be implemented. This alternate uses flattening of the slopes thus eliminating the proposed guardrail.

If this recommendation can be implemented, there is a possible savings of $52,852.00

Recommendation No. 6 - Use current approved end treatments

The Value Engineering Team recommends that this VE alternative be implemented. This alternate uses updated end treatments for any guardrail that may be necessary,

If this recommendation can be implemented, there is a possible savings of $0.00.

Recommendation No. 7 - Eliminate two strands of perforated pipe under pavement

The Value Engineering Team recommends that this VE alternative be implemented. This alternate eliminates two of the five strands of perforated pipe

If this recommendation can be implemented, there is a possible savings of $828,596

Recommendation No. 8 - Box Culverts

The Value Engineering Team recommends that this VE alternative be implemented. This alternate recommends not extending the box culverts but warping the fill around the ends.

If this recommendation can be implemented, there is a possible savings of $204,000

Recommendation No. 9 - Eliminate perforated pipe headwalls

The Value Engineering Team recommends that this VE alternative be implemented. This alternate eliminates the need for perforated pipe headwalls and using granular material.

If this recommendation can be implemented, there is a possible savings of $50,000

Total Possible Savings $2,189,139.6