PLEASE DO NOT TRIM

TITLE SHEET

R.O.W. & UTILITIES UNDER PROJ. NO. F017-1(2)

FEDERAL ROAD REGION NO	DIVISION	PROJ NO	SHEET NO	TOTAL SHEETS
9	COLORADO	F017-1(3)	1	

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

PLAN AND PROFILE OF PROPOSED

FEDERAL AID PROJECT NO. F 017-1(3)

STATE HIGHWAY NO. 24

EL PASO COUNTY

SCALES OF ORIGINAL DRAWINGS

ON PLAN 1 IN = 100 FT.
ON PROFILE 1 IN = 100 FT. HORIZONTAL
1 IN = 10 FT. VERTICAL

GRADE LINE ON PROFILE IS SHOWN AS GRADE OF FINISHED ROAD

CONVENTIONAL SIGNS

CENTER LINE (on PLAN SHEET / TITLE SHEET)
RIGHT OF WAY LINE (R.O.W. MARKER)
COUNTY LINE
TOWNSHIP OR RANGE LINE
LAND LINES (SECTION LINE / 1/16 SECTION LINE / 1/32 SECTION LINE)
RAILROAD (TITLE SHEET / PLAN SHEET)
BARBED WIRE FENCE
COMBINATION WIRE FENCE
SNOW FENCE
TELEPHONE & TELEGRAPH LINES
POWER LINE
WATER LINE (WATER LINE)
PRESENT ROAD (Plan Sheets)
GUARD FENCE
GAS MAIN
CONTROL OF ACCESS
ACCESS DENIED BY DEED (A — 24'OP. — 16'OP. — OP=OPENING — A)

TABULATION OF LENGTH & DESIGN DATA

STATION	48 FT. ROADWAY LIN. FT.	24 FT. ROADWAY LIN. FT.	MAJOR STRUCTURE LIN. FT.	* NO WORK LIN. FT.
59+86.1 BEGIN F 017-1(3) APPROX. OPP. STA. 2216+98.5 on A.W.P. 5005-B				
72+16.4 APPROX. OPP. 2229+28.8 AWP 5005 B = 214+42.8 FAP 158 A	1,230.3			
73+84.1 BEGIN BRIDGE E.B. (73+88.9) (AVERAGE) STR. NO. I-17-AH	172.5			
73+93.7 BEGIN C.B.C. W.B.			23.0/2 = 11.5 AV.	42.1/2 = 21.1 AV.
74+26.2 END BRIDGE E.B. (74+21.5) (AVERAGE) STR. NO. I-17-AH				
74+16.7 END C.B.C. W.B.	880.4			
83+08.3 BEGIN BRIDGE E.B. (83+01.9) (AVERAGE) STR. NO. I-17-AE				
82+95.5 BEGIN C.B.C. W.B.			26.6/2 = 13.3 AV.	52.3/2 = 26.1 AV.
83+60.6 END BRIDGE E.B. (83+41.3) (AVERAGE) STR. NO. I-17-AE				
83+22.1 END C.B.C. W.B.	558.7			
89+00 END 48 FT. RDWY BEGIN 24 FT.		44.0		
89+44.0 BEGIN C.B.C. STR. NO. I-17-V			30.0	
89+74.0 END C.B.C.		3,141.8		
121+15.8 BK.* 121+00.8 AH. EQUATION		3,060.0		
151+60.8 BK.* 152+20.8 AH. EQUATION		4,840.0		
200+60.8 BEGIN C.B.C. STR. NO. I-17-AF			32.5	
200+93.3 END C.B.C.		2,711.9		
228+05.2 END F 017-1(3) APPROX. OPP. STA. 54+10.0 on FAP 158-A				
TOTALS	2,841.9	13,797.7	87.3	47.2

SUMMARY

	LIN. FT.	MILES
48 FT. ROADWAY	2,841.9	0.538
24 FT. ROADWAY	13,797.7	2.613
MAJOR STRUCTURES (AVERAGE)	87.3	0.017
* NO WORK (AVERAGE)	47.2	0.009
TOTAL NET LENGTH	16,726.9	3.168
TOTAL GROSS LENGTH	16,774.1	3.177

* NO WORK EXCEPT REMOVE ASPHALTIC MATERIAL FROM BRIDGES AND PLACE TOP / LAYER OF PLANT MIXED ASPHALTIC SURFACING ON BRIDGES - NON-FEDERAL AID

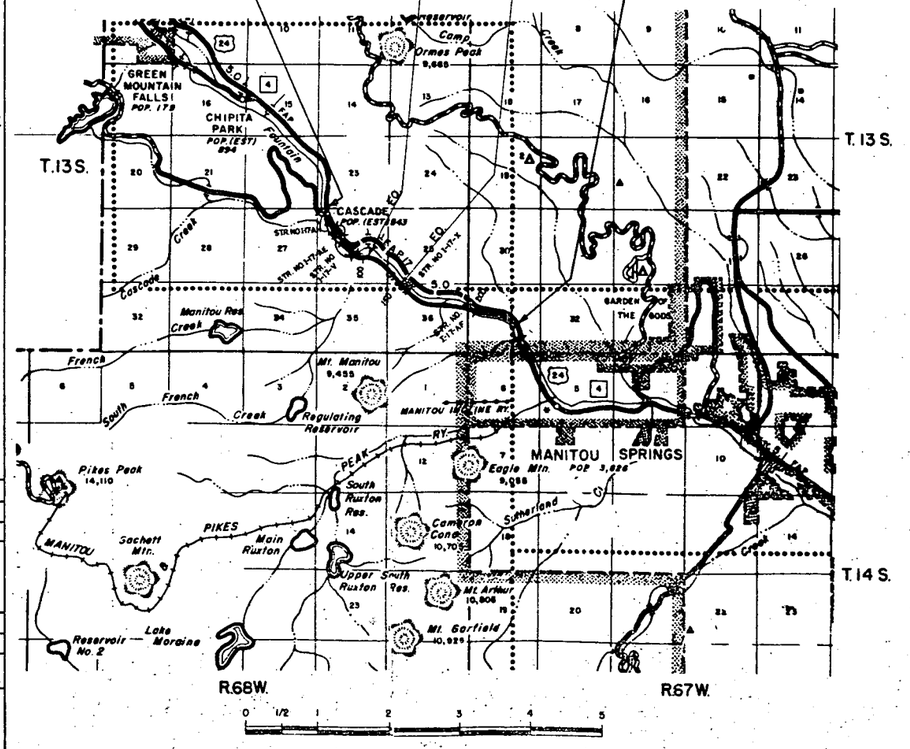
DESIGN DATA

MAXIMUM DEGREE OF CURVE	12°00'
MAXIMUM GRADE	6.9312 %
MINIMUM S.S.D. - HORIZONTAL	285'
MINIMUM S.S.D. - VERTICAL	390'
MAXIMUM DESIGN SPEED	40 M.P.H.

D.W.D.

STA. 59+86.1 BEGIN F 017-1(3)
APPROX. OPP. STA. 2216+98.5 on A.W.P. 5005-B

STA. 228+05.2 END F017-1(3)
APPROX. OPP. STA 54+10.0 on FAP158-A



INDEX OF SHEETS

SHEET NO.

SEE SPECIAL PROVISIONS FOR NOTICE TO BIDDERS

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

APPROVED

Chas. E. Shumate 9-16-64
CHIEF ENGINEER DATE

By: L. C. Bower, Deputy Chief Engr.

DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

APPROVED

DATE

DIVISION ENGINEER

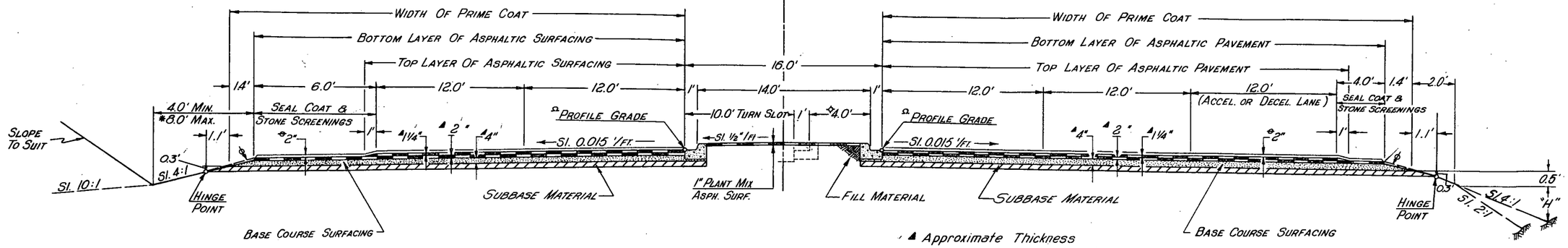
COLORADO DEPARTMENT OF HIGHWAYS
FORM S. D. 11. 185
JANUARY 1960

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F 017-1(3)	2	

NOTE
See Standard M-2-A for details of cut slope treatment, flaring and widening.

TYPICAL SECTION "A"
STA. 59+ to STA. 85+
AND
STA. 85+ to STA. 89+
With Median Transition Δ

FILL SLOPES:
ON CURVES & TANGENTS
Slope 4:1 where "H" is 5' or less
Slope 2:1 where "H" is over 5'
Slope 1½:1 adjacent to Fountain Creek



▲ Approximate Thickness
⊖ Future Asphaltic Pavement

Contractor will be required to blade Additional Surfacing Material to this line after completion of Paving Operation. Material to be Paid for as provided in Item 26.

* Dimension used for Preliminary Quantities.

Ω Where turning slots are provided the profile grade point shall be at the same distance from center line as if the turn slot were not being placed.

Δ See Plan and Profile Sheet & Sheet No. 16 for Median Transition

Approximate compacted thicknesses of asphaltic pavement and base course surfacing shall be placed in separate courses at the following rates in tons per 100 Lin ft. of roadway:

		A	B	C
Asphaltic Pavement	Top Layer	38	22	35
	Bottom Layer	74	42	—
Base Course		139	79	66

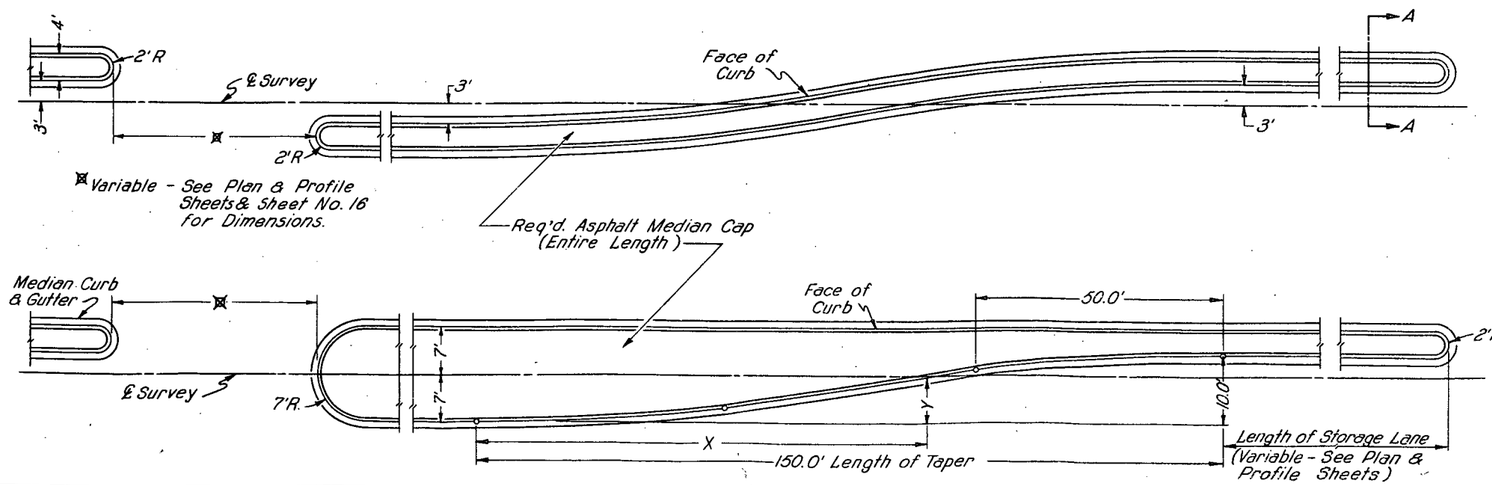
Material above the subgrade is to be constructed of subbase material at locations designated in subbase material tabulation. Estimated quantities involved in this operation and thickness of material required are tabulated in the subbase material plan.

Excavation below 4:1 slope and/or 10:1 slope will not be permitted.

The depth and width of the side ditch shall be varied where necessary in order to provide proper drainage and/or entrance to drainage structures.

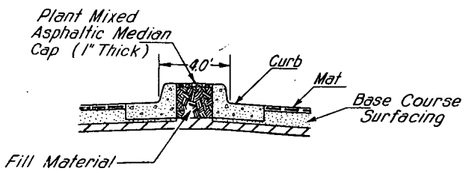
Bottom Layer of Asphaltic Surfacing shall be completed for full width before Top Layer of Asphaltic Surfacing is placed. Paving joints in Top Layer will overlap min. 1 ft. over joints in Bottom Layer.

TYPICAL LAYOUT OF MEDIAN OPENINGS & LEFT TURN SLOTS



OFFSET Y	DISTANCE X
0.00	—
0.16	12.5
0.62	25.0
1.41	37.5
2.50	50.0
5.00	75.0
7.50	100.0
8.59	112.5
9.38	125.0
9.84	137.5
10.00	150.0

DETAILS OF PLANT MIXED ASPHALTIC MEDIAN CAP

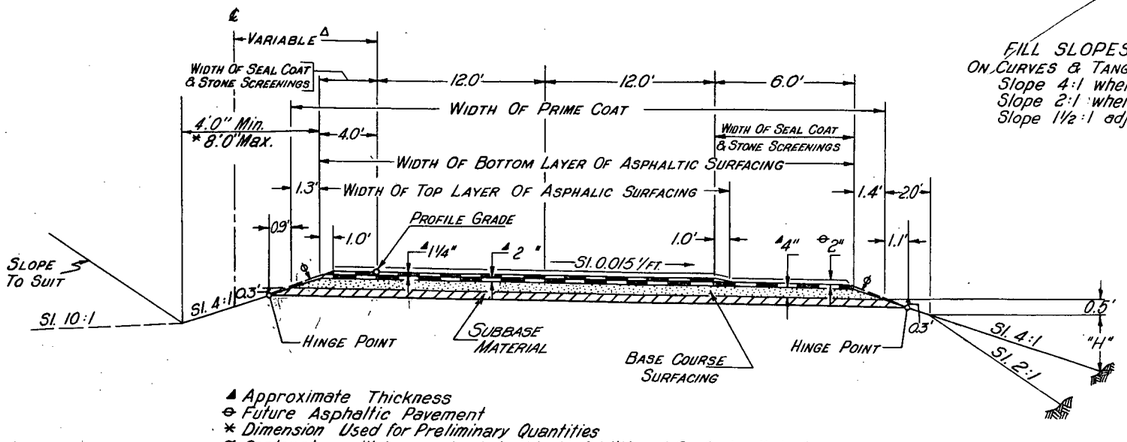


SECTION A-A

COLORADO DEPARTMENT OF HIGHWAYS
FORM C. D. H. 126
JANUARY 1960

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F 017-1(3)	3	

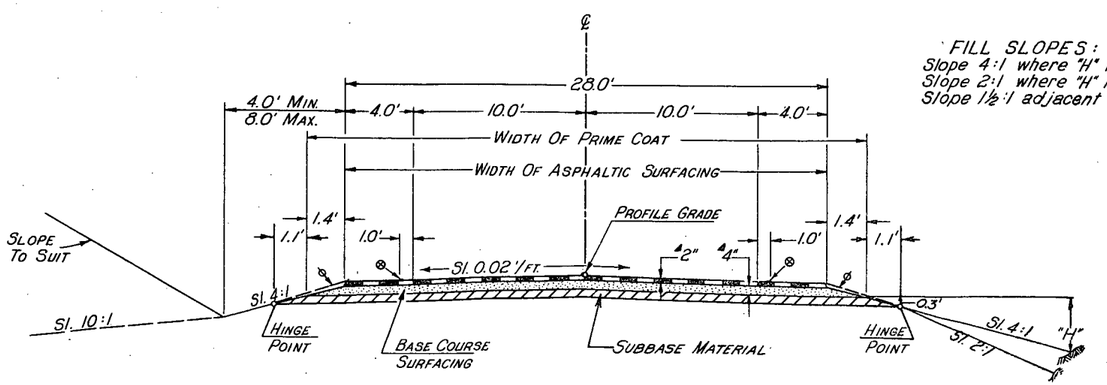
TYPICAL SECTION "B"
STA. 89+ to STA. 228+



FILL SLOPES:
ON CURVES & TANGENTS
Slope 4:1 where "H" is 5' or less
Slope 2:1 where "H" is over 5'
Slope 1½:1 adjacent to Fountain Creek

▲ Approximate Thickness
⊖ Future Asphaltic Pavement
* Dimension Used for Preliminary Quantities
ø Contractor will be required to blade Additional Surfacing Material to this line after completion of Paving Operation. Material to be Paid for as provided in Item 26.
△ See Plan and Profile Sheet & Sheet No. 16 for Median Transition.
⊕ Location of 2" Solid White Painted Stripe.

TYPICAL SECTION "C"
(FRONTAGE ROAD)



FILL SLOPES:
Slope 4:1 where "H" is 3' or less
Slope 2:1 where "H" is over 3'
Slope 1½:1 adjacent to Fountain Creek

GENERAL NOTES

This Project is to be Constructed in Conformity with Standard Specifications of the Colorado Department of Highways, Adopted January 1, 1958.

All Quantities on Preliminary Plans are to be Considered Approximate only.

All Poles Encroaching on Construction are to be Moved by the Owners.

For Preliminary Plan Quantities of Asphaltic Road Materials and Stone Screenings, the Following Rates of Application were used.

Plant Mixed Asphaltic Surfacing	@ 110 Lbs. per sq. yd. per /" thickness
Prime Coat MC	@ 0.40 Gals. per sq. yd.
Tack Coat (120-150) Penetration	@ 0.10 Gals. per sq. yd.
Seal Coat RC	@ 0.35 Gals. per sq. yd.
Stone Screenings Type 1	@ 25 Lbs. per sq. yd.

Rate of Application and Grade of Asphaltic Material shall be as Determined by the Engineer at Time of Application.

Thickness of Subbase, Surfacing and Asphaltic Pavement Materials as shown on Plans is Approximate only. These Materials are to be Placed on the Basis of Tonnages shown on plans.

The Force Account Item, "Clearing of Building sites, etc." shall Include Removal of all Foundations, Wells, Outhouses and other Appurtenances not Removed by the Owner, and any Necessary Backfilling of cellars, Cess Pools, Wells, etc. to Provide Neat Road-Side Conditions. It is Estimated that this Item Applies at the following Locations:
Sta. 60+ Lt.; Sta. 65+ Rt.; Sta. 71+ Lt.; Sta. 77+ Lt. & Sta. 97 Rt.

Road Approaches which Require Plant Mixed Asphaltic Surfacing in the "Structure List" shall be primed and a 2" Thickness of Asphaltic Surfacing Placed as Follows:

Public Approaches and Entrances to Buildings or Residences shall be Surfaced 50 ft. out from Edge of Shoulder or to the R.O.W. Line whichever is Less. Field Entrances shall be Surfaced 4 ft. out from Edge of Shoulder.

If Excavation Operations Develop Materials which will stand on Slopes Steeper than Slope Stake Lines, the Department Reserves the Right to Change Cut Slopes During the Progress of such Excavations.

Application Methods, for Liquid Asphaltic Road Material, which Result in the Discoloration of Concrete Pavement, Curbs or Gutters will not be Permitted.

When Ordered by the Engineer, a Tack Coat is to be Applied between Pavement Courses to Improve Bond. Tack Coat will be placed at Approximate Rate of 0.10 Gallon per square yard if Required.

During Construction of this Project, Traffic will use the Present Traveled Roadway except where Detours are shown on Plans.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
113 (Mylar)

SUMMARY OF APPROXIMATE QUANTITIES

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F 017-1(3)	4	

SPECIFICATION ITEM NO.	ITEM	UNIT		48 F.T. ROADWAY		24 F.T. ROADWAY	*EXISTING BRIDGE DECK TREATMENT	STA. 74+ STR. NO. I-17-AH		STA. 83+ STR. NO. I-17-AE	STA. 89+ STR. NO. I-17-V		STA. 156+50 STR. NO. I-17-X	STA. 200+ STR. NO. I-17-AF	PROJECT TOTALS			
10'	'Clearing and Grubbing Entire Project	L.S.'		●		●									●			
11	Remove Asphaltic Material (Bridges)	Sq. Yd.'					320'								320'			
11'	'Removal of Bridge, Sta. 1567	Ea.'				1'									1'			
11'	'Removal of Structures	Ea.'		9		4'									13			
11'	'Removing Retaining Walls	Lin. Ft.'		555'											555'			
11'	'Removal of Guard Posts	Ea.'		25'											25'			
11'	'Removing Bridge Railing	Lin. Ft.'						44'		54'					98'			
12'	'Removing Guard Fence	Lin. Ft.'		1,712'		1,216'									2,928'			
12'	'Removing Fence	Lin. Ft.'		1,500'		3,400'									4,900'			
12'	'Removing and Rebuilding Guard Fence	Lin. Ft.'		1,050'											1,050'			
13'	'Unclassified Excavation	Cu. Yd.'		62,200'		216,310'		200'		1,800'	530'		110'	850'	282,000'			
13'	'Unclassified Ditch Excavation	Cu. Yd.'		30'		70'									100'			
14'	'Unclassified Structural Excavation - Miscellaneous	Cu. Yd.'		1,238'		942'		74'		43'	119'		75'	119'	2,610'			
16'	'Structure Backfill (Class X)	Cu. Yd.		550		525		245		200	245		180	205	2,150			
17'	'Compaction (Modified)	Cu. Yd.'		51,900		227,100									279,000			
17'	'Wetting	M Gal.'		1,518		5,992									7,510			
17	Water (Diluted Emulsified Asphalt)	M Gal.		70											70			
18'	'Station Yard Overhaul	Sta Yd.'		85,000'		961,000'									1,046,000'			
18'	'Yard Mile Overhaul	Yd. Mi.'		190'		12,110'									12,300'			
23'	'Subbase Material (Class 1)	Ton'		6,800'		9,900'									16,700'			
26'	'Gravel or Crushed Rock Surfacing (Grading C)	Ton'		8,300'		11,700'									20,000'			
29'	Asphalt (120-150 Penetration) (Tack Coat)	Ton'		8		22									30'			
30'	'Asphaltic Road Material MC (Prime)	Gal.'		9,100'		22,900'									32,000'			
30'	'Asphaltic Road Material RC (Seal)	Gal.'		1,330'		5,370'									6,700'			
31'	'Stone Screenings (Type 1)	Ton'		48'		192'									240'			
32'	'Plant Mixed Asphaltic Surfacing	Ton'		6,015'		9,240'	25'								15,280'			
32'	'Plant Mixed Asphaltic Shoulder Roll	Ton'		15'		105'									120'			
45'	'18" Culvert Pipe	Lin. Ft.'		562		56									618			
45'	'24" Culvert Pipe	Lin. Ft.'		384'		743'									1,127'			
45'	'36" Culvert Pipe	Lin. Ft.'				146'									146'			
45'	'42" Culvert Pipe	Lin. Ft.'		56'											56'			
45'	'60" Culvert Pipe	Lin. Ft.'		212'		172'									384'			
45'	'72" Culvert Pipe	Lin. Ft.'				138'									138'			
46'	'Class "A" Concrete	Cu. Yd.'		189.7		73.6		245.9		184.9	203.2		133.2	242.5	1,273'			
47'	'Reinforcing Steel	LB'				4,410		24,820'		18,270'	20,380'		13,129	22,391'	103,400'			
51'	'Relaying 18" Pipe (C.M.P.)	Lin. Ft.'		110'											110'			

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
FORM C [illegible] H 133 (Mylar)

SUMMARY OF APPROXIMATE QUANTITIES

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F 017-1(3)	5	

SPECIFICATION ITEM NO.	ITEM	UNIT		48 FT. ROADWAY		24 FT. ROADWAY	*EXISTING BRIDGE DECK TREATMENT	STA. 74+ STR. NO I-17-AH		STA. 83+ STR. NO. I-17-AE	STA. 89+ STR. NO. I-17-V		STA.136+50 STR. NO. I-17-X	STA. 200+ STR. NO. I-17-AF	PROJECT TOTALS			
53'	6" Corrugated Metal Culvert Pipe	Lin. Ft.				60'									60'			
53'	24" Corrugated Metal Culvert Pipe	Lin. Ft.		49'											49'			
53'	30" Corrugated Metal Culvert Pipe	Lin. Ft.		114'											114'			
65'	Concrete Slope and Ditch Paving	Cu. Yd.		2.1		11.9									14'			
67'	Riprap	Cu. Yd.						5'		10'	10'			10'	35'			
71'	6" Perforated CMP Underdrain	Lin. Ft.				100'									100'			
75'	Metal Plate Guard Fence (Beam Type)	Lin. Ft.		1,125'		5,325'									6,450'			
76'	Barbed Wire Fence with Metal Posts	Lin. Ft.		1,075'		5,425'									6,500'			
76'	End Posts	Ea.				12'									12'			
76'	Corner and Line Brace Posts	Ea.		7'		9'									16'			
78'	Chain Link Wire Mesh Fence	Lin. Ft.						20'							20'			
81'	Right of Way Markers	Ea.		4'		7'									11'			
84'	Concrete Comb. Curb and Gutter (Type I)	Lin. Ft.		5,552											5,552			
192'	Delineators (Type I)	Ea.		48'		96'									144'			
192'	Delineators (Type II)	Ea.		50'											50'			
192'	Delineators (Type III)	Ea.		20'											20'			
	Furnish & Install Identification Signs (State Forces)	Ea.		1'		1'									2'			
	FORCE ACCOUNT																	
	Clearing of Building Sites and Appurtenances	L.S.		[illegible]		[illegible]									[illegible]			
	Placing Boulders	L.S.		[illegible]		[illegible]									[illegible]			
	STATE FORCES (NON-FEDERAL AID)																	
	Signing and Striping Entire Project	L.S.													1			
	Flashing Yellow Unit	Ea.													3'			
	Relocation of Water Lines (Work by Cascade Town Co.) was provided for under F 017-1(2)																	

* NON-FEDERAL AID

COLORADO DEPARTMENT OF HIGHWAYS
FORM C.D.H. 125
OCTOBER 1961

STRUCTURE QUANTITIES

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	F 017-1(3)	8

LOCATION	MISCELLANEOUS	REMOVAL OF STRUCTURES NO.	EXCAVATION CUBIC YARDS UNCL.	EXCAVATION CUBIC YARDS EMB.	EXCAVATION CUBIC YARDS UNCL. DITCH	UNCLASSIFIED STRUCTURAL EXCAVATION CUBIC YARDS MISC.	REMOVING RETAINING WALLS LIN. FT.	STRUCTURE BACKFILL CUBIC YARDS CL. X	GRAVEL OR CRUSHED ROCK SURFACING TONS	ASPHALTIC SURFACING TONS	CONCRETE CUBIC YARDS CL. "A"	REINFORCING STEEL LBS.	HEIGHT OF COVER FT.	CULVERT PIPE LINEAR FEET 18"	24"	36"	42"	60"	72"	SLOPE AND DITCH PAVING CU. YDS.	CULVERT END SECTIONS NO. 18"	24"	36"	42"
'53+00 to 59+86.1			Δ'						ϕ'	ϕ'														
'55+22						55'		15'			2.5 '		5.5'		70'									
55+53		1'																						
'59+	'1-Flashing Yellow Unit (State Forces)																							
'59+65		1'																						
59+	'1-Identification Sign (State Forces)																							
'60+ to 72+				Δ'					ϕ'	ϕ'														
'60+00						91'		35'			2.0		5.5'		174'									
'62+68	*'49 Lin.Ft.-24" Corrugated Metal Pipe	1'				39'		11'			3.0		5'											
'63+00						3'		10'					1'		43'							2'		
'63+				Δ'					ϕ'	ϕ'														
'63+ to 72+				Δ'					ϕ'	ϕ'														
'64+							80'																	
'64+70	('71* Lin.Ft.-30" Corrugated Metal Pipe	2'				47'		30'			4.1 '													
'65+62	('43* Lin.Ft.-30" Corrugated Metal Pipe	1'	160'		5'	344		117			8.7		3'					212'						
66+00			Δ'						ϕ'	ϕ'														
'66+30			Δ'						ϕ'	ϕ'														
67+00			Δ'						ϕ'	ϕ'														
67+10							25'																	
'67+80			Δ'			9'		5'	ϕ'	ϕ'			1'	28'										
'68+25				Δ'					ϕ'	ϕ'														
'68+10 to 71+30						348'		171'			167.9													
'69+20			Δ'			9'		5'	ϕ'	ϕ'			1'	28'										
'69+				Δ'					ϕ'	ϕ'														
'70+30			Δ'			9'		5'	ϕ'	ϕ'			1'	28'										
'70+55 to 72+80							225'																	
'72+00	'110 Lin.Ft.-Relaying 18" Pipe (C.M.P.)			Δ'		54'		30'	ϕ'	ϕ'			1'	70'								4'		
72+05			Δ'			9'		5'	ϕ'	ϕ'			1'	28'										
'71+				Δ'					ϕ'	ϕ'														
'72+30			Δ'			9'		5'	ϕ'	ϕ'			1'	28'										
'74+00	'QUANTITIES IN SUMMARY																							
'75+ to 93+				Δ'					ϕ'	ϕ'														
'76+25				Δ'					ϕ'	ϕ'														
'76+ to 77+							225'																	
'78+10				Δ'		9'		5'	ϕ'	ϕ'			1'	28'										
'78+55				Δ'		27'		20'	ϕ'	ϕ'			1'	120'								2'		
'79+10				Δ'		9'		5'	ϕ'	ϕ'			1'	28'										
'80+85					5'	12'		8'					1'	36'								2'		
'81+90				Δ'					ϕ'	ϕ'														

COLORADO DEPARTMENT OF HIGHWAYS
FORM C.D.H. 125
OCTOBER 1961

STRUCTURE QUANTITIES

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	F017-1(3)	7

LOCATION	MISCELLANEOUS	REMOVAL OF STRUCTURES	EXCAVATION CUBIC YARDS			UNCLASSIFIED STRUCTURAL EXCAVATION	REMOVING RETAINING WALLS	STRUCTURE BACKFILL		GRAVEL OR CRUSHED ROCK SURFACING	ASPHALTIC SURFACING	CONCRETE	REINFORCING STEEL	HEIGHT OF COVER	CULVERT PIPE LINEAR FEET						SLOPE AND DITCH PAVING	CULVERT END SECTIONS NO.			
		NO.	UNCL.	EMB.	UNCL. DITCH	CUBIC YARDS MISC.	LIN. FT.	CUBIC YARDS CL. X		TONS	TONS	CUBIC YARDS CL. "A"	LBS.	FT.	18"	24"	36"	42"	60"	72"	CU. YDS.	18"	24"	36"	42"
'82+50				Δ'		9'		5'		ϕ'	ϕ'			1'	28'										
'83+00	'QUANTITIES IN SUMMARY																								
'83+	'25-Removal of Guard Posts																								
'83+30					5'	26'		10'						2.5'		46'							2'		
'83+40				Δ'						ϕ'	ϕ'														
'85+15				Δ'		9'		5'		ϕ'	ϕ'			1'	28'										
'85+45				Δ'		9'		5'		ϕ'	ϕ'			1'	28'										
86+ to 89+			Δ																						
'86+00				Δ'		9'		5'		ϕ'	ϕ'			1'	28'										
'86+40				Δ'		9'		5'		ϕ'	ϕ'			1'	28'										
'86+95		2			5'	24'		12'				1.5'		2.5'		{31' 20'							1'		
'88+13					5'	55'		18'						3.5'				56'						1'	
'88+				Δ'						ϕ'	ϕ'														
'88+	1-Flashing Yellow Unit (State Forces)																								
'88+		1																							
'89+00	END 48 FT. ROADWAY																								
	BEGIN 24 FT. ROADWAY																								
'89+05				Δ'						ϕ'	ϕ'														
'89+59	'QUANTITIES IN SUMMARY																								
93+25 to 94+25	'100 Lin. Ft. - 6" Perforated CMP					50'								4'											
'93+40	Underdrain			Δ'		9'		5'		ϕ'	ϕ'			1'	28'										
'94+00				Δ'						ϕ'	ϕ'														
'94+25						29'		16'				3.0		7'		64'									
'95+85						22'		11'						1'		48'									
'96+00	60 Lin. Ft. - 6" Corrugated Metal Pipe					9'		5'						10'				86'							
'97+00						61'		22'																	
'104+00				Δ'		9'		5		ϕ'	ϕ'			1'	28'										
'105+65					10'	50'		121				55.8	4406'	2.5'											
'117+16					5'	31'		12'				2.0		3.5'		60'							1'		
'126+00						10'		11'				2.0		2.3'		52'									
'130+00						21'		12'				2.0		3.5'		52'							1'		
'135+ to 149+			Δ'																						
'141+ to 144+				Δ'																					
'144+75						9'		12'						4.8'		59'							1'		
'150+00						50'		14'				2.0		5.2'		68'									
'151+50 to '156+50				Δ'						ϕ'	ϕ'														
'154+ to 165+			Δ'																						

COLORADO DEPARTMENT OF HIGHWAYS
FORM C.D.H. 125
OCTOBER 1961

STRUCTURE QUANTITIES

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	F017-1(3)	8

LOCATION	MISCELLANEOUS	REMOVAL OF STRUCTURES	EXCAVATION CUBIC YARDS			UNCLASSIFIED STRUCTURAL EXCAVATION	REMOVING RETAINING WALLS	STRUCTURE BACKFILL	GRAVEL OR CRUSHED ROCK SURFACING	ASPHALTIC SURFACING	CONCRETE	REINFORCING STEEL	HEIGHT OF COVER	CULVERT PIPE LINEAR FEET						SLOPE AND DITCH PAVING	CULVERT END SECTIONS NO.			
		NO.	UNCL.	EMB.	UNCL. DITCH	CUBIC YARDS MISC.	LIN. FT.	CUBIC YARDS CL. X	TONS	TONS	CUBIC YARDS CL. "A"	LBS.	FT.	18"	24"	36"	42"	60"	72"	CU. YDS.	18"	24"	36"	42"
1156+04						58'		44'					6'					96'						
1156+25	1-Removal of Bridge																							
1156+50	QUANTITIES IN SUMMARY(C.B.C.)			Δ'					Ø'	Ø'														
1159+50		1'																						
1164+00						15'		16'					3.5'			60'							1'	
1173+76					10'	49'		33'					3.8'					76'						
1177+ to 1187+			Δ'																					
1182+20						16'		11'			2.0		4.5'		54'									
1190+50						33'		12'			2.0		4.8'		56'									
1197+35						71'		21'			2.0		6'		84'									
1200+77	QUANTITIES IN SUMMARY																							
1201+ to 1225+			Δ'																					
1208+00 to 1212+00				1500'																				
1211+00						9'		11'					5'		64'									
1215+54		1'			10'	275		101'					7'						138'					
1215+90		1'																						
1221+00 to 1228+00				500'																				
1224+40		1'				15'		13'			0.8		2'		28'									
1227+00					30'	24'		16'					2'		54'								2'	
1226+				Δ'																				
1228+05.2 to 1230+00				Δ'					Ø'	Ø'														
1228+	1-Flashing Yellow Unit (State Forces)																							
1228+	1-Identification Sign (State Forces)																							
	TOTAL 48 FT. ROADWAY	9'	160'	0'	25'	1233'	555'	547'	Ø'	Ø'	189.7'	0'		562'	384'	0'	56'	212'	0'		8'	5'	0'	1'
	TOTAL 24 FT. ROADWAY	4'	0'	2000'	65'	925'	0'	524'	Ø'	Ø'	73.6'	4,406'		56'	743'	146'	0'	172'	138'		0'	5'	1'	0'

Δ Included in Profile Quantities
Ø Included in Surfacing Plan
* Includes 1 Ft. for Connecting Band (External)

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F017-1(31)	9	

SUMMARY OF EARTHWORK QUANTITIES

	48 FT. ROADWAY	24 FT. ROADWAY	PROJECT TOTAL
UNCLASSIFIED EXCAVATION			
* FROM CROSS SECTIONS & ELECTRONIC COMPUTER	56,222	194,348	250,570
* EST. FOR OVERBREAK & SUBSIDENCE	5,622	19,435	25,057
STRUCTURE QUANTITIES AS EXCAVATION	160		160
STRUCTURE QUANTITIES AS EMBANKMENT		2,000	2,000
EST. FOR CUT SLOPE TREATMENT	121	467	588
TOTALS (CU. YDS.)	62,125	216,250	278,375
UNCLASSIFIED EXCAVATION			
FROM CROSS SECTIONS & ELECTRONIC COMPUTER	58,222	194,348	250,570
MINUS EXCESS EXCAVATION	29,353	3,484	30,837
TOTALS (CU. YDS.)	28,869	190,864	219,733
UNCLASSIFIED EXCAVATION X FACTOR	25,982	219,494	245,476
EMBANKMENT FROM CROSS SECTIONS & ELECTRONIC COMPUTER (CU. YDS.)	25,982	219,494	245,476
STATION YARD OVERHAUL FROM MASS DIAGRAM	77,258	873,065	950,323
EST. FOR OVERBREAK & SUBSIDENCE	7,726	87,306	95,032
TOTALS (STA. YDS.)	84,984	960,371	1,045,355
YARD MILE OVERHAUL			
FROM MASS DIAGRAM	169	11,004	11,173
EST. FOR OVERBREAK & SUBSIDENCE	17	1,100	1,117
TOTALS (YD. MI.)	186	12,104	12,290

UNCLASSIFIED DITCH EXCAVATION

	48 FT. ROADWAY	24 FT. ROADWAY	PROJECT TOTAL
FROM LIST OF STRUCTURES	25	65	90

COMPACTION

	48 FT. ROADWAY	24 FT. ROADWAY	PROJECT TOTAL
* TOTAL UNCLASSIFIED EXCAVATION (LESS EXCESS EXCAV. & FILLING OLD CHANNEL)	34,491	195,427	229,918
BASE OF CUTS & FILLS (1 Ft. DEEP)	17,190	31,280	48,470
TOTALS (CU. YDS.)	51,681	226,707	278,388

ESTIMATED FOR FILLING OLD CHANNEL (24 FT. ROADWAY) 14,872 CU. YDS.

SURFACING & SUBBASE PLAN

	MATERIAL TO BE PLACED	SOURCE	QUANTITY — TONS PLANT MIX TOP	PLANT MIX BOTTOM	BASE COURSE GRADING "C"	SUBBASE CLASS I 3" THICK
48' Roadway	Approach to Project	Undesignated	240	480	884	663
	59+86.1 to 73+84.1		532	1,035	1,944	1,566
	73+84.1 to 74+26.2		ø10	—	—	
	74+26.2 to 83+08.3		336	653	1,227	988
	83+08.3 to 83+60.6		ø12	—	—	
	83+60.6 to 89+00		205	400	750	605
	Accel. & Decel. Lanes		72	93	175	132
	Median Cap & Storage Lanes		206	104	188	141
	Frontage Road Rt. & Lt. (60+ to 72+)		810	—	1,520	1,272
	Frontage Road Rt. (75+ to 93+)		455	—	858	689
	Road Appr's. & Median Openings		333	61	680	84
	Shoulder Finishing		—	—	46	
	Estimated for Irregularities					614
24' Roadway	89+00 to 228+05.2		3,060	5,841	10,986	8,761
	Decel Lane		29	44	78	59
	Road Appr's. & Median Openings		100	36	226	51
	Shoulder Finishing				207	
	Approach to Project		44	84	158	119
	Estimated for Irregularities					899
	Total 48 ft. Roadway		3,189	2,826	8,271	6,754
	Total 24 ft. Roadway		3,233	6,005	11,655	9,889
	TOTAL		6,422	8,831	19,926	16,643

ø Material to be placed on Bridges is Non-Fed. Aid, not included in Totals.

TABULATION OF CURB & GUTTER

	STATION	LOCATION	Δ TYPE I LIN. FT.
48 ft. Roadway	59+86.1 ∞ 63+00	Median	640
	63+15 ∞ 63+35	Island Lt.	55
	63+38 ∞ 63+59	Island Rt.	75
	63+88 ∞ 64+33	Island Rt.	121
	64+30 ∞ 71+70	Median	1,493
	72+30 ∞ 78+20	Median	1,192
	79+00 ∞ 88+70	Median	1,976
	Total 48 ft. Roadway		5,552
	PROJECT TOTAL		5,552

Δ Combination Curb and Gutter

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F017-1(3)	10	

DELINEATORS

	STATION	SIDE	SPACING	TYPE I EACH		TYPE II EACH	TYPE III EACH
48' Roadway	53+00 to 72+00		Intersection	18		50	13
	72+37.8 ≈ 76+03.8	Lt.&Rt.	Transition	4			
	74+	Lt.&Rt.	Bridge	8			2
	76+03.8 ≈ 81+38.8	Lt.&Rt.	4°00 Curve	6			2
	81+38.8 ≈ 88+04.8	Lt.&Rt.	Transition	4			1
	83+	Lt.&Rt.	Bridge	8			2
24' Roadway	95+13.2 ≈ 99+55.2	Rt.	Transition	4			
	99+55.2 ≈ 105+36.2	Rt.	10°00 Curve	8			
	105+36.2 ≈ 113+69.6	Rt.	Transition	3			
	113+69.6 ≈ 118+40.3	Rt.	10°00 Curve	7			
	118+40.3 ≈ 126+41.2	Rt.	Transition	3			
	126+41.2 ≈ 126+81.0	Rt.	8°00 Curve	2			
	126+81.0 ≈ 132+37.6	Rt.	Transition	2			
	132+37.6 ≈ 134+20.3	Rt.	8°00 Curve	3			
	134+20.3 ≈ 147+03.7	Rt.	Transition	4			
	147+03.7 ≈ 148+60.8	Rt.	4°00 Curve	3			
	148+60.8 ≈ 151+60.8 Bk.						
	152+20.8 Ah. ≈ 158+49.1	Rt.	Transition	3			
	158+49.1 ≈ 160+86.6	Rt.	10°00 Curve	4			
	160+86.6 ≈ 168+60.2	Rt.	Transition	3			
	168+60.2 ≈ 169+50.4	Rt.	8°00 Curve	2			
	169+50.4 ≈ 176+71.2	Rt.	Transition	3			
	176+71.2 ≈ 179+55.2	Rt.	12°00 Curve	5			
	179+55.2 ≈ 184+92.3	Rt.	Transition	2			
	184+92.3 ≈ 188+43.1	Rt.	12°00 Curve	5			
	188+43.1 ≈ 191+56.2	Rt.	Transition	2			
	191+56.2 ≈ 192+77.9	Rt.	12°00 Curve	3			
	192+77.9 ≈ 196+80.2	Rt.	Transition	2			
	196+80.2 ≈ 197+60.2	Rt.	6°00 Curve	2			
	197+60.2 ≈ 202+93.6	Rt.	Transition	2			
	202+93.6 ≈ 205+16.9	Rt.	12°00 Curve	4			
	205+16.9 ≈ 212+72.3	Rt.	Transition	3			
	212+72.3 ≈ 213+72.3	Rt.	8°00 Curve	2			
	213+72.3 ≈ 221+55.2	Rt.	Transition	3			
	221+55.2 ≈ 225+05.2	Rt.	8°00 Curve	5			
	225+05.2 ≈ 230+05.2	Rt.	Transition	2			
Total 48 ft. Roadway				48		50	20
Total 24 ft. Roadway				96			
PROJECT TOTAL				144		50	20

FENCING REQUIREMENTS

	STATION	SIDE	REMOVE FENCE LIN. FT.		BUILD BARBED WIRE FENCE LIN. FT.		GATE OPENINGS EACH		POSTS END EACH	POSTS CORNER & LINE BRACE EACH
48' Roadway	54+50 ≈ 62+90	Lt.	915							
	63+50 ≈ 66+15	Lt.	415							
	65+80 ≈ 66+20	Rt.	60							
	55+00 ≈ 62+85	Lt.			760					4
	63+40 ≈ 66+15	Lt.			300					3
	81+00 ≈ 81+90	Rt.	90							
24' Roadway	94+00 ≈ 96+20	Lt.	220							
	86+15	Rt.	30							
	93+50	X	120							
	93+20 ≈ 99+20	Rt.			600				2	2
	93+40	Rt.					1			
	96+40	X	90							
	96+80 ≈ 110+50	Rt.	1,370							
	119+50 ≈ 135+00	Rt.	1,550							
	92+00 ≈ 140+00	Rt.			4,810		1		10	7
	94+00	Rt.					1			
	103+85	Rt.					1			
	117+65	Rt.					1			
	117+85	Rt.					1			
	127+00	Rt.					1			
Total 48 ft. Roadway			1,480		1,060					2
Total 24 ft. Roadway			3,380		5,410				12	9
PROJECT TOTAL			4,860		6,470				12	16

TABULATION OF R.O.W. MARKERS

	STATION	SIDE	NUMBER
48' R.O.W.'y	S.T.C. 59+86.1	Rt.& Lt.	2
	84+38.8	Rt.& Lt.	2
24' Roadway	108+36.2	Rt.	1
	136+60.3	Rt.	1
	163+86.6	Rt.	1
	181+95.2	Rt.	1
	200+53.6	Rt.	1
	228+05.2	Rt.& Lt.	2
Total 48' Roadway			4
Total 24' Roadway			7
TOTAL			11

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F017-1(13)	11	

ASPHALTIC SHOULDER ROLL & EMBANKMENT PROTECTORS

	STATION	SIDE	SHOULDER ROLL LIN. FT.		CONCRETE SLOPE PAVING CU. YD.		STRUCTURAL EXCAVATION CU. YD.
48 ft. Roadway	73+30 ∞ 76+00	Lt.	270		1.25		2
	76+00	Lt.					
	83+50 ∞ 89+00	Rt.	550				
	~~89+00~~	~~Rt.~~			~~0.84~~		~~1~~
	~~97+00 ∞ 108+00~~	~~Lt.~~	~~1,100~~				
	102+50	Lt.			0.67		1
	108+00	Lt.			1.12		2
	124+00 ∞ 129+00	Lt.	500				
	129+00	Lt.			1.75		2
	137+00 ∞ 145+00	Rt.	800		0.67		1
	145+00	Rt.					
	153+50 ∞ 163+50	Lt	1,000				
	158+50	Lt.			0.92		1
	163+50	Lt.			1.12		2
	174+00 ∞ 182+00	Lt.	800				
	182+00	Lt.			1.17		2
	190+00 ∞ 194+00	Lt.	400				
	194+00	Lt.			1.08		2
	207+50 ∞ 229+50	Rt.	2,200				
	115+50	Rt.			1.25		2
	222+50	Rt.			0.98		1
	229+50	Rt.			0.84		1
Total 48 ft. Roadway			820 = 13 Tons		2.09		3
Total 24 ft. Roadway			6800 = 102 Tons		11.57		17
PROJECT TOTALS			7,620 = 115 Tons		13.66		20

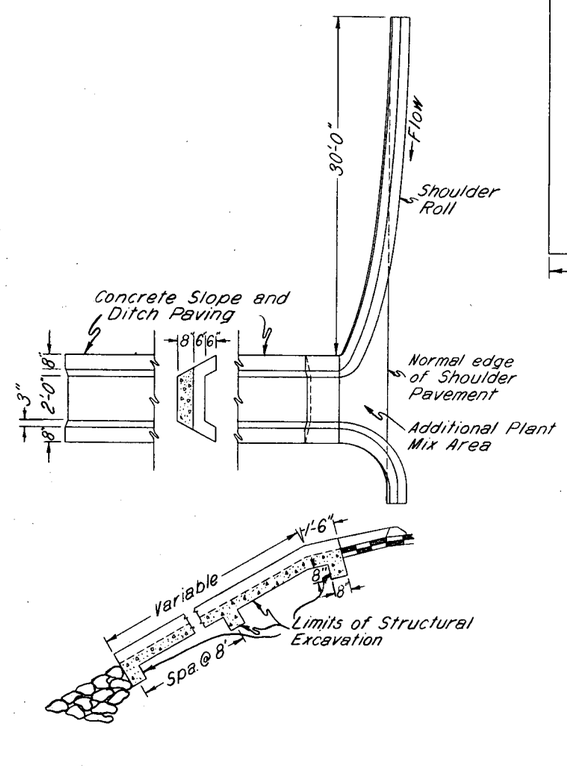
TABULATION OF GUARD FENCE

	STATION	SIDE	REMOVE GUARD FENCE LIN. FT.		REMOVE & REBUILD GUARD FENCE LIN. FT.		BUILD METAL PLATE GUARD FENCE LIN. FT.
48 ft. Roadway	53+00 ∞ 59+50	Rt.			650		
	62+ ∞ 63+	Rt.			75		
	64+00 ∞ 66+00	Lt.			225		
	64+00 ∞ 66+00	Rt.			100 ✓		
	71+45 ∞ 73+80	~	235				
	72+92 ∞ 73+80	~	88				
	74+25 ∞ 75+26	~	101				
	74+25 ∞ 76+85	~	260				
	77+82 ∞ 81+60	~	378				
	83+70 ∞ 89+00	~	650				
	68+05 ∞ 71+30	Lt. Ft. Rd.					325
	73+80 ∞ 75+30	Lt.					250
	X72+80 ∞ 73+80	Rt.					100 ✓
	74+20 ∞ 75+20	Rt.					100
	81+80 ∞ 83+80	Lt.					200
	X82+35 ∞ 83+10	Rt.					75 ✓
	X83+75 ∞ 84+50	Rt.					25 ✓
	204+00 ∞ 216+06		1,216				
24 ft. Roadway	113+00 ∞ 119+00	Lt.					600
	145+00 ∞ 149+50	Lt.					450
	152+40 ∞ 156+40	Lt.					400
	181+00 ∞ 189+00	Lt.					800
	191+00 ∞ 200+75	Lt.					975
	X201+50 ∞ 222+50	Rt.					2,100 ✓
Total 48 ft. Roadway			1,712		1,050		1,125
Total 24 ft. Roadway			1,216				5,325
PROJECT TOTAL			2,928		1,050		6,450

COLORADO DEPARTMENT OF HIGHWAYS
FORM C. D. H. 126
JANUARY 1960

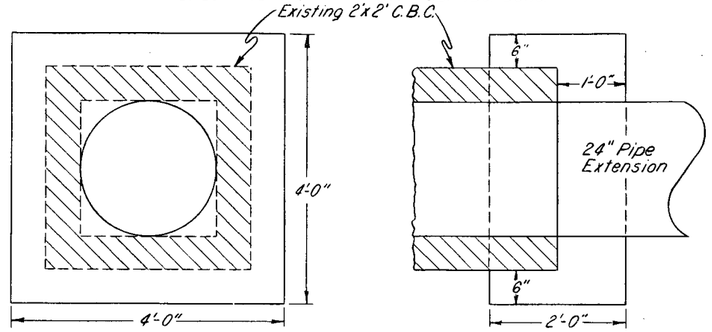
FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F017-1(3)	12	

DETAILS OF EMBANKMENT PROTECTOR

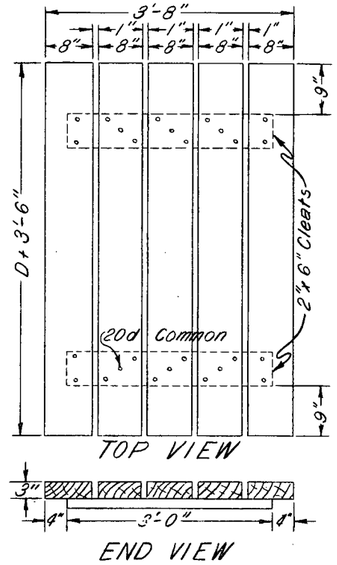


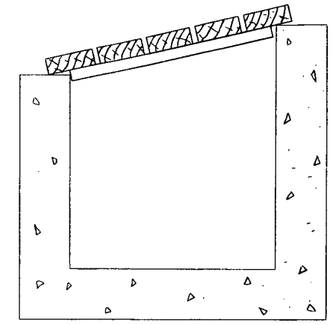
DETAILS OF CONCRETE CONNECTING COLLAR

Sta. 86+95 Lt. & Rt. 1.48 Cu. Yds. Conc.
Sta. 224+40 Rt. 0.74 Cu. Yds. Conc.



TIMBER COVER FOR INTERCEPTING HEADWALL





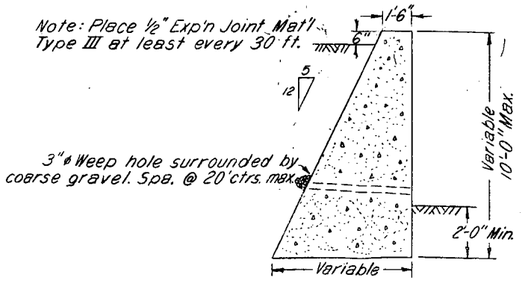
D=24" 61 Board Feet
D=30" 66 Board Feet
Miscellaneous Untreated Timber.

Material may be full Sawn or S4S. Dimensions Shown are for full Sawn.

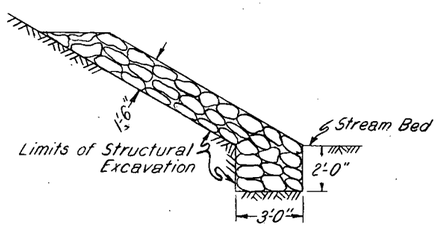
Timber to be included in cost of Concrete

GRAVITY TYPE RETAINING WALL

Sta. 68+10 to 71+30



DETAILS OF RIPRAP



COLORADO DEPARTMENT OF HIGHWAYS
FORM C. D. H. 126
JANUARY, 1952

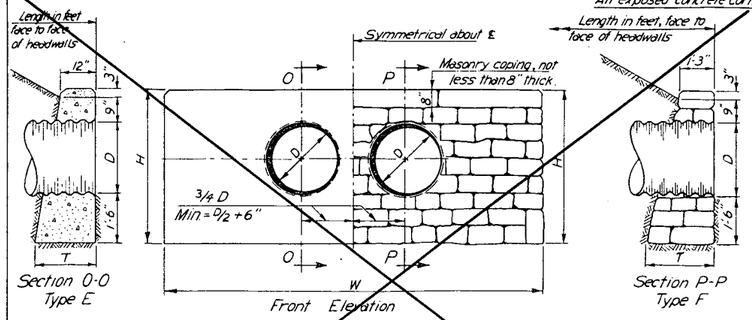
STANDARD M-95-A

(MAY 1, 1962)
(REVISED FOR THIS PROJECT)

FEDERAL ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	F017-1(3)	13

REVISIONS		
2-3-64	DEPT. NAME	M.R.H.

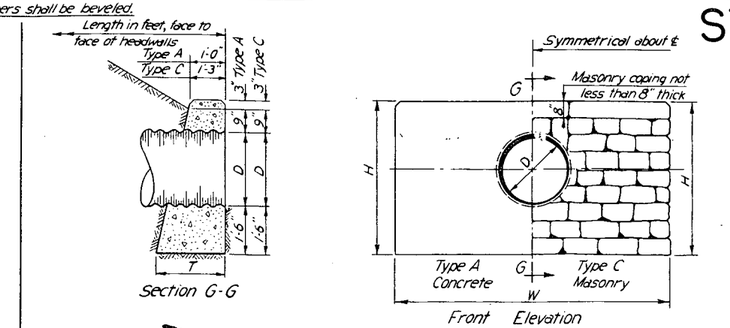
All exposed concrete corners shall be beveled.



STANDARD HEADWALLS FOR DOUBLE CORRUGATED METAL PIPE CULVERTS

Table of Dimensions and Quantities

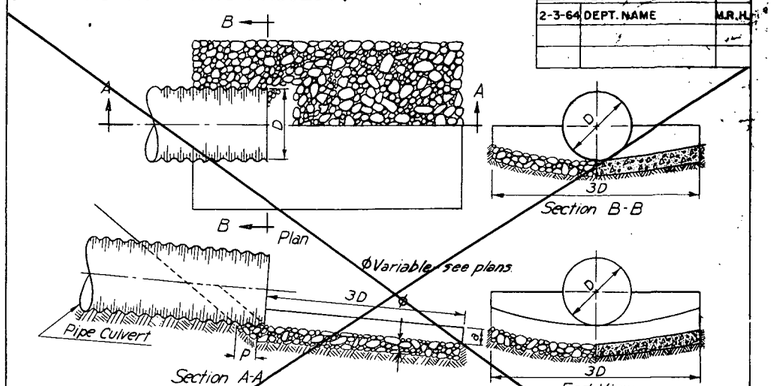
Type E — Both Types					Type F		
D Diam.	T	* Concrete in two Headwalls	W	H	Cement Rubble Masonry in Two Headwalls	T	D Diam.
15"	1'-6"	2.4 Cu. Yds.	7'-6"	3'-9"	3.1 Cu. Yds.	2'-0"	15"
18"	1'-7"	3.0 DO	8'-6"	4'-0"	3.8 DO	2'-1"	18"
24"	1'-10"	4.4 DO	10'-6"	4'-6"	5.5 DO	2'-4"	24"
30"	2'-0"	6.1 DO	12'-9"	5'-0"	7.5 DO	2'-6"	30"
36"	2'-3"	8.1 DO	15'-0"	5'-6"	10.0 DO	2'-8"	36"
42"	2'-5"	10.8 DO	17'-3"	6'-0"	12.8 DO	2'-10"	42"
48"	2'-7"	13.6 DO	19'-6"	6'-6"	16.3 DO	3'-0"	48"



STANDARD HEADWALLS FOR SINGLE CORRUGATED METAL PIPE CULVERTS

Table of Dimensions and Quantities

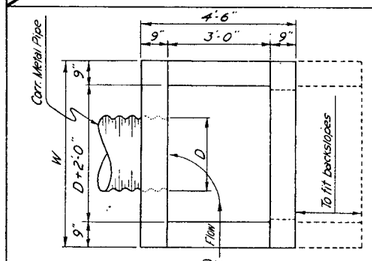
Type A — Both Types					Type C		
D Diam.	T	* Concrete in two Headwalls	W	H	Cement Rubble Masonry in Two Headwalls	T	D Diam.
15"	1'-6"	1.8 Cu. Yds.	5'-3"	3'-9"	2.2 Cu. Yds.	2'-0"	15"
18"	1'-7"	2.2 DO	6'-0"	4'-0"	2.8 DO	2'-1"	18"
24"	1'-10"	3.3 DO	7'-6"	4'-6"	4.1 DO	2'-4"	24"
30"	2'-0"	4.5 DO	9'-0"	5'-0"	5.6 DO	2'-6"	30"
36"	2'-2"	6.0 DO	10'-6"	5'-6"	7.4 DO	2'-8"	36"
42"	2'-5"	8.0 DO	12'-0"	6'-0"	9.2 DO	2'-10"	42"
48"	2'-7"	10.0 DO	13'-6"	6'-6"	11.5 DO	3'-0"	48"
60"	4'-0"	17.4 Cu. Yds.	15'-0"	7'-6"			



CONCRETE OR GROUTED RUBBLE APRON FOR PIPE CULVERT

Square Yards of Slope and Ditch Paving

Fill Slope	B	15"	18"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"
1:1	2'-0"	3	4	6	9	12	17	21	27	33	39	46	54	62
2:1	2'-0"	3	4	7	10	13	18	22	28	34	41	49	57	66
3:1	3'-0"	3	4	7	11	15	20	25	31	38	45	54	63	72
4:1	4'-0"	3	5	8	12	16	22	28	34	42	50	59	69	79

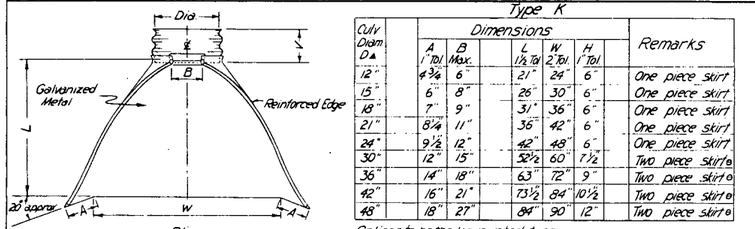


Quantities of *Concrete or Cement Rubble Masonry

Size of Pipe D	Width of Wall W	Height of Wall H	Quantities in One Headwall cu. yds.
24"	5'-6"	4'-6"	1.99
24"	5'-6"	5'-6"	2.46
24"	5'-6"	6'-6"	2.93
30"	6'-0"	7'-6"	4.01

Note: Backwall to be eliminated and end walls connected to back slope where ordered by the Engineer. Floor slab is to be extended with side walls if in common material and is to be omitted when inlet is in rock. Actual quantities involved in such operation shall be allowed and paid for.

* See plan sheets for concrete classification.



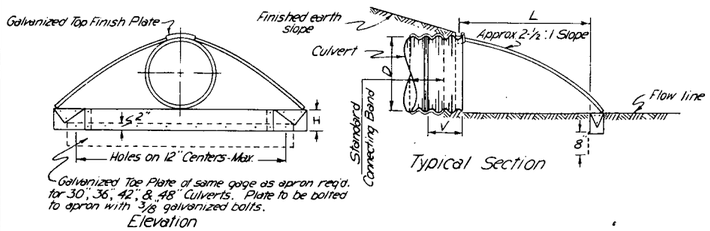
Type K

Culv. Diam. D ▲	A 1" Tol	B Max.	L 1½ Tol	W 2" Tol.	H 1" Tol	Remarks
12"	4¾"	6"	21"	24"	6"	One piece skirt
15"	6"	8"	26"	30"	6"	One piece skirt
18"	7"	9"	31"	36"	6"	One piece skirt
21"	8¼"	11"	36"	42"	6"	One piece skirt
24"	9½"	12"	42"	48"	6"	One piece skirt
30"	12"	15"	52½"	60"	7½"	Two piece skirt ⊖
36"	14"	18"	63"	72"	9"	Two piece skirt ⊖
42"	16"	21"	73½"	84"	10½"	Two piece skirt ⊖
48"	18"	27"	84"	90"	12"	Two piece skirt ⊖

Splices to be the lap riveted type.
⊖ One splice on ℄ made by either riveting or bolting. Galvanized Connector Section, Corner Plate & Toe Plate to be same gage as skirt section.
▲ Culvert diameter is equal to dimension D of connector section.

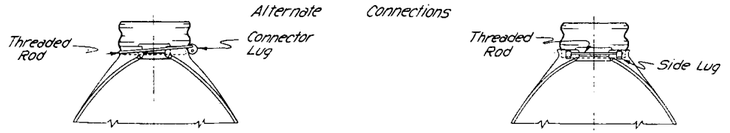
V = 7" for 12" D to 30" D
V = 12" for 36" D to 48" D

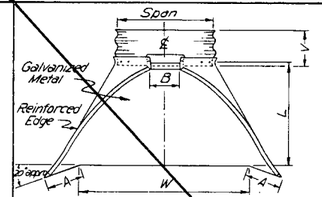
Note: Length of Toe Plate for Culverts 15" to 30" Dia incl. = "W" + 10"
36" to 48" Dia incl. = "W" + 22"



STANDARD METAL APRONS FOR CORRUGATED METAL PIPE CULVERTS TYPE K

ROUND METAL PIPE
Alternate Connections





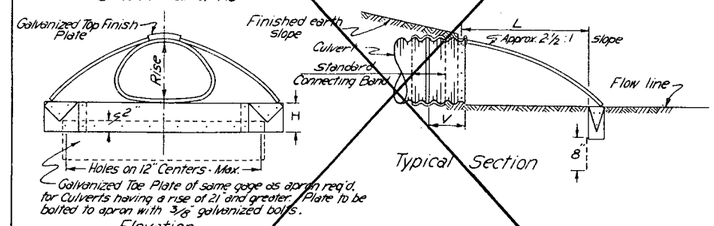
Type L

Normal Culvert Diam.	Arch Dimensions Span	Arch Dimensions Rise	A 1" Tol	B Max.	L 1½ Tol	W 2" Tol.	H 1" Tol	Remarks
15"	18"	11"	4½"	9"	19"	30"	6"	One piece skirt
18"	22"	13"	5¼"	10"	23"	36"	6"	One piece skirt
24"	29"	18"	7"	14"	31½"	48"	6"	One piece skirt
30"	36"	22"	8¾"	16"	38½"	60"	6"	One piece skirt
36"	43"	27"	10¾"	17½"	47"	75"	7⅝"	Two piece skirt ▲
42"	50"	31"	12¼"	20"	54"	85"	9⅛"	Two piece skirt ▲
48"	58"	36"	14"	26"	63"	96"	10⅝"	Two piece skirt ▲
54"	65"	40"	15¾"	23"	70"	112"	10⅝"	Three piece skirt ⊕
60"	72"	44"	17¼"	24"	77"	128"	12⅛"	Three piece skirt ⊕

▲ Splices to be the lap riveted or bolted on ℄
⊕ Sections to be joined by riveting or bolting equal distance from ℄ Galvanized Connector Section, Corner Plate & Toe Plate to be same gage as skirt Section.

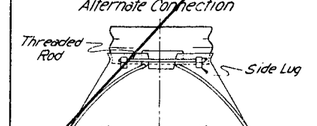
V = 7" for 18"x11" to 36"x22" Pipe-Arches
V = 12" for 43"x27" to 72"x44" Pipe Arches

Note: Length of Toe Plate for Pipe-Arch Culverts with rise of 11" to 27" incl. = "W" + 10"
31" to 44" incl. = "W" + 18"

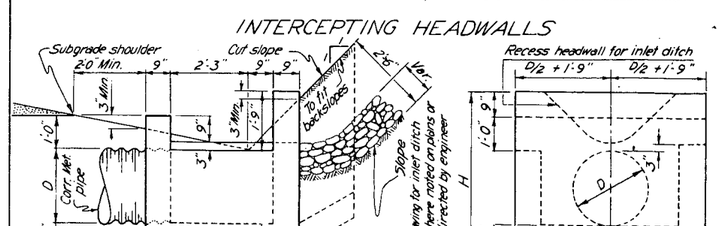


STANDARD METAL APRONS FOR CORRUGATED METAL PIPE ARCH CULVERTS TYPE L

PIPE ARCHES
Alternate Connection



INTERCEPTING HEADWALLS



General Notes for All Structures

All work shall be done according to the standard specifications of the Colorado Department of Highways applicable to the Project.

All construction joints shall be thoroughly cleaned before fresh concrete is poured.

When culvert is skewed, headwalls shall be placed parallel to ℄ of roadway.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

HEADWALLS AND APRONS FOR C.M.P. CULVERTS

Designed by P.S.B-G.H.D.	Approved by [signature]
Made by H.G.P.	Bridge Engineer
Checked by M.W.M.	Date June 1, 1958

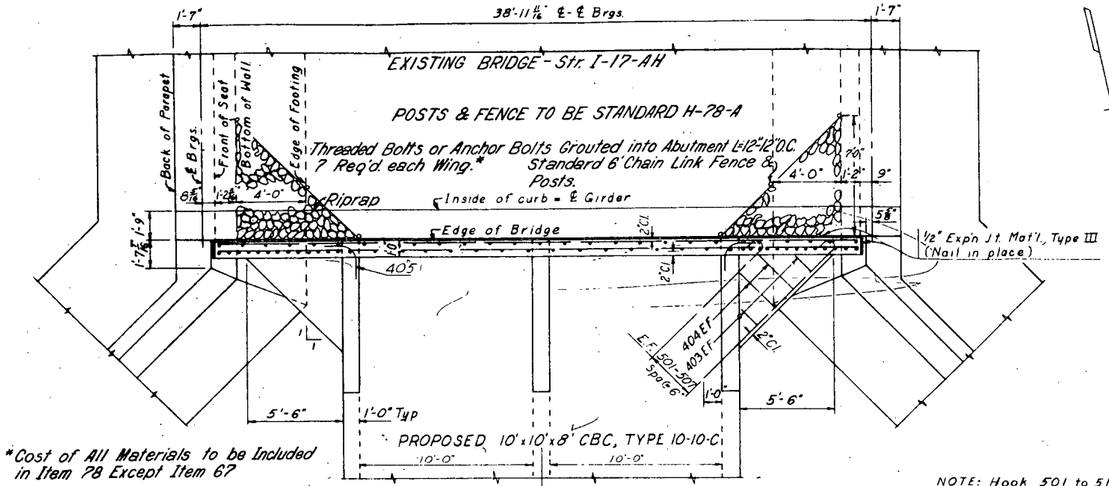
STANDARD M-95-A

PRINTED IN U.S.A.

REVISIONS

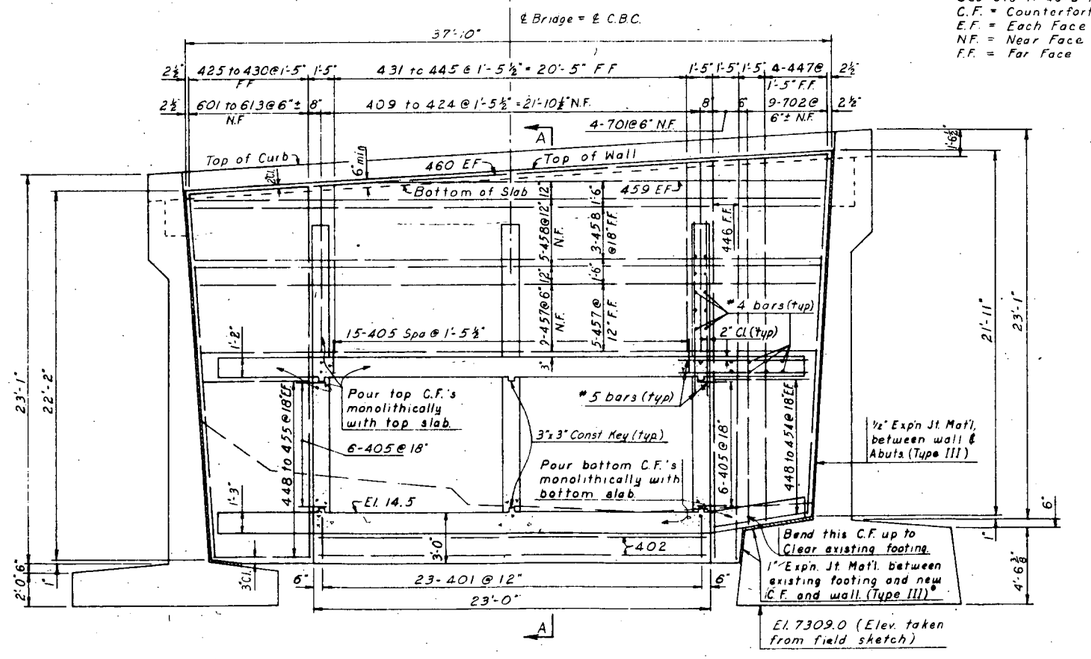
A

FED. ROAD SER. NO.	DIVISION	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	F017-1(3)	14	



*Cost of All Materials to be Included in Item 78 Except Item 67

NOTE: Hook 501 to 515 bars over #4 bars in walls whenever possible.
See Std M-46-C for bars in C.B.C.
C.F. = Counterfort
E.F. = Each Face
N.F. = Near Face
F.F. = Far Face



ELEVATION

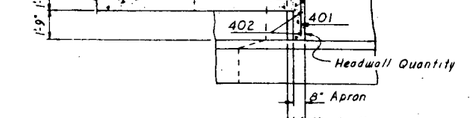
NOTE: Dimensions of Bridge are taken off of original plans.

(1) To be included in Bid Price for Item 46.

QUANTITIES for ONE HEADWALL & 2 RIPRAP WINGS

ITEM	DESCRIPTION	UNIT	TOTAL
46	Class A Concrete	Cu. Yd	28.0
47	Reinforcing Steel	Lb	3,500
(1)	1/2" Exp'n Jt. Mat'l. (AASHO Spec M-153-54) Type III	Sq. Ft	65
(1)	1" Exp'n. Jt. Mat'l. (AASHO Spec. M-153-54) Type III	Sq. Ft	7
67	Riprap	Cu. Yd.	5
78	Chain Link Fence	Lin. Ft.	20

BENDING DIAGRAMS (Dimensions are out to out of bars)



Remove existing handrail to top of curb. Leave steel projecting to secure 3"x1'-4" curb cap.

SECTION A-A

FOR GENERAL NOTES SEE STD. M-46-E.

BAR LIST

MARK	SIZE	No REQ'D	LENGTH	TYPE	DIM'S ℓ
401	1/2" ø	23	3'-6"	I	
402	1/2" ø	2	22'-6"	Str.	
403	1/2" ø	16	1'-4"	Str.	
404	1/2" ø	16	2'-10"	Str.	
405	1/2" ø	27	3'-4"	II	
406	1/2" ø	12	2'-6"	Str.	
407	1/2" ø	12	4'-0"	Str.	
408	1/2" ø	6	5'-6"	Str.	
409			10'-5"		
to	1/2" ø	1 ea.	by 1" to	Str.	
424			11'-8"		
425			21'-10"		
to	1/2" ø	1 ea.	by 1" to	Str.	
430			22'-3"		
431			10'-5"		
to	1/2" ø	1 ea	by 1" to	Str.	
445			11'-7"		
446	1/2" ø	2	23'-9"	Str.	
447	1/2" ø	4	21'-7"	Str.	
448			5'-8"		
to	1/2" ø	4 ea.	by 1" to	Str.	
454			6'-2"		
455	1/2" ø	2	6'-3"	Str.	
457	1/2" ø	14	36'-1"	Str.	
458	1/2" ø	8	36'-8"	Str.	
459	1/2" ø	2	26'-0"	Str.	
460	1/2" ø	2	37'-6"	Str.	
501			6'-0"		5'-5"
to	5/8" ø	8 ea.	by 1'-0" to	III	
507			12'-0"		11'-5"
508			6'-3"		5'-8"
to	5/8" ø	6 ea.	by 1'-4" to	III	
515			15'-7"		15'-0"
601			21'-10"		
to	3/4" ø	1 ea	by 1/2" to	Str.	
613			22'-4"		
701	5/8" ø	4	23'-9"	Str.	
702	5/8" ø	9	21'-7"	Str.	

BAR SUMMARY

2105 Lin. Ft. 1/2" ø @ 0.668 #/Lin. Ft. = 1406 #
1028 Lin. Ft. 5/8" ø @ 1.043 #/Lin. Ft. = 1072 #
287 Lin. Ft. 3/4" ø @ 1.502 #/Lin. Ft. = 431 #
289 Lin. Ft. 7/8" ø @ 2.044 #/Lin. Ft. = 591 #
TOTAL = 3500 #

	Initial	Date
Approved by	G.H.N.	4-64
Checked by	J.H.M.	5-64
Drawn by	P.S.-J.D.	5-64
Traced by		
Quantities by		

COLORADO DEPARTMENT OF HIGHWAYS

SPECIAL HEADWALL BETWEEN EXIST. BRIDGE AND 10'x10'x8' C.B.C.

Across FOUNTAIN CREEK
Sta. 74 +
Near CASCADE Sec. 26 T. 19 S R 68 W

Designed by G.H.N. Made by J.H.M. Checked by

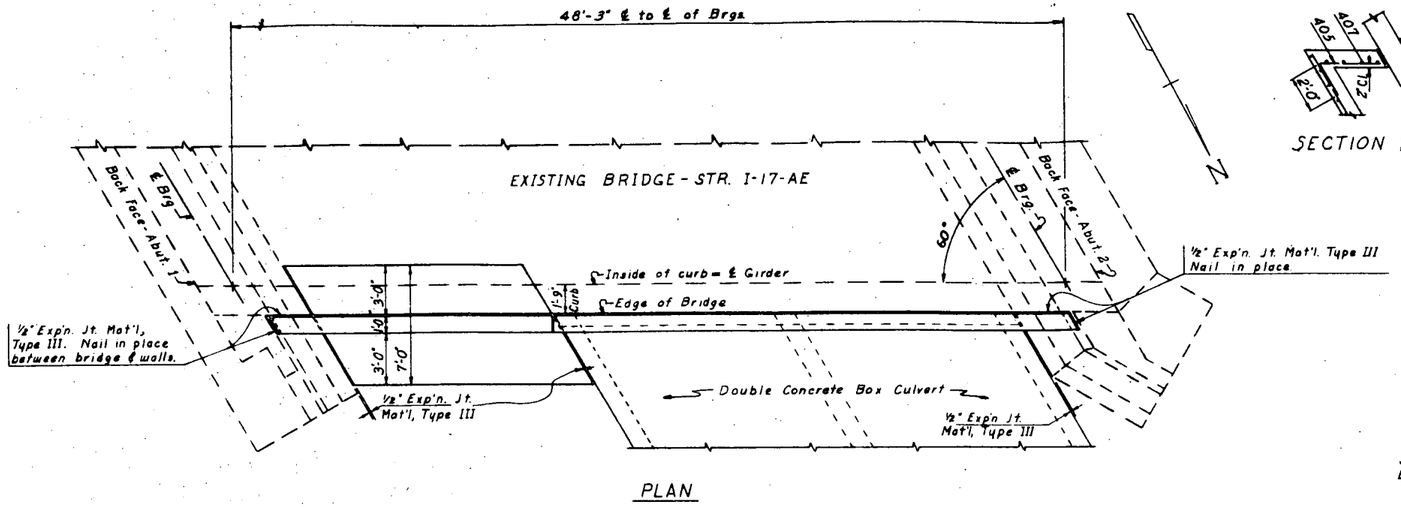
Approved by C.D. Bridge Engineer

Date: June 2, 1964

STRUCTURE NO. I-17-AH

REVISIONS

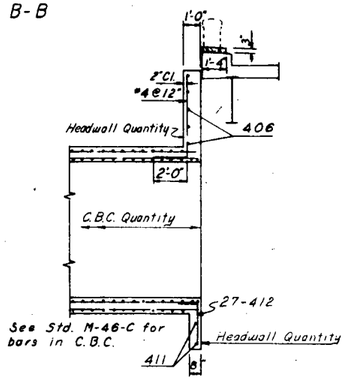
FED. ROAD DIV. NO.	DIVISION	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	F017-1(3)	15	



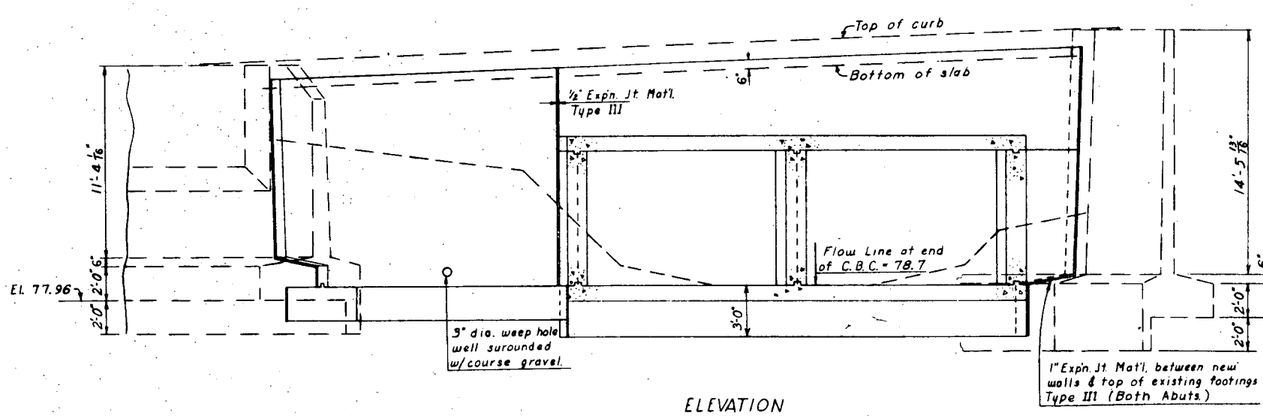
PLAN

SECTION B-B

Remove existing handrail to top of curb. Leave steel projecting to secure 3"x 1'-4" curb cap.

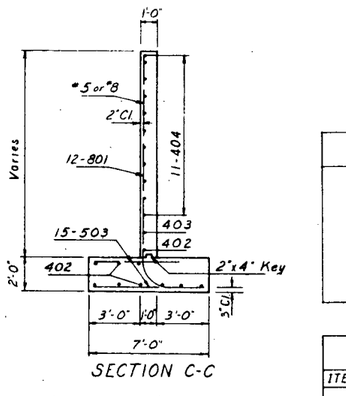


SECTION A-A

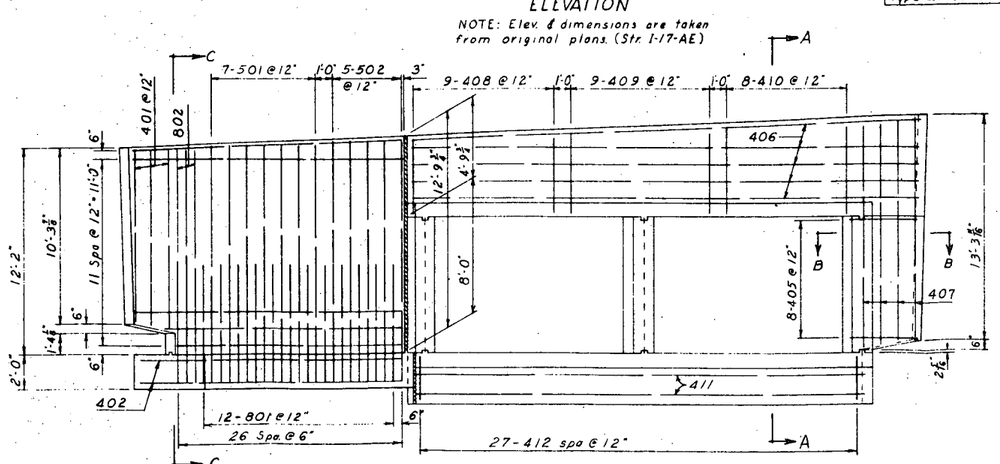


ELEVATION

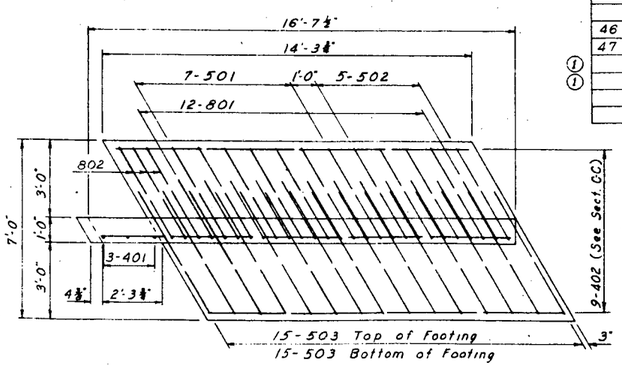
NOTE: Elev. & dimensions are taken from original plans. (Str. I-17-AE)



SECTION C-C



WALL ELEVATION



FOOTING PLAN

Max. Soil Pressure = 1.3 tons / sq. ft.

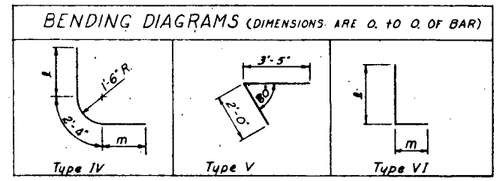
BAR LIST

MARK	SIZE	No. REQ'D	LENGTH	TYPE	DIMENSIONS ℄	DIMENSIONS m
401	½" ø	3	10'-0"	Str.		
402	½" ø	10	13'-7"	Str.		
403	½" ø	1	14'-0"	Str.		
404	½" ø	11	15'-6"	Str.		
405	½" ø	8	5'-5"	V		
406	½" ø	5	29'-0"	Str.		
407	½" ø	4	13'-0"	Str.		
408	½" ø	9	6'-6"	VI	4'-6"	2'-0"
409	½" ø	9	6'-9"	VI	4'-9"	2'-0"
410	½" ø	8	7'-0"	VI	5'-0"	2'-0"
411	½" ø	2	26'-0"	Str.		
412	½" ø	27	3'-6"	VI	2'-6"	1'-0"
501	⅝" ø	7	17'-5"	IV	12'-6"	2'-7"
502	⅝" ø	5	17'-8"	IV	12'-9"	2'-7"
503	⅝" ø	30	5'-6"	Str.		
801	1" ø	12	9'-0"	IV	5'-6"	1'-2"
802	1" ø	3	17'-2"	IV	12'-3"	2'-7"

BAR SUMMARY

912 Lin. Ft. ½" ø @ 0.668 #/Lin. Ft. = 609 Lb.
375 Lin. Ft. ⅝" ø @ 1.043 #/Lin. Ft. = 391 Lb.
160 Lin. Ft. 1" ø @ 2.670 #/Lin. Ft. = 427 Lb.
TOTAL = 1,427 Lb.

BENDING DIAGRAMS (DIMENSIONS ARE O. TO O. OF BAR)



QUANTITIES FOR ONE HEADWALL

	ITEM	DESCRIPTION	UNIT	TOTAL
	46	Class 'A' Concrete	Cu. Yd.	22.0
	47	Reinforcing Steel	Lb.	1,427
①		½" Exp'n. Jt. Mat'l, (AASHO Spec M-153-54) Type III	Sq. Ft.	90
①		1" Exp'n. Jt. Mat'l, (AASHO Spec M-153-54) Type III	Sq. Ft.	5

① To be included in Bid Price for Item 46.

FOR GENERAL NOTES SEE STD. M-46-E.

COLORADO DEPARTMENT OF HIGHWAYS

SPECIAL HEADWALL BETWEEN EXISTING BRIDGE AND 10' x 10' x 8' C.B.C.

Across FOUNTAIN CREEK
Sec. 23+
Near CASCADE Sec. 26 T. 13 S R 68 W

Designed by G.H.W.
Made by J.W.M.
Checked by

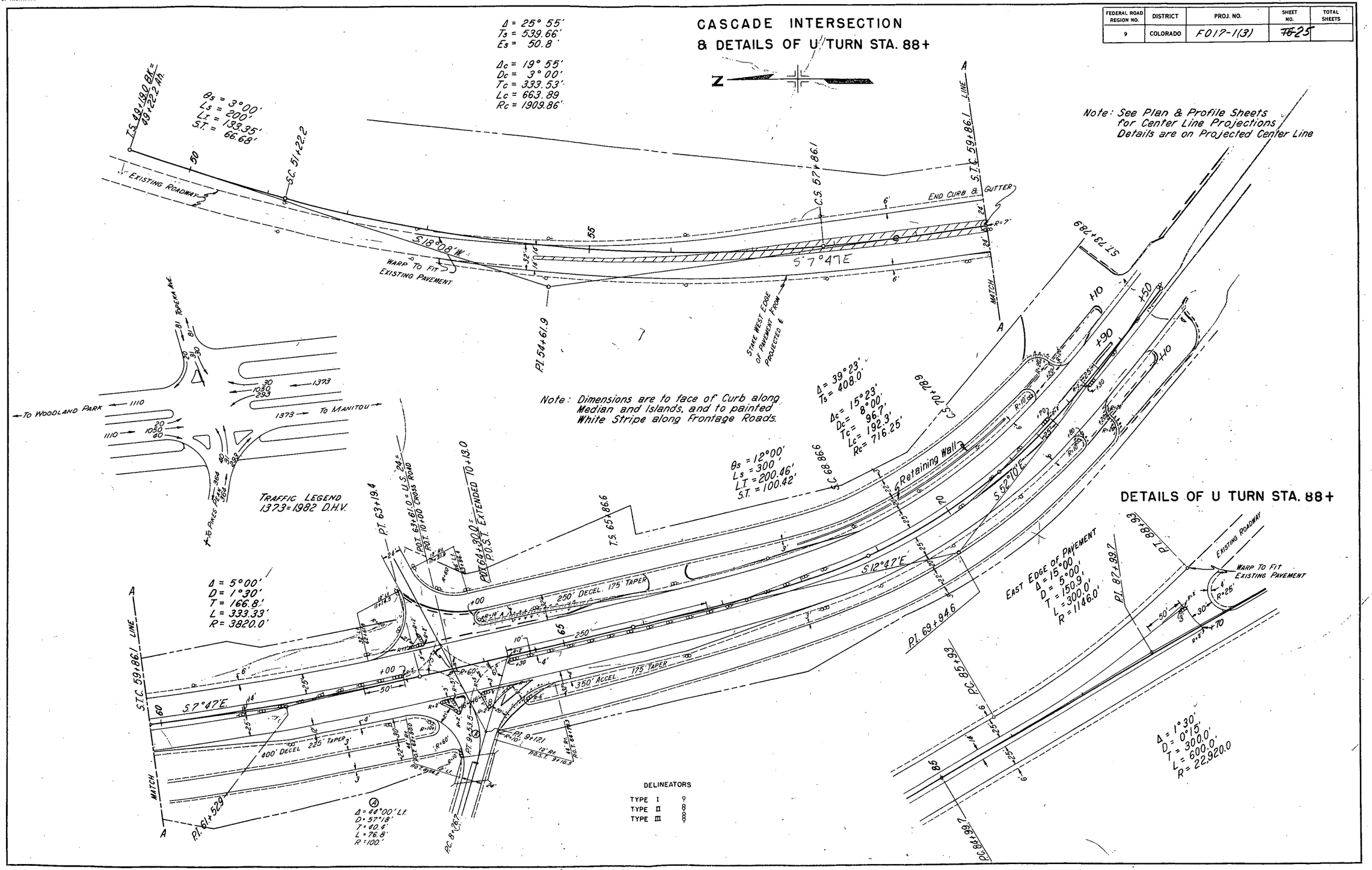
Approved by O.H. Hausmann Bridge Engineer
Date: June 2, 1964

STRUCTURE NO. I-17-AE

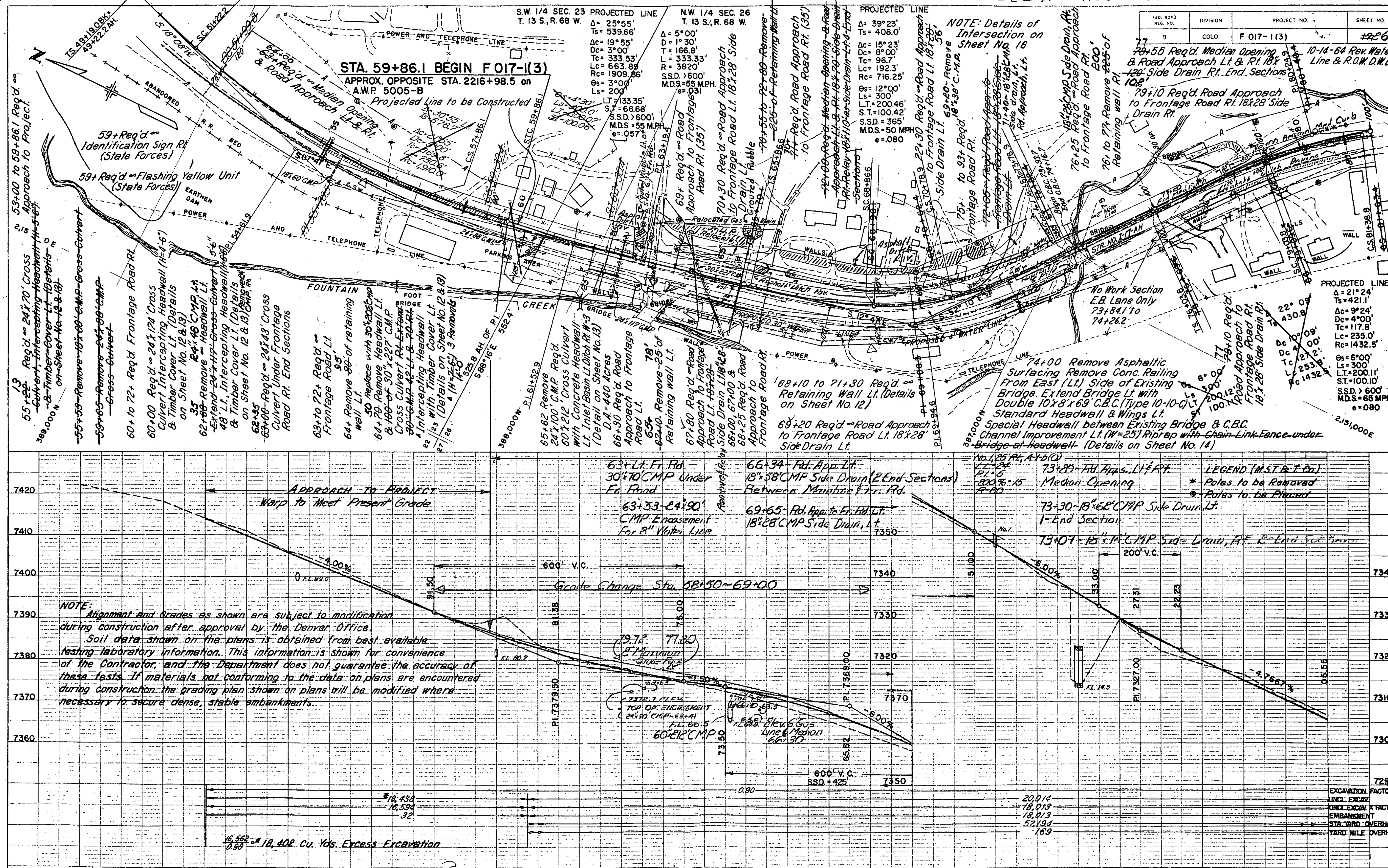
COLORADO DEPARTMENT OF HIGHWAYS
FORM C. D. H. 126
JANUARY 1960

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F017-1(3)	~~75~~25	

CASCADE INTERSECTION
& DETAILS OF U TURN STA. 88+



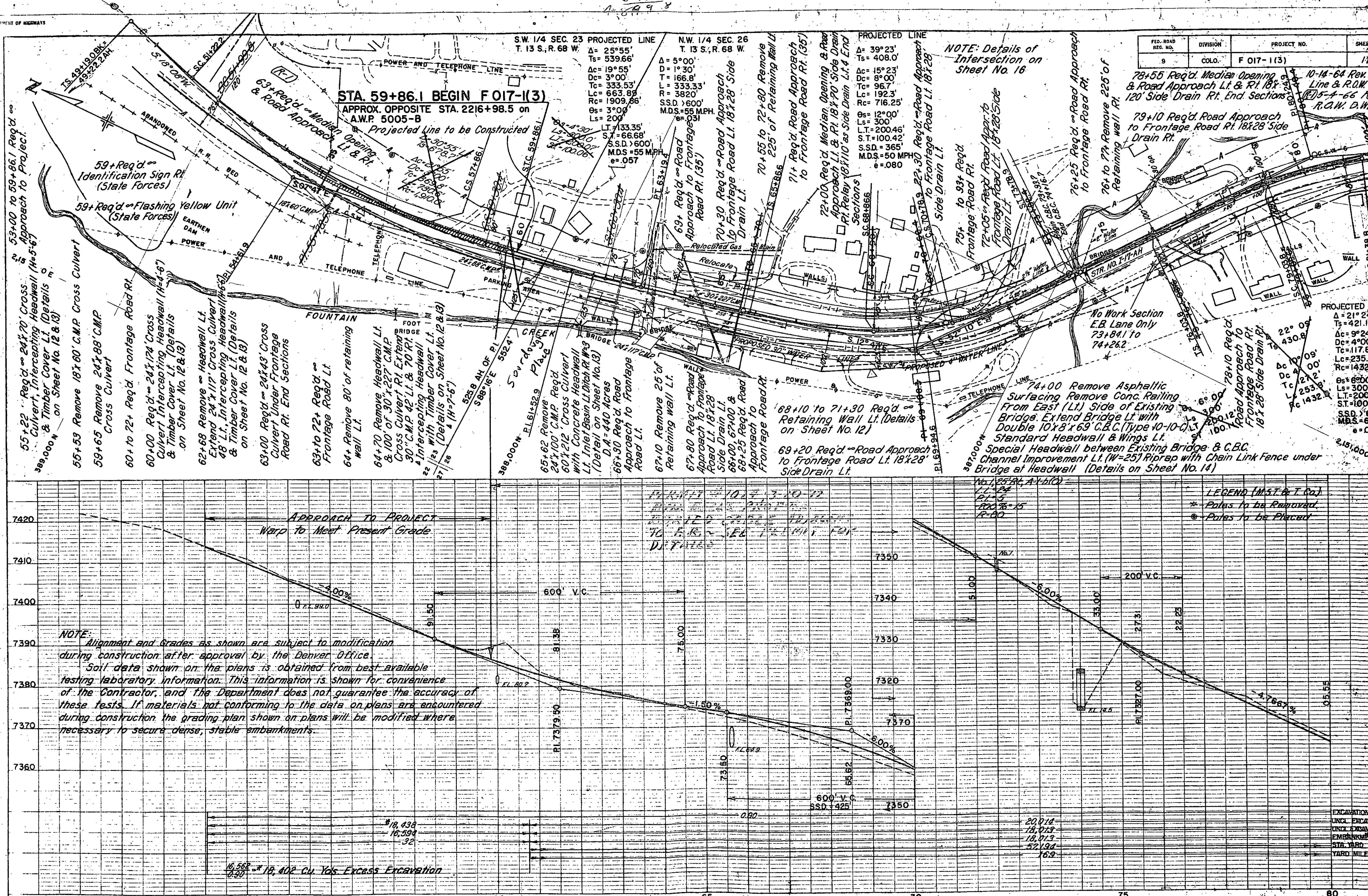
See Rev. Sheet next



K+E PLATE 1. PLAN-PROFILE KEUFFEL & ESSER CO.

COLORADO DEPARTMENT OF HIGHWAYS
Form C. D. H. 134
May 1961

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	F 017-1(3)	17



K+E PLATE 1, PLAN-PROFILE KEUFFEL & ESSER CO.

FED. ROAD REG. NO	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	F 017-1(3)	#27

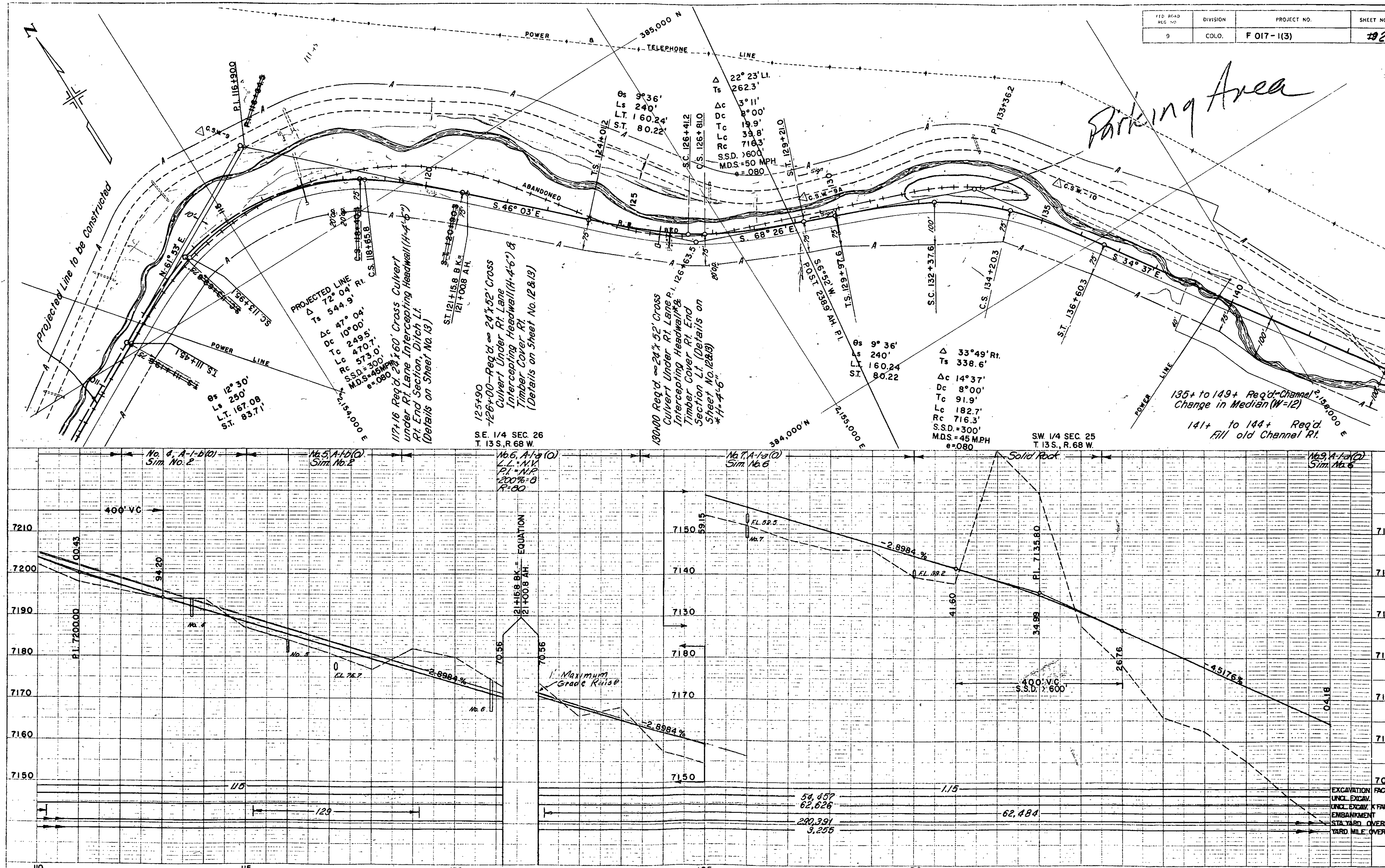
10-14-64 Rev. Water Line D.W.D.

PLAN

PROFILE

K&E PLATE 1, PLAN-PROFILE

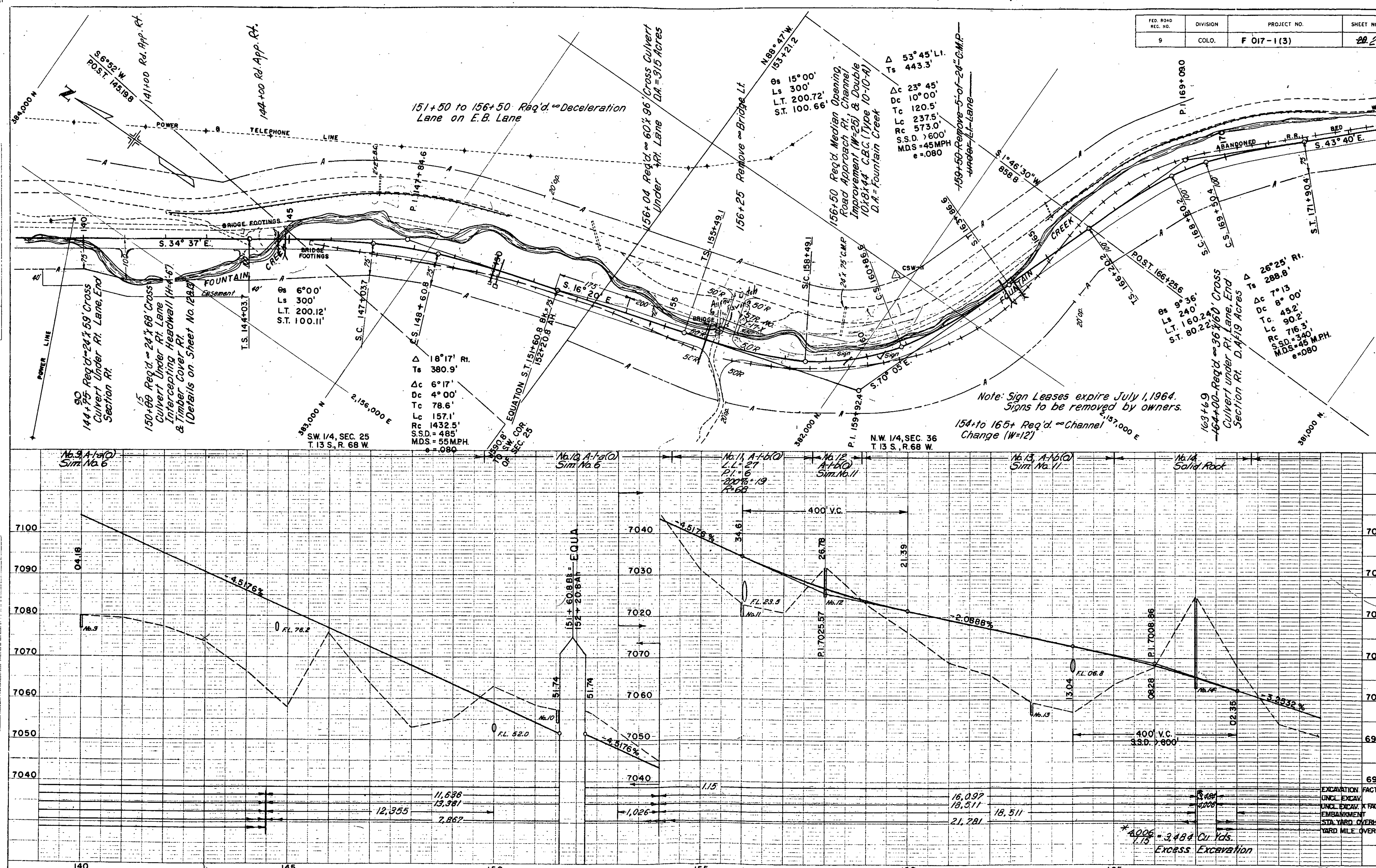
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	F 017-1(3)	#28



COLORADO DEPARTMENT OF HIGHWAYS

See Rev. Sheet next

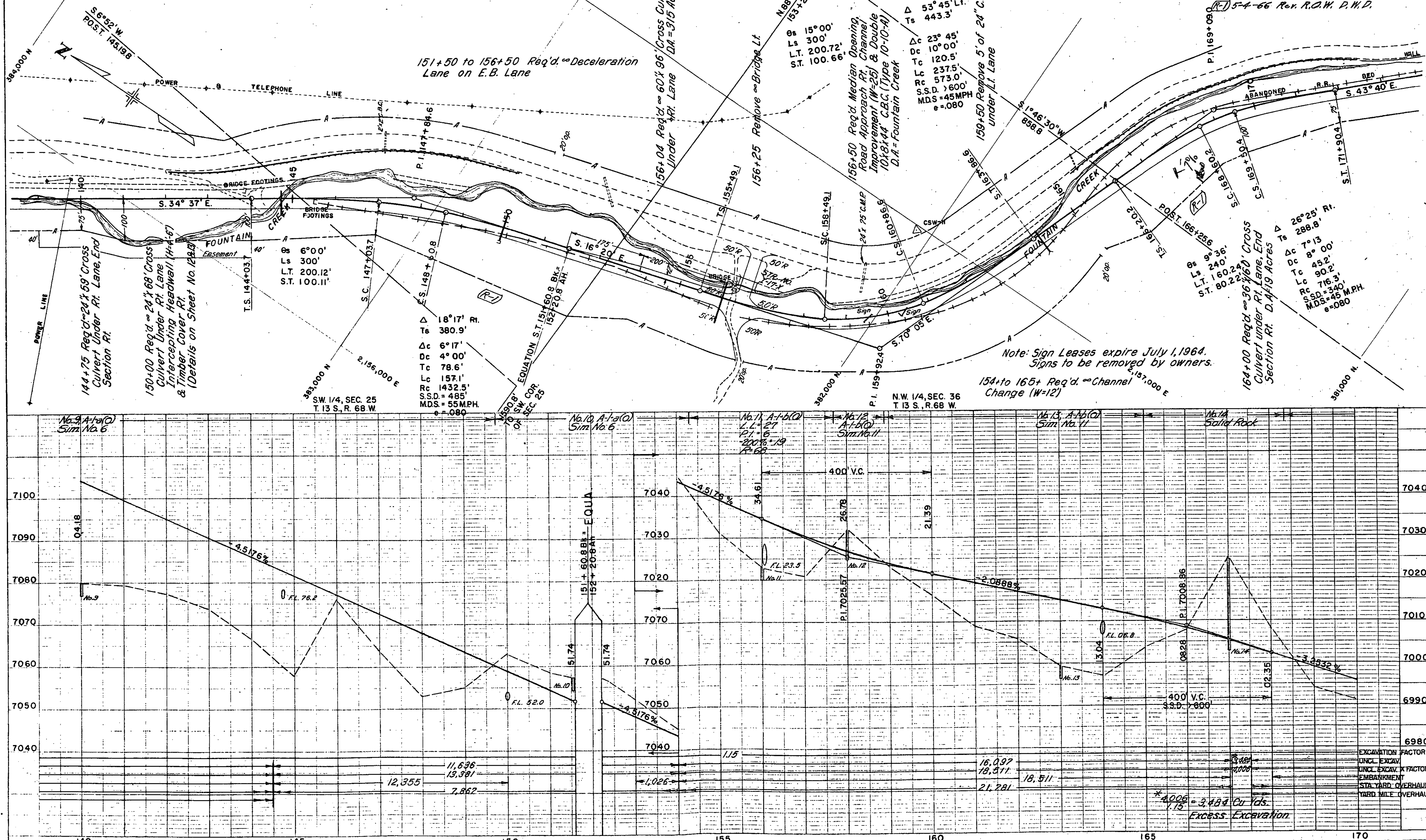
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	F 017-1(3)	~~28~~ 29



K+E PLATE 1. PLAN-PROFILE KEUFFEL & ESSER CO.

COLORADO DEPARTMENT OF HIGHWAYS
Form C. D. H. 134

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	F 017-1(3)	20



K+E PLATE 1. PLAN-PROFILE KEUFFEL & ESSER CO.

COLORADO DEPARTMENT OF HIGHWAYS

FED. ROAD DIV. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	F 017-1(3)	30

382,000 N

381,000 N

2,158,000 E

2,159,000 E

2,160,000 E

N.E. 1/4, SEC. 36 T. 13 S., R. 68 W.

N.W. 1/4, SEC. 31 T. 13 S., R. 67 W.

POWER & TELEPHONE LINE

ABANDONED R.R. BED

FOUNTAIN CREEK

Note: Sign Leases expire July 1, 1964
Signs to be moved by owners

177+ to 187+ Req'd. Channel Change in Median (W=12')

193+76 Req'd. = 60'x 76' Cross Culvert Under Rt. Lane, Ditch Rt. D.A. = 465 Acres Remove 2-4" C.M.P.

182+20 Req'd. = 24'x 54' Cross Culvert Under Rt. Lane Intercepting Headwall (W=46') & Timber Cover Rt. (Details on Sheet No. 12 & 13)

188+15 Req'd. = 24'x 66' Cross Culvert Under Rt. Lane, Intercepting Headwall (W=46') & Timber Cover Rt. (Details on Sheet No. 12 & 13)

195+80 Req'd. = 24'x 84' Cross Culvert Under Rt. Lane Intercepting Headwall (W=46') & Timber Cover Rt. (Details on Sheet No. 12 & 13)

Median Trans. 0' to 3' Rt.

1825.7' TO NE COR. SEC. 36

P.I. 169+09.0 — Δ 62° 53', Ts 414.7', Δc 34° 05', Dc 12° 00', Tc 146.4', Lc 284.0', Rc 477.5', S.S.D. > 600', M.D.S. = 40 M.P.H., e = .080

S.C. 168+60.2 — θs 14° 24', Ls 240', LT 160.53', ST 80.48'

C.S. 169+50.4

S.T. 171+90.4 — Δ 26° 25', Ts 288.8', θs 9° 36', Ls 240', LT 160.24', ST 80.22', Δc 7° 13', Dc 8° 00', Tc 45.2', Lc 90.2', Rc 716.3', S.S.D. = 340', M.D.S. = 45 M.P.H., e = .080

P.I. 178+45.9 — Δ 63° 42', Ts 388.3', Δc 42° 06', Dc 12° 00', Tc 183.8', Lc 350.8', Rc 477.5', S.S.D. = 285', M.D.S. = 40 M.P.H., e = .080

S.T. 183+12.5 — θs 10° 48', Ls 180', LT 120.22', ST 60.20'

P.I. 187+00 — Δ 29° 00', Ts 183.8', Δc 14° 36', Dc 12° 00', Tc 61.2', Lc 121.7', Rc 477.5', S.S.D. > 600', M.D.S. = 40 M.P.H., e = .080

S.C. 191+56.2 — θs 7° 12', Ls 120, LT 80.07', ST 40.06

S.T. 193+67.9

P.I. 192+20.0

S.T. 194+40.2 — Δ 19° 12', Ts 281.9', Δc 4° 48', Dc 6° 00', Tc 40.0', Lc 80.0', Rc 955.0', S.S.D. = 420', M.D.S. = 55 M.P.H., e = .080

S.C. 196+80.2 — θs 7° 12', Ls 240', LT 160.13', ST 80.12'

C.S. 197+60.2

S.T. 200+00.2

T.S. 200+53.6

S. 42° 51' E.

S. 52° 39' E.

N. 73° 27' E.

S. 43° 40' E.

No. 15, A-1-b(0) Sim. No. 11

No. 16, Solid Rock

No. 17, Solid Rock

EXCAVATION FACTOR	
UNCL. EXCAV.	15,211
UNCL. EXCAV. X FACTOR	17,493
EMBANKMENT	543,124
STA. YARD OVERHAUL	7,749
YARD MILE OVERHAUL	

EXCAVATION FACTOR	1.15
UNCL. EXCAV.	85,940
UNCL. EXCAV. X FACTOR	98,831
EMBANKMENT	119,199
STA. YARD OVERHAUL	
YARD MILE OVERHAUL	

PLATE 1. PLAN-PROFILE
KUPPER & ESSER CO.

COLORADO DEPARTMENT OF HIGHWAYS

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	F 017-1(3)	22-31

N.W. 1/4, SEC. 31 T. 13 S., R. 67 W.

N.E. 1/4, SEC. 31 T. 13 S., R. 67 W.

SW 1/4, SEC. 31 T. 13 S., R. 67 W

SE 1/4, SEC. 31 T. 13 S., R. 67 W

381,000 N

380,000 N

2,160,000 E

2,161,000 E

201+ to 225+ Req'd = Channel Change Rt. (W=12')

Δ 55°36' Lt.
Ts 374.1'
Δc 26° 48'
Dc 12° 00'
Tc 113.8'
Lc 223.3'
Rc 477.5'
S.S.D. = 390'
M.D.S. = 40 M.P.H.
e=.080

θs 14° 24'
Ls 240'
L.T. 160.53'
S.T. 80.48'

201+18 to 204+22 Req'd = Double 10'x8'x78' C.B.C. (Type 10-10-B) Standard Wingwalls Rt. & Lt. Channel Improvement (W=25') Riprap (Details on Sheet No. 12)

S.C. 202+93.6

208+00 to 212+00 Adjust Median to Flow Ahead

Grouted Rubble 209+16 in 216+72 Rt. Lane

Remove 48"x89' C.M.P. Cross Culvert, Req'd = 22+38 Cross Culvert, Ditch Lt. D.A. = 1,225 Acres

Remove 36"x70' C.M.P. Cross Culvert

215+90 to 221+00 Adjust Median to Flow Ahead

221+40 Remove Headwall & Extend 2'-6"x4'-0" C.B.C. Under Lt. Lane 28 Rt. With 24" Culvert Pipe Conc. Connecting Collar (Details on Sheet No. 12)

Θs 12° 00'
Ls 300'
L.T. 200.46'
S.T. 100.42'

Δ 52° 00' Rt.
Ts 501.6'
Δc 28° 00'
Dc 8° 00'
Tc 178.6'
Rc 716.3'
S.S.D. = 580'
M.D.S. = 50 M.P.H.
e=.080

Θs 12° 00'
Ls 300'
L.T. 200.46'
S.T. 100.42'

Δ 32° 00' Rt.
Ts 356.7'
Δc 8° 00'
Dc 8° 00'
Tc 50.1'
Lc 100.0'
Rc 716.3'
S.S.D. > 600'
M.D.S. = 50 M.P.H.
e=.080

S 1°46'30" W
POST 221+13.4

POST 227+11.6

227+84 Req'd = 24'x4' Cross Culvert Under Rt. Lane, Outlet Ditch, End Sections.

228+ Req'd = Identification Sign Lt. (State Forces)

228+05.2 to 230+00 = Req'd. Approach to Project

228+ Req'd = Flashing Yellow Unit (State Forces)

226+ Req'd = Dike Rt.

S. 76° 15' E.

S 89° 45' E

N. 71° 45' E.

S. 82° 39' E.

Median Trans. Rt. 0 to 3

Asphalt Ditch Pos. No. 19

CSW-4a

CSW-15A

CSW-18

CSW-19

CSW-20

Begin C.B.C. 200+60.8
End C.B.C. 200+93.8

FOUNTAIN CREEK

WALL A

ABANDONED R.R.

TUNNEL

EARTH FILL TO BE REMOVED

20' OP.

Solid Rock Rt. of ℄

400' V.C.

200' V.C.

200' V.C. S.S.D. > 600'

400' V.C. S.S.D. = 490'

P.I. 6829.40

P.I. 6807.00

P.I. 6760.00

P.I. 6730.00

P.I. 6712.00

-5.5325%

-6.0000%

-5.7143%

-6.0000%

-3.6000%

-6.0000%

F.L. 22.7

F.L. 79.2

F.L. 79.2

F.L. 90

STA. 228+05.2 END F 017-1(3)
APPROX. OPPOSITE STA. 54+10.0 on FAP 158-A

APPROACH TO PROJECT

EXCAVATION FACTOR	1.15
UNCL. EXCAV.	2,500
UNCL. EXCAV. K FACTOR	2,875
EMBANKMENT	
STA. YARD OVERHAUL	
YARD MILE OVERHAUL	

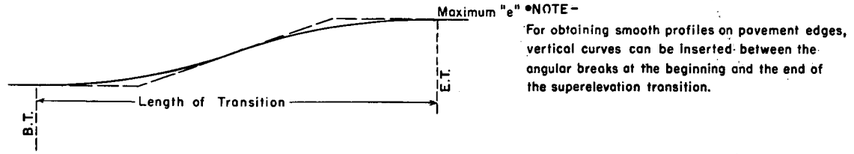
200 205 210 215 220 225 230

K&E PLATE 1. PLAN-PROFILE KEUFFEL & ESSER CO.

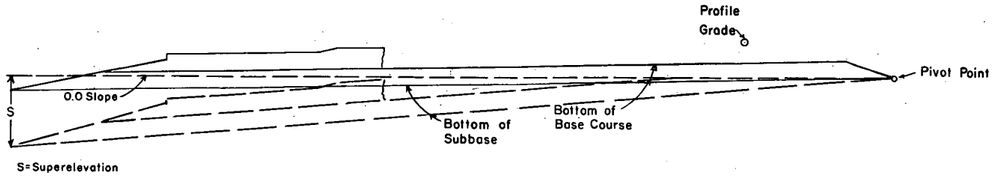
STANDARD M-1-D-1

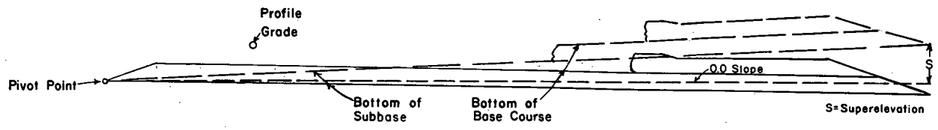
(MAY 1, 1962)

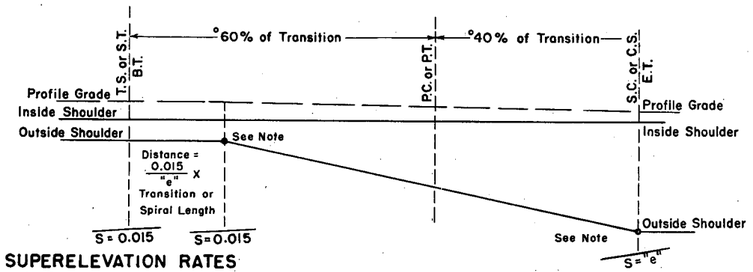
FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		



NOTE –
For obtaining smooth profiles on pavement edges, vertical curves can be inserted between the angular breaks at the beginning and the end of the superelevation transition.







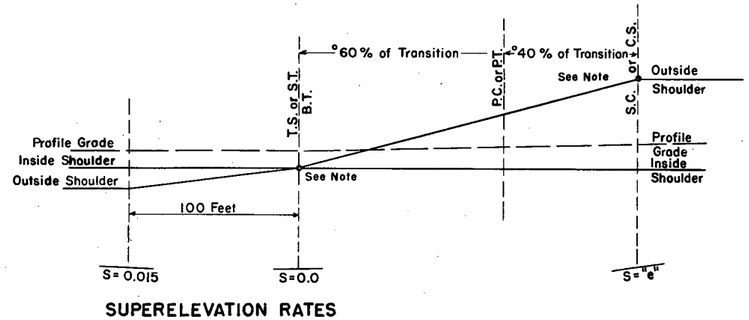
SUPERELEVATION RATES FOR FOUR LANE DIVIDED SECTION

TABLE 1

Degree of Curve	Maximum Superelevation = 0.08			Maximum Superelevation = 0.10		
	Super. Rate Ft./Ft.	Maximum Design Speed M.P.H.	Minimum Transition or Spiral Length	Super. Rate Ft./Ft.	Maximum Design Speed M.P.H.	Minimum Transition or Spiral Length
0° 15'	RC	70	200'	RC	70	200'
0° 30'	RC	70	200'	RC	70	200'
0° 45'	.021	70	200'	.020	70	200'
1° 00'	.028	70	200'	.028	70	200'
1° 30'	.042	70	200'	.042	70	200'
2° 00'	.056	70	250'	.055	70	250'
2° 30'	.069	70	250'	.069	70	250'
3° 00'	.077	70	250'	.083	70	300'
3° 30'	.080	70	300'	.096	70	350'
4°	.080	65	300'	.100	70	350'
5°	.080	60	300'	.100	65	350'
6°	.080	55	250'	.100	55	300'
7°	.080	50	250'	.100	55	300'
8°	.080	50	250'	.100	50	300'
9°	.080	45	250'	.100	45	300'
10°	.080	45	250'	.100	45	300'
11°	.080	40	200'	.100	40	250'
12°	.080	40	200'	.100	40	250'
13°	.080	35	200'	.100	40	250'
14°	.080	35	200'	.100	35	200'
15°	.080	35	150'	.100	35	200'
16°	.080	35	150'	.100	35	200'
17°	.080	30	150'	.100	35	200'
18°	.080	30	150'	.100	35	200'
19°	.080	30	150'	.100	30	200'
20°	.080	30	150'	.100	30	200'
21°	.080	30	150'	.100	30	200'
22°	.080	30	150'	.100	30	200'
23°	.080	30	150'	.100	30	200'
24°				.100	30	200'
25°				.100	30	200'

NOTES – Plains Areas use 0.10 Maximum Superelevation Rate.
Mountainous Areas & areas where icing conditions frequently exist, use 0.08 Maximum Superelevation Rate.

° When Curve is Not Spiralled



SUPERELEVATION RATES FOR SPECIAL CASES ⧄

TABLE 2

Degree of Curve	25 M.P.H.			30 M.P.H.			35 M.P.H.			40 M.P.H.			45 M.P.H.			50 M.P.H.			55 M.P.H.			60 M.P.H.			Degree of Curve
	Required Super. Rate Ft./Ft.		Minimum Length of Transition	Required Super. Rate Ft./Ft.		Minimum Length of Transition	Required Super. Rate Ft./Ft.		Minimum Length of Transition	Required Super. Rate Ft./Ft.		Minimum Length of Transition	Required Super. Rate Ft./Ft.		Minimum Length of Transition	Required Super. Rate Ft./Ft.		Minimum Length of Transition	Required Super. Rate Ft./Ft.		Minimum Length of Transition	Required Super. Rate Ft./Ft.		Minimum Length of Transition	
	0.08	0.10	or Spiral	0.08	0.10	or Spiral	0.08	0.10	or Spiral	0.08	0.10	or Spiral	0.08	0.10	or Spiral	0.08	0.10	or Spiral	0.08	0.10	or Spiral	0.08	0.10	or Spiral	
0° 15'	N S	N S	0	N S	N S	0	N S	N S	0	N S	N S	0	N S	N S	0	N S	N S	0	N S	N S	0	N S	N S	0	0° 15'
0° 30'	N S	N S	0	N S	N S	0	N S	N S	0	N S	N S	0	N S	N S	0	R C	R C	150'	R C	R C	200'	R C	R C	200'	0° 30'
0° 45'	N S	N S	0	N S	N S	0	N S	N S	0	R C	R C	150'	R C	R C	150'	R C	R C	150'	.016	.016	200'	.018	.018	200'	0° 45'
1° 00'	N S	N S	0	N S	N S	0	R C	R C	150'	R C	R C	150'	.016	.016	150'	.018	.018	150'	.021	.021	200'	.022	.022	200'	1° 00'
1° 30'	N S	N S	0	R C	R C	100'	R C	.016	150'	.019	.020	150'	.023	.024	150'	.027	.027	150'	.031	.031	200'	.035	.034	200'	1° 30'
2° 00'	R C	R C	100'	.016	.016	100'	.020	.021	150'	.025	.027	150'	.030	.032	150'	.035	.036	150'	.041	.042	200'	.047	.046	200'	2° 00'
2° 30'	R C	R C	100'	.020	.020	100'	.025	.026	150'	.030	.033	150'	.036	.039	150'	.043	.045	150'	.050	.052	200'	.057	.059	200'	2° 30'
3° 00'	.016	.017	100'	.023	.024	100'	.029	.031	150'	.035	.038	150'	.042	.046	150'	.050	.054	150'	.057	.062	200'	.066	.070	250'	3° 00'
3° 30'	.019	.019	100'	.026	.027	100'	.033	.035	150'	.040	.045	150'	.048	.053	150'	.056	.063	200'	.064	.072	250'	.072	.081	300'	3° 30'
4°	.021	.021	100'	.029	.030	100'	.037	.040	150'	.044	.050	150'	.053	.060	150'	.062	.070	200'	.069	.079	250'	.076	.090	300'	4°
5°	.026	.026	100'	.035	.038	100'	.044	.048	150'	.053	.060	150'	.062	.071	200'	.070	.083	250'	.077	.091	300'	.080	.099	350'	5°
6°	.031	.031	100'	.041	.044	100'	.050	.056	150'	.060	.068	150'	.069	.080	200'	.076	.093	250'	.080	.098	300'		.100	350'	6°
7°	.035	.035	100'	.045	.050	100'	.056	.063	150'	.066	.076	200'	.074	.088	250'	.079	.097	300'		.100	300'				7°
8°	.039	.040	100'	.050	.055	100'	.061	.069	150'	.071	.084	200'	.078	.094	250'	.080	.100	300'							8°
9°	.043	.044	100'	.054	.061	100'	.065	.075	150'	.074	.089	200'	.080	.097	300'										9°
10°	.046	.048	100'	.058	.065	150'	.069	.081	150'	.077	.093	200'		.100	300'										10°
11°	.049	.052	100'	.061	.070	150'	.072	.085	200'	.079	.096	250'													11°
12°	.052	.056	100'	.065	.074	150'	.075	.089	200'	.080	.098	250'													12°
13°	.054	.060	100'	.067	.078	150'	.077	.092	200'		.100	250'													13°
14°	.057	.063	100'	.070	.082	150'	.078	.095	200'																14°
15°	.059	.067	100'	.072	.085	150'	.079	.097	200'																
16°	.061	.070	100'	.074	.087	150'	.080	.099	200'																
17°	.063	.073	100'	.076	.090	150'		.100	200'																
18°	.065	.076	100'	.077	.093	200'																			
19°	.067	.078	100'	.078	.095	200'																			
20°	.069	.081	100'	.079	.096	200'																			
21°	.070	.083	100'	.080	.098	200'																			
22°	.072	.086	100'	.080	.099	200'																			
23°	.073	.088	100'		.099	200'																			
24°	.075	.090	100'		.100	200'																			
25°	.076	.091	100'																						
26°	.077	.093	150'																						
27°	.078	.094	150'																						
28°	.079	.096	150'																						
29°	.079	.097	150'																						
30°	.080	.098	150'																						
32°	.080	.099	150'																						
35°		.100	150'																						

⧄ Table 2 data may be used for City Streets & Interchanges.
NS = Normal Slope section.
RC = Remove adverse crown, superelevate at normal section slope.

NOTES – A Minimum 50 Foot Tangent Runout is required for all outside parts of Divided Highways on curve.
Transition or Spiral Lengths are shown in the tables for 4 Lane Divided Highways.
For 6 Lane Divided Highways use 1.2 times the lengths shown, rounded to the nearest 50 feet.
Width of Roadway to be figured for Superelevation = Length at base of subbase.

REVISIONS		
2-3-64	DEPT. NAME	M.R.H.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

SUPERELEVATION OF CURVES DIVIDED HIGHWAYS

Designed by S.B.L.
Made by S.B.L.
Checked by L.E.O.
Approved by E. Sullivan
Date 2-4-64

STANDARD SIDE APPROACH ROADS, FLARING, CUT SLOPE TREATMENT & WIDENING AT BRIDGES AND AT CREST OF GRADES

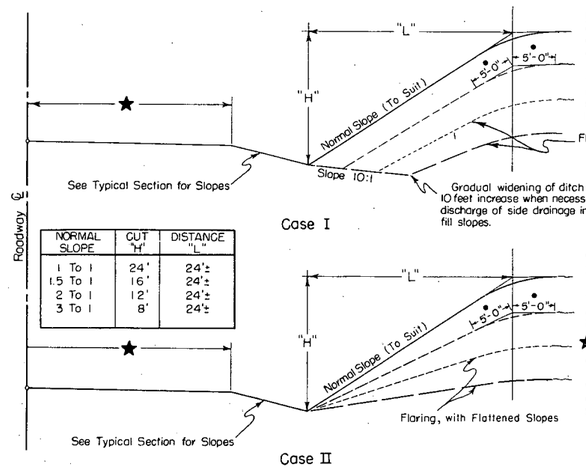
STANDARD M-2-A

(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

REVISIONS		
4-22-63	Rev. Bridge Approaches	L.E.O.
2-3-64	DEPT. NAME	M.R.H.

GENERAL DETAILS FOR FLARING OF EARTH CUTS, CUT SLOPE TREATMENT & WIDENING AT BRIDGES



Case I

NORMAL SLOPE	CUT "H"	DISTANCE "L"
1 To 1	24'	24'±
1.5 To 1	16'	24'±
2 To 1	12'	24'±
3 To 1	8'	24'±

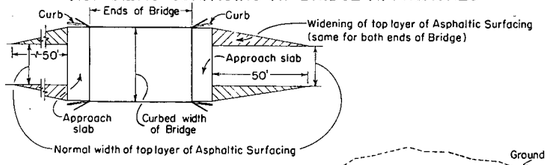
Case II

FLARING OF EARTH CUTS : The backslopes at ends of all earth cuts shall be flattened & where necessary the ditch shall be widened gradually to discharge side ditch drainage away from the base of adjacent fill slopes in order to avoid erosion & to improve appearance. The transition of flattened backslopes & widened ditch shall be constructed in such a manner that a uniform appearance of slope & ditch results. Backslopes shall be flared to the approximate "L" distance shown on Slope Table included with this detail. Rock cuts shall not be flared.

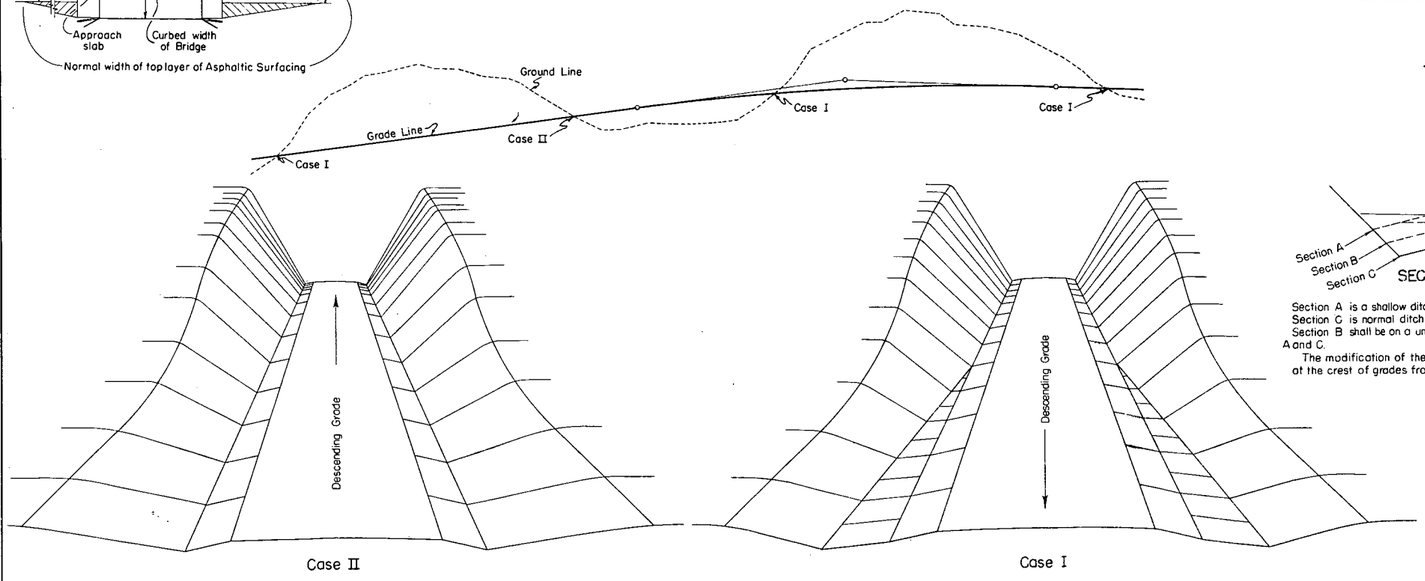
•CUT SLOPE TREATMENT IN EARTH CUTS: The intersection of cut slopes with the existing ground shall be rounded in earth cuts, beginning 5ft. outside the slope stake and extending 5 ft. down the cut slope. Where the cut slope is less than 5ft. reduce each of the above widths of slope treatment to the actual slope distance. Quantities shall be included in "Unclassified Excavation".

★ WIDENING AT BRIDGE APPROACHES: Roadway embankment at bridge approaches shall be so constructed that base of surfacing at shoulder point is a Min. of 2 ft. beyond the outside edge of bridge deck. Where widening of the section is necessary to achieve this result it shall take place gradually over a distance of 300 ft. The bottom layer of Asphaltic Surfacing shall be placed on widened sections to conform with dimensions shown on typical section. This is done to accomodate guard fence and/or guard posts at bridge approaches. The top layer of Asphaltic Surfacing shall be widened to meet the curbed width of the bridge or approach slab as shown in sketch, left.

PLAN OF WIDENING TOP LAYER OF ASPHALTIC SURFACING AT BRIDGE APPROACHES



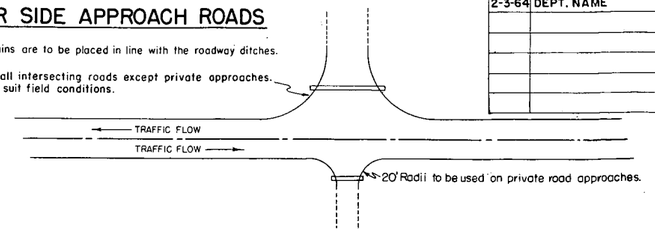
PLAN OF FLARING IN EARTH CUTS



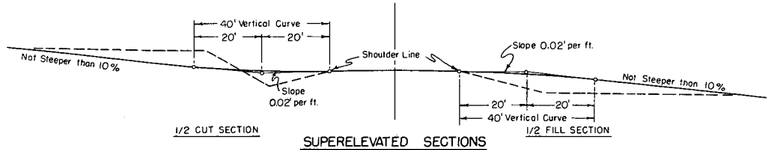
TYPICAL PLANS FOR SIDE APPROACH ROADS

Where practical Side Drains are to be placed in line with the roadway ditches.

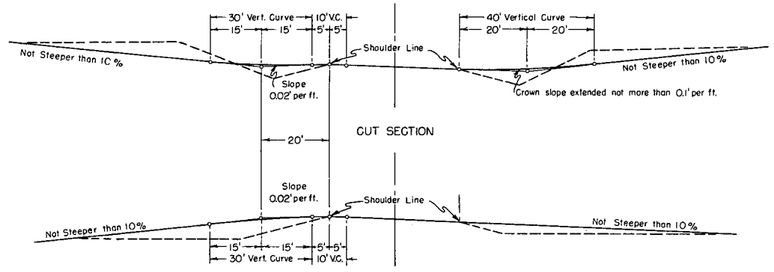
50' Radii to be used on all intersecting roads except private approaches. Radii may be varied to suit field conditions.



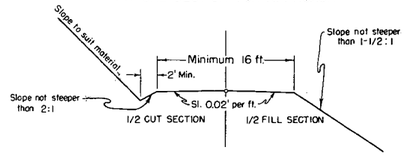
STANDARD CROWNED SECTION



SUPERELEVATED SECTIONS



TYPICAL SECTION FOR APPROACH

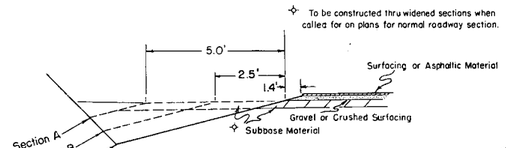


NOTE:

ROAD APPROACHES: To conform to the above details unless otherwise indicated on plans by Special Details. The width of the crowned section shall be not less than the width of the crowned section of the existing approach road and in no case shall the new construction be less than sixteen (16) feet in width.

DETAILS FOR DITCH & WIDENED SHOULDERS AT CREST OF GRADES

(TO BE USED ONLY WHERE SIGHT DISTANCE AT CREST OF GRADE IS 600 FT. OR LESS)



SECTION OF SIDE DITCHES

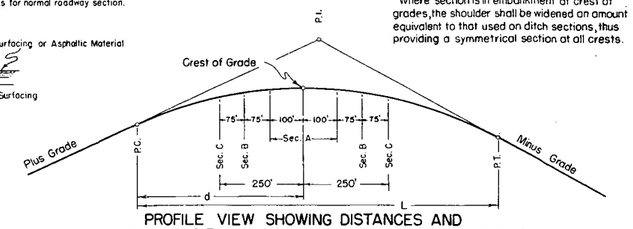
Section A is a shallow ditch section.
Section C is normal ditch section.
Section B shall be on a uniform transition between Sections A and C.
The modification of the ditch indicated shall be used only at the crest of grades from which drainage breaks both ways.

Formula for finding the Crest of Grade

$$d = \frac{\text{Plus Grade}}{\text{Algebraic Diff.}} \times L$$

NOTE

Where section is in embankment at crest of grades, the shoulder shall be widened an amount equivalent to that used on ditch sections, thus providing a symmetrical section at all crests.



PROFILE VIEW SHOWING DISTANCES AND RELATIVE POSITIONS OF DITCH-TREATMENT SECTIONS

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Colorado Department of Highways applicable to the Project.

All side approach roads to the Project shall be Gravel Surfaced with a four (4) inch thickness of "Gravel or Crushed Rock Surfacing" extending approximately to the Right of Way Line. Estimated tonnage & type of material required for this operation are shown in the Surfacing Plan.

The maximum grades shown are to be the limiting grades for all road approaches. Modifications of grades will be permitted where adherence to the grades as shown would cause damage to property or create other unsatisfactory conditions. Grades less than the maximum shown are to be used wherever feasible.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

APPROACH ROADS, FLARING, CUT SLOPE TREATMENT, BRIDGE & CREST WIDENING

Designed by A.Z.	Approved by A. Zulian
Made by S.J.M. & A.B.H.	
Checked by C.R.S.	Date: November 1, 1953

STANDARD M-5-A

(MAY 1, 1962) REV. 1-31-64, DEPT. NAME, M.R.H.

FED. ROAD REQ. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

1 2 3 4 5 6 7 8 9 0.

A B C D E F G H I J K L

M N O P Q R S T U V W

Scale in inches 0 1 2 3

a f g l J 14 K 1950

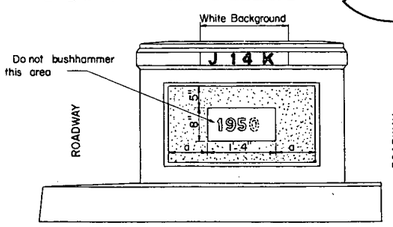
2" 1⅛" 2" 3" ⅜" 1¼" 1¼" 1¼" 1¼" 8" 1'-0"

SECTION

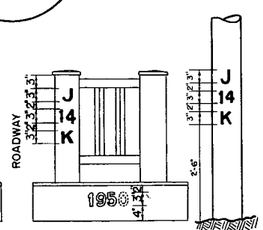
abcdefghijklmnopqrstuvwxyz

SAMPLE BRIDGE NUMBER

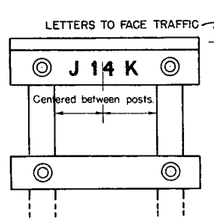
SAMPLE YEAR NUMBER



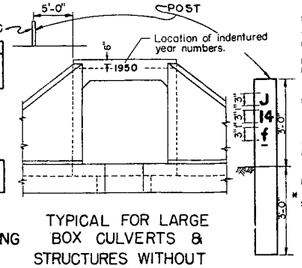
TYPICAL FOR CONCRETE ENDPOST



TYPICAL FOR STEEL HANDRAIL END POST TYPICAL FOR SIGN POSTS



TYPICAL FOR TIMBER WING HANDRAIL



TYPICAL FOR LARGE BOX CULVERTS & STRUCTURES WITHOUT END POSTS

GENERAL NOTES

ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS OF THE COLORADO DEPARTMENT OF HIGHWAYS APPLICABLE TO THE PROJECT.

THE SIZE SHAPE AND SPACING OF THE LETTERS AND FIGURES SHALL BE IN ACCORDANCE WITH THE FULL SIZE SHOWN ON THIS SHEET. ADDITIONAL COPIES OF THIS FULL SIZE SHEET CAN BE OBTAINED FROM THE DEPARTMENT WITHOUT CHARGE.

THE YEAR NUMBERS ARE RECESSED IN CONCRETE ¾" MINIMUM AS SHOWN INTO THE PANEL OF THE ENDPOST ON THE RIGHT HAND SIDE OF EACH BRIDGE END AND INTO THE FACE OF THE DOWNSTREAM HEADWALL OF CULVERTS AS SHOWN ON PLAN DETAILS. NUMBERS TO BE MADE OF WOOD, METAL OR OTHER SUITABLE MATERIAL AND ATTACHED TO THE FORMS BEFORE CONCRETE IS POURED. THE YEAR NUMBER OF EACH STRUCTURE SHALL CORRESPOND WITH THE YEAR IN WHICH THE CONCRETE IS POURED.

THE STRUCTURE NUMBER SHALL BE STENCILED ON THE RIGHT HAND SIDE OF EACH BRIDGE END AS SHOWN ON THIS STANDARD AND AS SPECIFIED. WHERE THE STRUCTURE HAS NO END POSTS THE NUMBER SHALL BE PLACED ON A POST ON THE RIGHT HAND SIDE OF THE ROAD AS SHOWN. FOR SIGNS THE NUMBER SHALL BE PLACED ON SIGN POSTS ON THE RIGHT HAND SIDE OF THE ROADWAY.

THE CORRECT NUMBER FOR EACH BRIDGE OR SIGN IS SHOWN ON THE PLANS.

THE NUMBERS FOR MAJOR STRUCTURES OF OVER 20 FEET CLEAR SPAN SHALL BE UPPER CASE LETTERS. THE NUMBERS FOR MINOR STRUCTURES OF 12 TO 20 FEET CLEAR SPAN SHALL BE LOWER CASE LETTERS. SIGN BRIDGES SHALL BE CONSIDERED AS MAJOR STRUCTURES.*

A PROPER WHITE BACKGROUND RECTANGULAR IN SHAPE AND EXTENDING THREE INCHES BEYOND THE LIMITS OF THE NUMBER SHALL BE PAINTED WITH TWO COATS OF ACCEPTABLE WHITE PAINT UNLESS AN APPROVED WHITE CONCRETE PAINT IS USED. BEFORE PAINTING THE SURFACE MUST BE THOROLY DRIED, CLEANED AND PROPERLY SIZED. ON TIMBER HANDRAILS THE WHITE PAINT USED ON THE BRIDGE WILL BE SATISFACTORY.

AFTER THE WHITE BACKGROUND HAS DRIED SUFFICIENTLY, THE CORRECT STRUCTURE NUMBER SHALL BE CAREFULLY STENCILED ON IT, WITH TWO COATS OF "SECOND FIELD COATS-DARK" OR "EXTERIOR BLACK PAINT (MAINT)" AS SPECIFIED UNDER ITEM 38 "PAINTS AND PAINTING". THE BRAGES OF THE STENCILED LETTERS AND FIGURES SHALL BE CAREFULLY FILLED IN BY HAND TO MAKE SOLID FIGURES.

SUFFICIENT TIME BETWEEN SUCCESSIVE COATS SHALL BE ALLOWED TO PERMIT THORO DRYING.

THE COST OF PAINTING OF STRUCTURE NUMBERS AND FURNISHING AND PLACING POSTS FOR STRUCTURE NUMBERS SHALL BE CONSIDERED SUBSIDIARY WORK AND SHALL BE INCLUDED IN THE ORIGINAL CONTRACT ITEMS AND WILL NOT PAID FOR AS A SEPERATE ITEM.

* THE LENGTH OF SPAN OF STRUCTURE SHALL BE MEASURED ALONG CENTER LINE OF ROADWAY. IN CASE OF DOUBLE OR MULTIPLE BOX CULVERTS THE CENTER WALL OR WALLS SHALL BE DISREGARDED AND CLEAR SPAN MEASURED FROM INSIDE OF END WALLS.

STRUCTURE NO._____

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

LETTERS AND FIGURES
FOR
STRUCTURE NUMBERS

Designed by	Approved by L.H. Woodruff
Made by	Bridge Engineer
Checked by	Date: Feb. 17, 1958

STANDARD ROADWAY CONSTRUCTION TRAFFIC SIGNS

STANDARD M-6-B

(SHEET 1 OF 2 SHEETS)

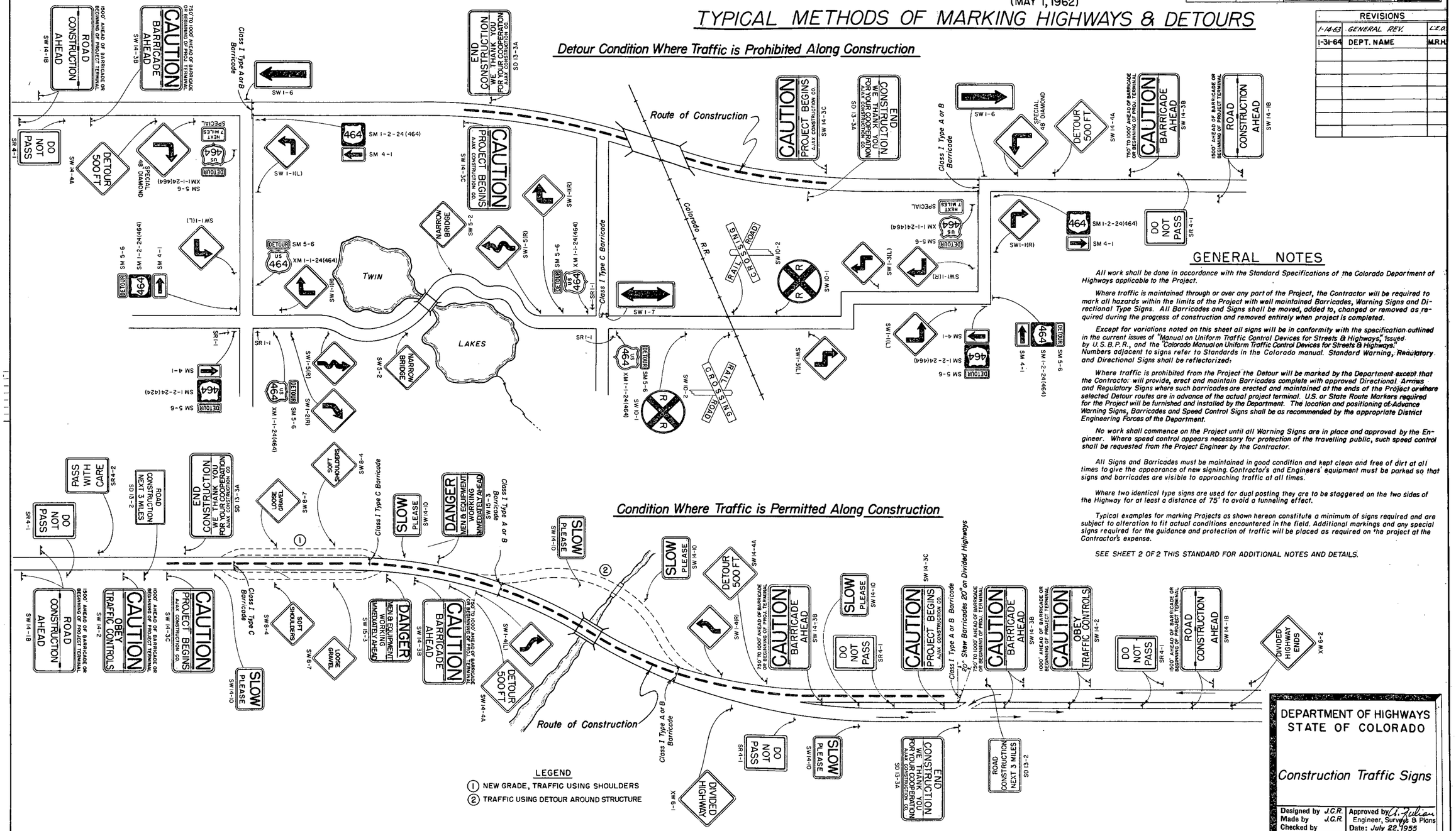
(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	[redacted]	[redacted]

REVISIONS		
1-1463	GENERAL REV.	C.E.O.
1-31-64	DEPT. NAME	M.R.H.

TYPICAL METHODS OF MARKING HIGHWAYS & DETOURS

Detour Condition Where Traffic is Prohibited Along Construction



Condition Where Traffic is Permitted Along Construction

LEGEND

(1) NEW GRADE, TRAFFIC USING SHOULDERS

(2) TRAFFIC USING DETOUR AROUND STRUCTURE

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Colorado Department of Highways applicable to the Project.

Where traffic is maintained through or over any part of the Project, the Contractor will be required to mark all hazards within the limits of the Project with well maintained Barricades, Warning Signs and Directional Type Signs. All Barricades and Signs shall be moved, added to, changed or removed as required during the progress of construction and removed entirely when project is completed.

Except for variations noted on this sheet all signs will be in conformity with the specification outlined in the current issues of "Manual on Uniform Traffic Control Devices for Streets & Highways," issued by U.S.B.P.R., and the "Colorado Manual on Uniform Traffic Control Devices for Streets & Highways." Numbers adjacent to signs refer to Standards in the Colorado manual. Standard Warning, Regulatory and Directional Signs shall be reflectorized.

Where traffic is prohibited from the Project the Detour will be marked by the Department except that the Contractor will provide, erect and maintain Barricades complete with approved Directional Arrows and Regulatory Signs where such barricades are erected and maintained at the ends of the Project or where selected Detour routes are in advance of the actual project terminal. U.S. or State Route Markers required for the Project will be furnished and installed by the Department. The location and positioning of Advance Warning Signs, Barricades and Speed Control Signs shall be as recommended by the appropriate District Engineering Forces of the Department.

No work shall commence on the Project until all Warning Signs are in place and approved by the Engineer. Where speed control appears necessary for protection of the travelling public, such speed control shall be requested from the Project Engineer by the Contractor.

All Signs and Barricades must be maintained in good condition and kept clean and free of dirt at all times to give the appearance of new signing. Contractor's and Engineers' equipment must be parked so that signs and barricades are visible to approaching traffic at all times.

Where two identical type signs are used for dual posting they are to be staggered on the two sides of the Highway for at least a distance of 75' to avoid a tunneling effect.

Typical examples for marking Projects as shown hereon constitute a minimum of signs required and are subject to alteration to fit actual conditions encountered in the field. Additional markings and any special signs required for the guidance and protection of traffic will be placed as required on the project at the Contractor's expense.

SEE SHEET 2 OF 2 THIS STANDARD FOR ADDITIONAL NOTES AND DETAILS.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

Construction Traffic Signs

Designed by J.C.R.	Approved by C. Julian
Made by J.C.R.	Engineer, Surveys & Plans
Checked by	Date: July 22, 1955

STANDARD ROADWAY CONSTRUCTION TRAFFIC SIGNS

STANDARD M-6-B

(SHEET 2 OF 2 SHEETS)

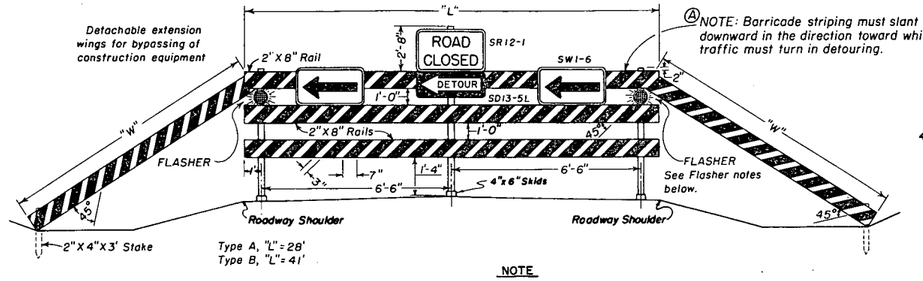
(MAY 1, 1962)

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		

REVISIONS		
5-16-62	Rev. Margin & Border Color	L.E.O.
1-14-63	General Rev.	L.E.O.
1-31-64	DEPT. NAME	M.R.H.
8-24-64	Flashers and Striping Notes	M.R.H.

DETAILS OF BARRICADES

Class I
Type A or B
(Road Closed)



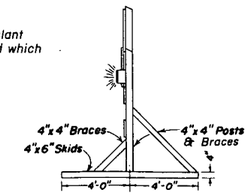
Type A, "L" = 28'
Type B, "L" = 41'

Ⓐ NOTE: Barricade striping must slant downward in the direction toward which traffic must turn in detouring.

"W" Variable, length to be adequate to provide closing of borrow pit and shoulder.

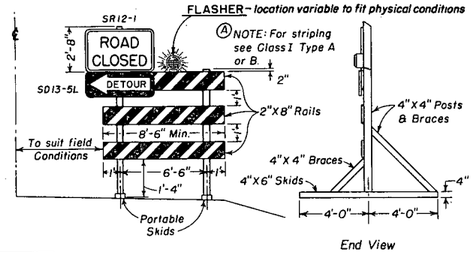
NOTE

The various types & combinations of approved Signs and Beacons for Barricades required for each project will be governed by field conditions and subject to approval by the Engineer.



End View

Class I
Type C
(Beg. of Detour; By-Pass Areas within Proj; Extreme Hazards; etc.)



End View

NOTE: Alternate materials or other reflective elements on Construction Traffic Signs and Barricades will be permitted only after approval of such material by the Department.

SPECIFICATIONS

PAINT - All paint and methods of painting shall be in conformity with Item 38 of the Standard Specifications.

STRIPING - Planking and Wings on all Barricades shall be painted with Maintenance Flat Black on both sides. Reflective Strips shall then be added to the face sides. Reflective Strips shall be Cutout Smooth Surface Yellow," of a type approved by the Department, 3" wide and spaced 7" apart as shown in the detail.

Diversion of traffic will be accomplished as follows:
1- Stripes for Barricades diverting traffic to the left shall start on the left hand side of the lower plank and progress up to the right with the stripes making an angle of 45 degrees with the horizontal axis of the board as shown in the detail. Traffic diversion to the right will be just the opposite.
2- Stripes on Barricades diverting traffic in both directions shall begin at the center of the lower plank and progress down in both directions.

TIMBER - All Timber used shall conform to the Standard Specifications for Miscellaneous Untreated Timber.

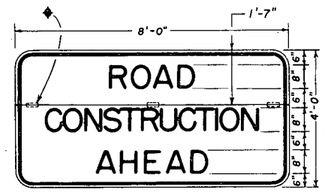
Planking	2"x8"	S4S
Posts (Barricades)	4"x4"	S4S
Posts (Signs)	4"x4" or 6"x6"	S4S

Barricades may be either portable as shown or fixed with posts set into the ground.

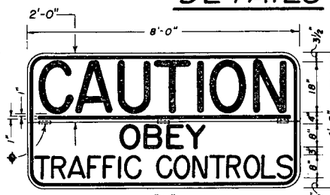
All skids, braces and posts to be painted yellow and nailed together with No. 20d nails.

Bases to be weighted where necessary to provide stability.

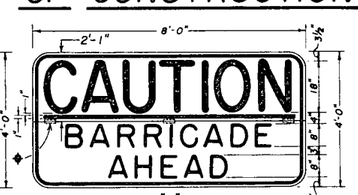
DETAILS OF CONSTRUCTION SIGNS



"A" (SW14-1B)



"B" (SW14-2)



"C" (SW14-3B)

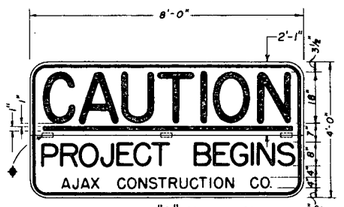
SEE DETAIL I

MARGIN AND BORDER COLOR

Signs "A" through "F"
Upper Portion: Margin - Same as Background; Border - Same as Legend
Lower Portion: Margin - Same as Background; Border - Same as Legend

Signs "G" and "I"
Margin - Reflectorized "Smooth Surface Yellow"
Border - Painted Black

Signs "J" and "K"
Margin - Reflectorized White
Border - Painted Black

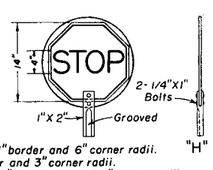


"D" (SW14-3C)

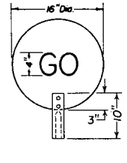
"E" (SW15-3)

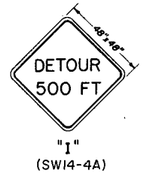
"F" (SD13-3A)

"G" (SW14-10)

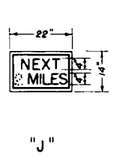


"H"





"I" (SW14-4A)



"J"

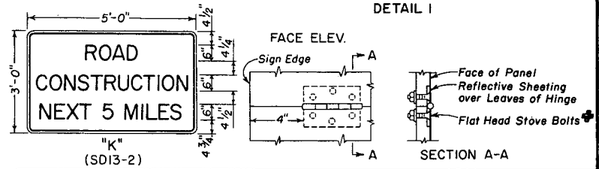
Signs "A" through "E" shall have 1" margin, 1" border and 6" corner radii.
Sign "F" shall have 3/4" margin, 7/8" border and 3" corner radii.
Signs "G" and "K" shall have 1/2" margin, 3/4" border and 1 7/8" corner radii.
Sign "I" shall have 3/4" margin, 1 1/4" border and 3" corner radii.

NOTES

1. Signs "A" through "F" shall be of the hinge and fold type to facilitate the closing down of the sign when the need is not prevalent. These signs shall be hinged with 3 - 4" Butt Hinges (tight pin) mortised into the face surface of the sign.
2. The reflective sheeting used on the sign background shall be placed over the leaves of the hinges.
3. ✤ Hinges shall be fastened to the sign with flat head stove bolts having a flat washer under the nut on back of sign.
4. All hinges, bolts, nuts and washers to be rust resistant.
5. Sign panels to be held in the open position with hooks and eyes or other approved fastening devices.

✤ 90° Countersunk Steel or Aluminum Lock Bolt Fasteners with Collars suitable for use on wood may be used in lieu of stove bolts.

DETAIL I



DETAILS OF SIGN AND BEACON FABRICATION AND USAGE

Construction Signs "A" through "G" and "K" shall be made of 5/8" Plywood or other material approved by the Department and as per details above.

Signs having reflectorized Yellow or Red surfaces shall be fabricated from "Flexible Reflective Sheeting" of the "Non-Exposed Lens" type approved by the Department. Signs having reflectorized White surfaces shall be fabricated from "Flexible Reflective Sheeting" of the "Exposed Lens" type approved by the Department.

Construction Sign "A" - Reflectorized Yellow background with painted Black lettering.

Construction Signs "B" through "D" - Top background to be reflectorized "Smooth Surface Red" with the legend and 1" Underline to be a White process paint. Balance of lettering to be painted Black over a reflectorized Yellow background.

Construction Sign "E" - The word "DANGER" and the 1" Underline only are to be of a White process paint over a reflectorized "Smooth Surface Red." Balance of lettering to be painted Black over a reflectorized Yellow background.

Construction Sign "F" - The words "End Construction" and "Contractors Name" shall be painted Black over a reflectorized White background. Balance of lettering to be applied with a White process paint over a reflectorized "Smooth Surface Red" background.

Construction Sign "G" - The legend to be painted Black over a reflectorized "Smooth Surface Yellow" background.

Flagman Warning Sign "H" - This sign shall be made of Plastic or other lightweight material, approved by the Department, having a painted Red background with White lettering on the "Stop" side and a painted Green background with White lettering on the "Go" side. Handle to be grooved on one side to indicate reading of sign to Flagman. This sign will be used whenever Flagmen are necessary. Sign to be reflectorized if used to stop traffic at night.

Detour Warning Sign "I" - This sign shall be made of 3/8" (Min.) Plywood or other material suitable to the Department. Legend to be painted Black on a reflectorized "Smooth Surface Yellow" background.

Construction Sign "J" - This sign shall be made of 3/8" (Min.) Plywood or other suitable material. Legend to be painted Black on a reflectorized White background. 3/4" X 9" metal slides to be placed between "NEXT - MILES," spaced so as to accommodate appropriate sized numerals. Numerals calculated to the nearest Mile.

Construction Sign "K" - Reflectorized White background with painted Black lettering.

Signs "A" through "E" and "G" shall be painted on the backside with one coat of white primer and one coat of yellow enamel.

Signs "F," "J" and "K" shall be given 2 coats of white paint on the backside.

Construction Signs shall be placed as follows:

Sign "A" - This is the first advance warning sign and shall be placed 1,500 feet ahead of barricade or beginning of project terminal and on both sides of the traveled way in all cases.

Sign "B" - This is the second advance warning sign and shall be placed 1,000 feet ahead of barricade or beginning of project terminal and on both sides of the traveled way on divided highways and singly on two-lane highways.

Sign "C" - This is the third advance warning sign in cases where barricades are used and shall be placed 750 to 1,000 feet ahead of barricade or beginning of project terminal and on both sides of the traveled way on divided highways and singly on two-lane highways.

Sign "D" - This sign shall be placed to mark the beginning of the Project. It shall be placed singly and may be placed opposite barricade if desirable.

Sign "E" - This sign shall be placed 500 feet ahead of the situation being advised of.

Sign "F" - This sign shall be placed to mark the end of the Project. It shall be placed singly and may be placed opposite barricade if desirable.

Sign "G" - This sign shall be used frequently within the limits of the Project.

Sign "K" - This sign shall be erected at the limits of any project more than 2 miles in extent, where traffic is maintained through the job.

Flares and Torches shall be either of the oil burning or electrical type approved by the Department and shall be placed 3 to 5 feet ahead of the object to be illuminated. Particular care shall be taken to protect all signs and barricades from smoke and smudge arising from the use thereof.

Flashers used on the barricades shall be of the battery or electrical type. The lens for this type flasher shall be at least 4 in. in dia. The illuminating element in a flashing yellow beacon or signal shall be flashed continuously at a rate of 50 to 60 flashes per min. with the "on" time being at least 25 % of the cycle. Each element, complete, shall be of such design as to render the lens when illuminated clearly visible for 1,000 ft. under all atmospheric conditions except dense fog. The color of the lens shall be in accordance with Technical Report No. 1 of the Institute of Traffic Engineers.

All material shall be sound and durable. Barricades, signs, symbols and lettering shown hereon will be of good workmanship and well maintained. Uneven lettering will not be accepted.

Alternate methods of processing signs or the substitution of symbols or other reflecting elements for painted symbols will be permitted only after approval of such methods or materials by the Department.

The Department shall furnish and install the following as required OUTSIDE THE LIMITS of the Project:

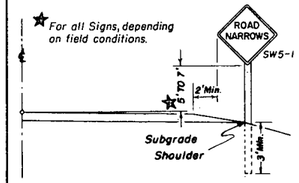
1.	"ROAD CONSTRUCTION AHEAD"	Minimum 4
2.	"CAUTION OBEY TRAFFIC CONTROLS"	Minimum 2
3.	"CAUTION BARRICADE AHEAD"	As Required
4.	Standard Warning, Guide & Directional Signs	As Required
5.	"ROAD CONSTRUCTION NEXT 5 MILES"	As Required

The Contractor shall furnish and install the following as required WITHIN THE LIMITS of the Project:

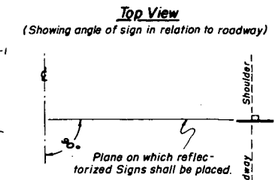
1.	All Barricades	As Required
2.	"CAUTION PROJECT BEGINS"	Minimum 2
3.	"DANGER MEN & EQUIPMENT WORKING IMMEDIATELY AHEAD"	As Required
4.	"END CONSTRUCTION WE THANK YOU FOR YOUR COOPERATION"	Minimum 2
5.	"SLOW PLEASE"	As Required
6.	Standard Warning & Directional Signs	As Required
7.	Approved Directional Arrows & Regulatory Signs for Barricades	As Required
8.	Torches and Flares as follows: Class I Type A or B Barricade	Minimum 3
	Class I Type C Barricade	Minimum 1
9.	Flashers - Class I Type A or B Barricade	2 Required
	Class I Type C Barricade	As Required

At the request of the Contractor layouts of signs will be furnished by the Traffic Operations Section indicating the details as to letter size, symbols, spacing, etc. which are required for these signs.

Position of Signs Relative to Roadbed & Hazards



Top View
(Showing angle of sign in relation to roadway)



NOTE:
Warning Signs to be made of 3/8"(Min.) plywood or other material suitable to the Department and shall be reflectorized.
Location to be governed by field conditions. Exact location to be staked by the Engineer. In all cases warning signs are to be placed well in advance of hazard, the distance depending on topography, and existing approach speeds.
For all signs prefixed with the letters "R," "M" or "W" refer to the "Colorado Manual on Uniform Traffic Control Devices for Streets and Highways" of current issue.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

Construction Traffic Signs

Designed by J.C.R.	Approved by [signature]
Made by J.C.R.	Engineer, Surveys & Plans
Checked by	Date: July 22, 1955

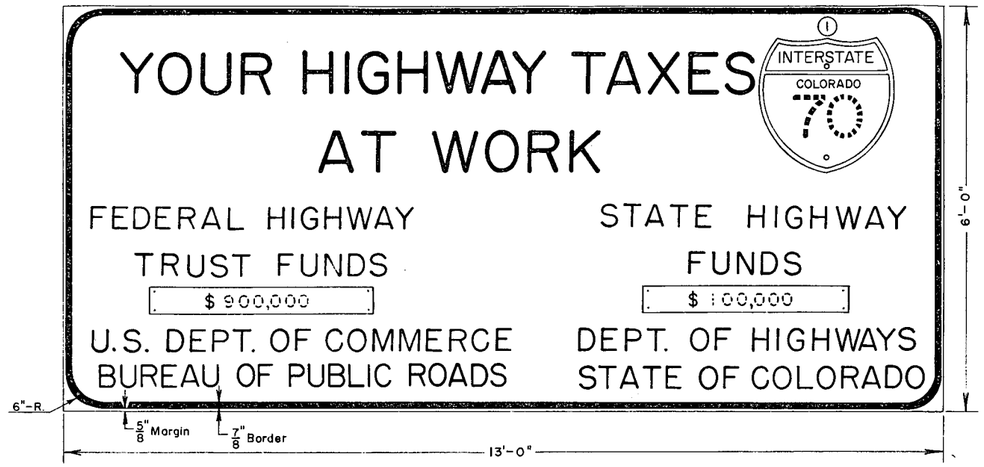
TYPICAL SIGNS

STANDARD M-6-CA
(JAN. 31, 1964)

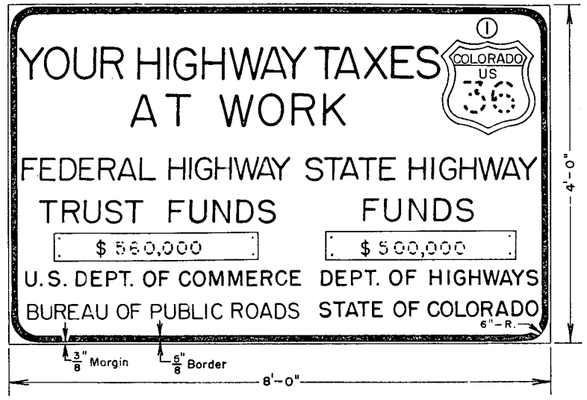
FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO			

REVISIONS		
6-26-64	GENERAL NOTES	M.R.H.

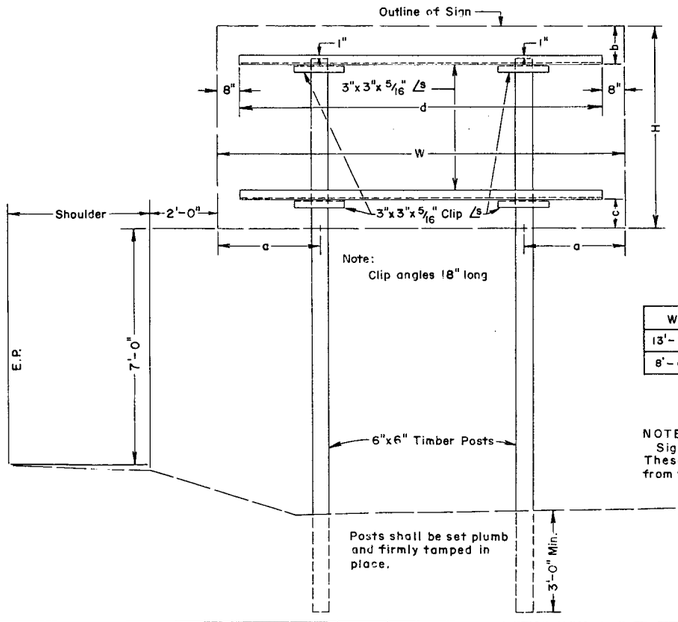
INTERSTATE SYSTEM



PRIMARY & SECONDARY SYSTEM



INSTALLATION DETAIL



W	H	a	b	c	d
13'-0"	6'-0"	2'-6"	1'-1½"	0'-10½"	11'-8"
8'-0"	4'-0"	1'-6"	1'-1½"	0'-10½"	6'-8"

NOTE:
Signs are to be placed facing traffic approaching the work. These signs should be so located as not to obscure or detract from the effectiveness of other official signs.

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Colorado Department of Highways, applicable to the Project.

Signs shall be made of ¾" Plywood or other material approved by the Department.

Background to be painted plain white with stencil black letters, numerals and border.

When a third governmental agency is participating its offical name should be included centrally in lines 6 and 7

Posts shall be 6"X 6" S 4 S timber or other material approved by the Department and shall be painted white.

Signs are to be non-reflectorized, black legend on plain white background. Route Marker plaques to be the appropriate standard colors, non-reflectorized.

Layout of signs will be furnished by the Traffic Operations Section indicating the details as to letter size, symbols, spacing, figure for amount of funds, etc. which are required for these signs.

These signs will be furnished and installed by State Forces.

ⓘ Applicable Interstate, U. S. Shield or State Route Shield.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

IDENTIFICATION SIGNS

Designed by B.F.R.
Made by D.J.B.
Checked by M.R.H.
Approved by L.C. Brown
Staff Design Engr.
Date: 2-5-64

STANDARD TYPES *of* DITCHES *and* CONSTRUCTION METHODS

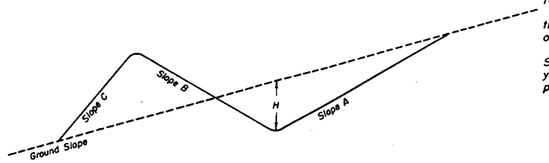
STANDARD M-13-A

(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

DETAILS *for* CONTOUR INTERCEPTING DITCHES

Typical Section for Contour Intercepting Ditches



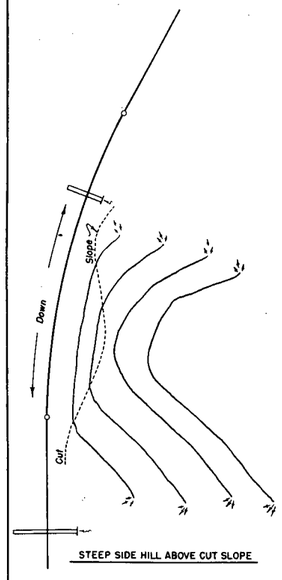
PURPOSE & USE OF THE TABLE

The primary purpose of the information for Contour and Intercepting Ditches shown on this sheet is to serve as a guide in construction and to readily arrive at yardages of excavation involved.

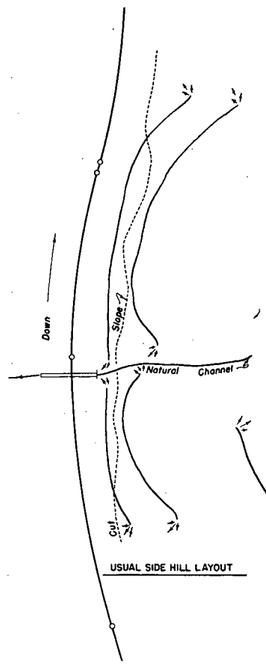
Foremost consideration in constructing these ditches is given first to the natural ground line slope confronted in construction, thence to the other values shown on the Typical Section.

By properly arriving at the combination of values shown on the Typical Section and in the Table for a specified condition, the number of cubic yards of excavation per 100 lin. ft. of ditch may be read under the appropriate column for this item.

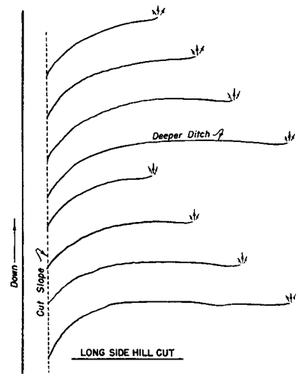
Typical Construction Layouts



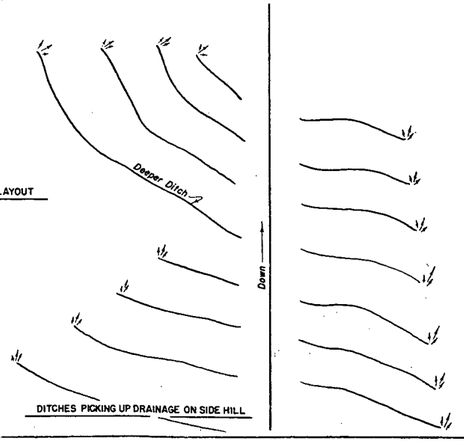
STEEP SIDE HILL ABOVE CUT SLOPE



USUAL SIDE HILL LAYOUT



LONG SIDE HILL CUT



DITCHES PICKING UP DRAINAGE ON SIDE HILL

Scale of Sketches in Feet

100 0 100 200 300 400

Table of Slopes and Yardages

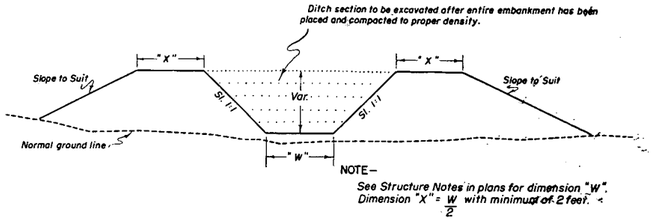
SLOPES				H	Cubic Yards per 100 lin. ft. of Ditch
Ground	A	B	C		
5:1 Or Flatter	2:1	4:1	2:1	15"	16
				18"	23
				21"	32
		3:1		15"	15
				18"	22
				21"	30
		2:1		15"	14
				18"	20
				21"	27
		1-1/2:1		15"	13
				18"	19
				21"	25
	1-1/2:1	4:1	1-1/2:1	15"	12
				18"	18
				21"	25
		3:1		15"	12
				18"	17
				21"	23
		2:1		15"	10
				18"	15
				21"	20
		1-1/2:1		15"	10
				18"	14
				21"	19
4:1	2:1	4:1	2:1	15"	17
				18"	25
				21"	34
		3:1		15"	17
				18"	24
				21"	32
		2:1		15"	15
				18"	22
				21"	30
		1-1/2:1		15"	15
				18"	21
				21"	29
	1-1/2:1	4:1	1-1/2:1	15"	13
				18"	18
				21"	25
		3:1		15"	12
				18"	17
				21"	23
		2:1		15"	11
				18"	16
				21"	21
		1-1/2:1		15"	10
				18"	14
				21"	20
3:1	2:1	3:1	2:1	15"	22
				18"	31
				21"	43
		2:1		15"	21
				18"	30
				21"	41
		1-1/2:1		15"	20
				18"	29
				21"	40
	1-1/2:1	3:1	1-1/2:1	15"	13
				18"	19
				21"	26
		2:1		15"	12
				18"	17
				21"	24
		1-1/2:1		15"	12
				18"	17
				21"	23
2:1	1-1/2:1	2:1	1-1/2:1	15"	20
				18"	29
				21"	40
		1-1/2:1		15"	20
				18"	28
				21"	39
	1:1	2:1	1:1	15"	9
				18"	13
				21"	17
		1-1/2:1		15"	8
				18"	12
				21"	16
1-1/2:1	1:1	1-1/2:1	1:1	15"	11
				18"	16
				21"	21

▲ *Slopes are approximate and may be varied to suit conditions encountered during construction.*

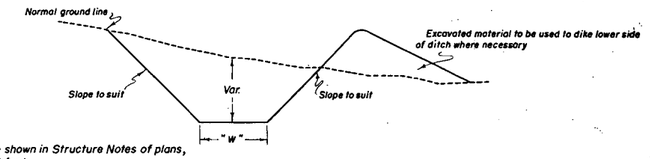
TYPICAL SECTIONS *for* DRAINAGE, IRRIGATION DITCHES *and* CHANNEL CHANGES

For Embankment Sections

(Generally for use in Irrigation Ditches & Channel Changes)



NOTE–
See Structure Notes in plans for dimension "W".
Dimension "X" = $\frac{W}{2}$ with minimum of 2 feet.



NOTE –
Unless otherwise shown in Structure Notes of plans, dimension "W" = 1 foot.

For Cut Sections

REVISIONS		
2-3-64	DEPT. NAME	M.R.H.

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Colorado State Highway Department applicable to the Project.

All ditches are to be constructed to lines and grades as staked by the Engineer using the ditch section shown on plans or as ordered by the Engineer.

CONTOUR INTERCEPTING DITCHES: *Ditches are to be laid out along the ground contour on a grade of not over 1% (Type of soil shall govern the grade).*

Ends of ditches are to be lined up so that concentration of flow from a higher contour ditch into one of lower contour is, as far as possible avoided. The use of a deeper ditch is recommended where this condition is encountered.

The following horizontal spacing of ditches is recommended:

4% to 6%	Approximately 70' Centers
8% to 10%	Approximately 60' Centers
20% to 4:1 Slope	Approximately 55' Centers
30% to 1-1/2:1 Slope	Approximately 50' Centers

Where ditch checks are required the intervening ditch between one set of ditch checks shall not exceed a grade of 1.0%. Details of checks will be shown on plans when required.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

DITCH TYPES

Designed by C.G.M.
Made by C.G.M.
Checked by

Approved by C. Hilton
Engineer of Surveys & Plans
Date: Apr. 17, 1962

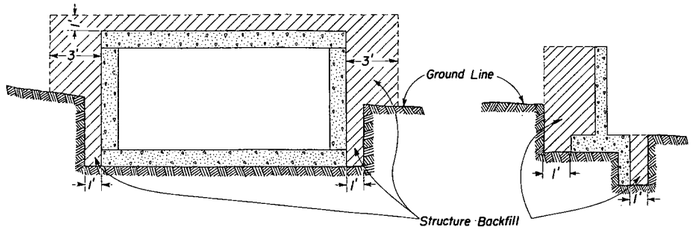
STANDARD M-16-A

(MAY 1, 1962)

FED. ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	[redacted]	[redacted]

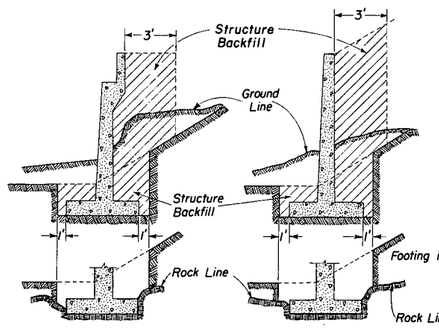
REVISION		
5-2-63	Rev. Backfill	L.E.O.
1-31-64	DEPT. NAME	M.R.H.

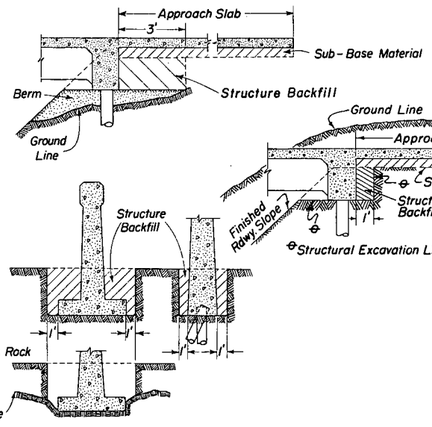
CONCRETE BOX CULVERTS & WINGWALLS



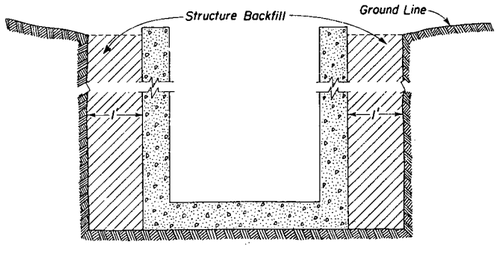
PIERS, ABUTMENTS, RETAINING WALLS ETC.

All material that is to be compacted shall be placed in horizontal layers not more than 6" inches in depth and compacted before the next layer is placed. For Arches, Rigid Frames and Box Culverts the fill shall be brought up uniformly on both sides of the center of structure to avoid stresses in the structure caused by unsymmetrical loading.

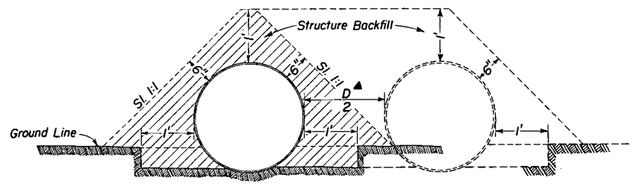




DROP INLETS, DIVISION BOXES, INTERCEPTING HEADWALLS ETC.



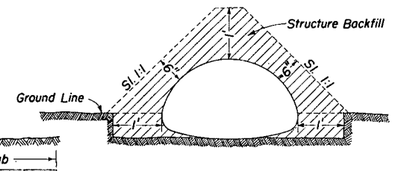
◆CIRCULAR CONDUIT



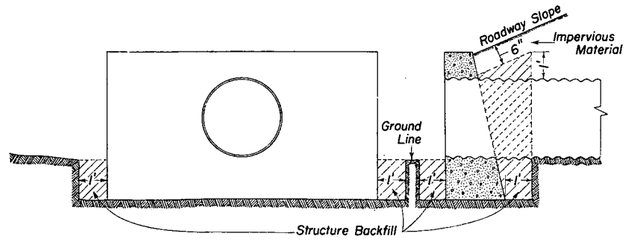
▲When two or more conduits are layed side by side, the distance between conduits shall be 1/2 the conduit diameter but not less than 1'-0".

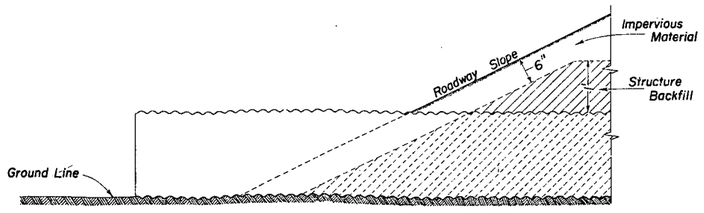
◆See Design Aid No. 16, 16a or 16b for computation of quantities.

◆ELLIPTICAL OR ARCH CONDUIT

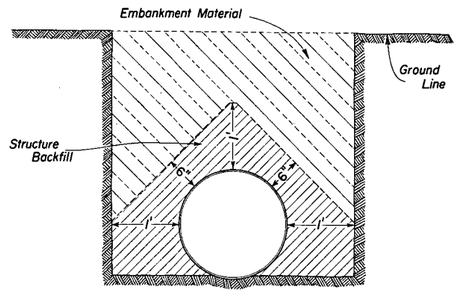


HEADWALLS AND END OF CULVERTS

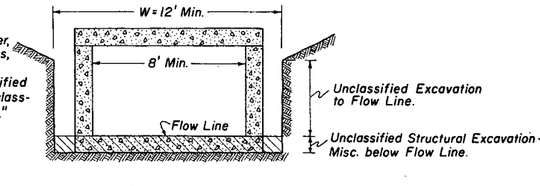




◆SIPHONS OR CONDUIT IN TRENCH



On all structures of 8' span or over, including extensions of old structures, excavation for structures shall be classified and paid for as "Unclassified Excavation" to Flow Line and "Unclassified Structural Excavation - Misc." below the Flow Line of box.



GENERAL NOTES

All work shall be done according to the Standard Specifications of the Colorado Department of Highways applicable to the Project.

If, in the opinion of the Engineer, the material beneath the Structure is of such character as to cause unequal settlement along the length of the Structure, the material shall be removed to such a depth ordered, and backfilled with gravel or Structure Backfill and compacted in accordance with Item 16 of the Standard Specifications.

For concrete box culverts located where roadway cross section is in Fill, embankment shall be built up and compacted to a point one (1) ft. above flow line of box. The trench shall then be excavated as shown to accommodate construction of the box.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

BACKFILL AROUND STRUCTURES

Designed by H.E.P.	Approved by L.D. Haverfield
Made by D.M.E.	Bridge Engineer
Checked by L.E.O.	Date: May 2, 1958

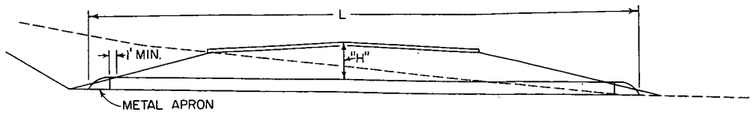
STANDARD M-45-A

(DEC. 1, 1963)

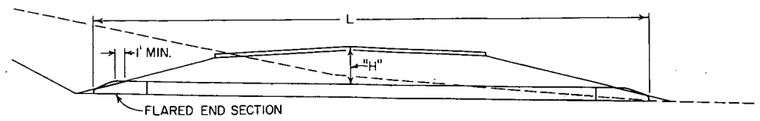
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		

REVISIONS		
2-3-64	DEPT. NAME	M.R.H.
3-12-64	BOLT OR RIVET DIMENSION	M.R.H.
4-29-64	DELETED FIELD SEAM	M.R.H.

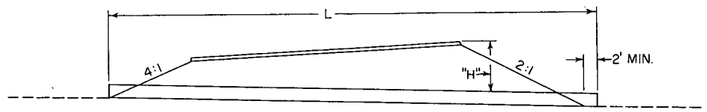
METAL CULVERT WITH END SECTIONS



CONCRETE CULVERT WITH END SECTIONS



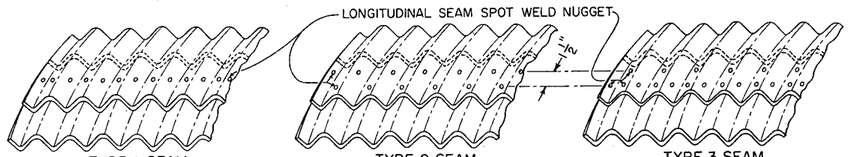
CULVERT WITHOUT END SECTIONS



H = Height of fill over top of Culvert.
L = Length of Culvert as shown on Structure List.
For Class of Concrete Pipe, see Standard M-52-A.
On Divided Highway Sections and Superelevated Sections the "H" dimension shall be the maximum depth of overfill including the pavement thickness over the top of the Culvert.

DETAILS OF SPOT WELDED LONGITUDINAL SEAM

1" X 3" CORRUGATIONS



TYPE 1 SEAM
TWO WELDS PER CORRUGATION
IN LINE

TYPE 2 SEAM
TWO WELDS PER CORRUGATION
IN STAGGERED LINE

TYPE 3 SEAM
THREE WELDS PER CORRUGATION

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Colorado Department of Highways applicable to the Project.

Structural excavation and structure backfill will be paid for on the basis of the actual type of pipe used on the Project.

End Sections shall be of the same material as the Culvert.

TABLE C
HEIGHT OF FILL AND GAGE FOR HELICALLY CORRUGATED STEEL PIPE

Diameter	Height of Cover (Feet)											
	1 to 10	10 to 13	14 to 16	17 to 20	21 to 23	24 to 26	27 to 30	31 to 33	34 to 40	41 to 46	47 to 53	54 to 66
Inches												
8	16	16	16	16	16	16	16	16	16	16	16	14
10	16	16	16	16	16	16	16	16	16	16	14	14
12	16	16	16	16	16	16	16	16	16	14	14	14
15	16	16	16	16	16	16	16	16	14	14	12	12
18	16	16	16	16	16	16	16	14	14	12	12	12
21	16	16	16	16	14	14	14	12	12	12	12	10
24	16	14	14	14	14	14	14	12	12	12	10	10
30	14	14	14	14	12	12	12	10	10	10	8	8
36	14	12	12	12	10	10	10	8	8	8	8	8
42	12	12	12	10	10	8	8	8	8	8	8	8
48	12	12	12	10	10	10	10	10	10	10	8	8
54	12	12	10	10	10	10	10	10	8	8	8	
60	10	10	10	10	10	10	10	8	8	8	8	
66	10	10	10	10	10	8	8	8	8	8		
72	10	10	10	8	8	8	8	8	8			
78	8	8	8	USE CORRUGATED METAL PIPE OR MULTIPLE PLATE CULVERT								
84	8	8										
90	8											
96	8											

TABLE A
HEIGHT OF FILL AND GAGE FOR CORRUGATED STEEL PIPE
(RIVETED OR SPOT WELDED)
$\frac{1}{2}$" X 2$\frac{2}{3}$" CORRUGATIONS

Diameter	Height of Cover (Feet)											
	1 to 15	16 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 60	61 to 70	71 to 80	81 to 100
Inches												
8	16	16	16	16	16	16	16	16	16	16	16	14
10	16	16	16	16	16	16	16	16	16	16	14	14
12	16	16	16	16	16	16	16	16	16	14	14	14
15	16	16	16	16	16	16	16	16	14	14	12	12
18	16	16	16	16	16	16	14	14	14	12	12	12
21	16	16	16	16	16	14	14	14	12	12	12	10
24	16	14	14	14	14	14	14	12	12	12	10	10
30	14	14	14	14	12	12	12	10	10	10	8	8
36	14	12	12	12	10	10	10	8	8	8	8	8
42	12	12	12	10	10	8	8	8	8	8	8	8
48	12	12	12	10	10	10	10	10	10	10	8	8
54	12	12	10	10	10	10	10	10	8	8	8	
60	10	10	10	10	10	10	10	8	8	8	8	
66	10	10	10	10	10	8	8	8	8	8		
72	10	10	10	8	8	8	8	8	8			
78	8	8	8	USE MULTIPLE PLATE CULVERTS								
84	8	8										
90	8											
96	8											

TABLE D
HEIGHT OF FILL AND GAGE FOR CORRUGATED ALUMINUM PIPE
$\frac{1}{2}$" X 2$\frac{2}{3}$" CORRUGATIONS

Diameter	Type of Shape	Minimum Cover	Maximum Fill Height (Feet) For Gages and Thicknesses (Inches)				
			16	14	12	10	8
Inches		Inches	0.060"	0.075"	0.105"	0.135"	0.164"
8	Full Circle	12	50				
10	Full Circle	12	40				
12	Full Circle	12	35	40	50		
15	Full Circle	12	32	35	40		
18	Full Circle	12	26	30	35		
21	Full Circle	12	21	25	30		
24	Full Circle	12	13	21	30		
30	Full Circle	15		19	25	30	
	5% Vertically Elongated	15		24	30	35	
36	Full Circle	18		10	18	25	30
	5% Vertically Elongated	18			21	30	35
42	Full Circle	21			16	20	25
	5% Vertically Elongated	21			20	25	30
	5% Field Strutted	21			30	35	40
48	Full Circle	24			15	20	25
	5% Vertically Elongated	24			18	25	30
	5% Field Strutted	24			30	35	40
54	Full Circle	24			15	20	25
	5% Vertically Elongated	24			18	22	30
	5% Field Strutted	24			25	30	35
60	Full Circle	24				14	18
	5% Vertically Elongated	24				17	25
	5% Field Strutted	24				25	30
66	Full Circle	24				13	17
	5% Vertically Elongated	24				15	20
	5% Field Strutted	24				25	30
72	Full Circle	24				12	15
	5% Field Strutted	24				20	25
78	5% Field Strutted	24				16	20

TABLE B
HEIGHT OF FILL AND GAGE FOR SPOT WELDED FABRICATED CORRUGATED STEEL PIPE
1" X 3" CORRUGATIONS

Diameter	Height of Cover (Feet)											
	1 to 10	11 to 15	16 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 60	61 to 70	71 to 80	81 to 100
Inches													
30	16	16	16	16	16	16	16	16	16	16	16	16	16
36	16	16	16	16	16	16	16	16	16	16	16	16	14
42	16	16	16	16	16	16	16	16	16	16	14	12	12
48	14	14	14	14	14	14	14	14	14	12	12	10	10
54	14	14	14	14	14	14	14	14	12	12	10	10	8
60	14	14	14	14	14	14	12	12	10	10	8	8	
66	12	12	12	12	12	12	10	10	8	8			
72	12	12	12	12	12	10	8	8					
78	12	12	12	10	10	8							
84	12	12	10	8	8								
90	12	10	8										
96	10	10	8										
102	10	8											
108	8	USE MULTIPLE PLATE CULVERTS											

① TYPE 1 SEAM
② TYPE 2 SEAM
③ TYPE 3 SEAM

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

CULVERT PIPE

H-20 LOADING

Designed by		Approved by C. E. Quinn
Made by	T.E.F.	Engineer, Surveys & Plans
Checked by		Date: Dec. 6, 1963

STANDARD M-46-C

(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	[redacted]	[redacted]

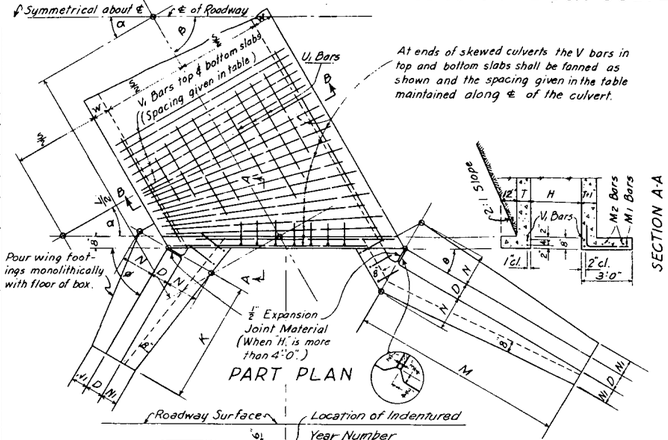
SINGLE CONCRETE BOX CULVERT

Dimensions & Quantities (see Wingwall Standard for Wings)

Height of Fill Allowed	Type	Span S	Height H	Slab T	Wall w	Bar size & spacing V_1 Size	V_1 Spa.	W_1 Size	W_1 Spa.	No. bars required U_1	M_1	Quantities For One Lin Ft of Box: Concrete Cu Yds.	Steel Lbs	Quantities For Two Headwalls: Concrete Cu Yds	Steel Lbs
35'-0"	2A	2'-0"	2'-0"	6"	8"	3/4ϕ	12"	1/2ϕ	12"	8	8	0.232	17.5	1.30	81
30'-0"	3A	3'-0"	2'-0"	7"	8"	5/8ϕ	12"	1/2ϕ	12"	10	Cos α	0.299	26.3	1.50	113
			3'-0"							12	Cos α	0.349	29.0	1.65	123
20'-0"	4A	4'-0"	2'-0"	7½"	8"	5/8ϕ	12"	1/2ϕ	12"	12	10	0.362	31.8	1.75	150
			3'-0"							14	Cos α	0.412	34.6	1.90	154
			4'-0"							16	Cos α	0.461	37.3	2.10	158
16'-0"	5A	5'-0"	3'-0"	8"	8"	5/8ϕ	8"	1/2ϕ	8"	16	12	0.481	45.3	2.20	153
			4'-0"							18	Cos α	0.530	48.7	2.40	157
			5'-0"							20	Cos α	0.579	52.0	2.60	161
20'-0"	5B	5'-0"	3'-0"	8½"	8"	3/4ϕ	8"	1/2ϕ	8"	16	12	0.500	47.5	2.20	153
			4'-0"							18	Cos α	0.549	48.8	2.40	157
			5'-0"							20	Cos α	0.598	52.2	2.60	161
			4'-0"							20		0.662	54.7	2.65	180
14'-0"	6A	6'-0"	5'-0"	8½"	8"	3/4ϕ	8"	1/2ϕ	8"	22	14	0.694	58.1	2.85	184
			6'-0"							24	Cos α	0.704	61.4	3.00	188
			7'-0"							26		0.753	64.9	3.30	192
			4'-0"							20		0.671	72.4	2.70	223
20'-0"	6B	6'-0"	5'-0"	10"	8"	7/8ϕ	8"	5/8ϕ	8"	22	14	0.720	76.9	2.90	228
			6'-0"							24	Cos α	0.771	81.4	3.10	234
			7'-0"							26		0.820	85.9	3.35	239
			4'-0"							22		0.720	68.2	3.05	208
12'-0"	7A	7'-0"	5'-0"	9"	9	3/4ϕ	7"	1/2ϕ	7"	24	16	0.776	77.9	3.25	218
			6'-0"							26	Cos α	0.832	75.5	3.40	216
			7'-0"							28		0.887	79.2	3.70	220
			4'-0"							22		0.772	81.0	3.05	257
15'-0"	7B	7'-0"	5'-0"	10"	9"	7/8ϕ	8"	5/8ϕ	8"	24	16	0.827	85.5	3.25	262
			6'-0"							26	Cos α	0.883	90.0	3.45	268
			7'-0"							28		0.938	94.5	3.75	273
			4'-0"							22		0.826	71.1	3.10	257
20'-0"	7C	7'-0"	5'-0"	11"	9"	7/8ϕ	7"	5/8ϕ	7"	24	16	0.881	96.0	3.30	263
			6'-0"							26	Cos α	0.937	101.0	3.50	268
			7'-0"							28		0.993	106.0	3.75	274
			4'-0"							24		0.844	75.8	3.45	235
10'-0"	8A	8'-0"	5'-0"	9½"	10"	3/4ϕ	7"	1/2ϕ	7"	26	18	0.905	79.5	3.60	239
			6'-0"							28	Cos α	0.966	83.2	3.80	245
			7'-0"							30	Cos α	1.027	86.8	4.10	247
			8'-0"							32		1.089	90.5	4.40	251
			4'-0"							24		0.963	100.9	3.50	292
			5'-0"							26	18	1.025	105.9	3.70	297
16'-0"	8B	8'-0"	6'-0"	11½"	10"	7/8ϕ	7"	5/8ϕ	7"	28	Cos α	1.086	110.8	3.90	303
			7'-0"							30	Cos α	1.148	115.8	4.20	308
			8'-0"							32		1.210	120.8	4.45	314
			4'-0"							24		1.023	115.8	3.65	292
			5'-0"							26	18	1.084	121.4	3.75	297
20'-0"	8C	8'-0"	6'-0"	12½"	10"	7/8ϕ	6"	5/8ϕ	6"	28	Cos α	1.146	126.9	3.95	304
			7'-0"							30		1.208	132.5	4.25	309
			8'-0"							32		1.270	138.1	4.50	315
			5'-0"							28		1.040	102.7	4.00	326
			6'-0"							30	20	1.108	107.7	4.20	331
7'-0"	9A	9'-0"	7'-0"	10"	11"	7/8ϕ	8"	5/8ϕ	8"	32		1.176	111.6	4.50	337
			8'-0"							34	Cos α	1.244	116.1	4.80	342
			9'-0"							36		1.311	120.7	5.15	348
			5'-0"							28		1.174	131.9	4.10	327
			6'-0"							30	20	1.242	137.5	4.30	333
14'-0"	9B	9'-0"	7'-0"	12"	11"	7/8ϕ	6"	5/8ϕ	6"	32		1.310	143.1	4.60	338
			8'-0"							34	Cos α	1.378	148.6	4.90	344
			9'-0"							36		1.445	154.2	5.25	349
			5'-0"							28		1.309	150.4	4.20	401
			6'-0"							30		1.377	156.9	4.40	408
			7'-0"							32	20	1.444	163.4	4.70	416
20'-0"	9C	9'-0"	8'-0"	14"	11"	1"ϕ	7"	3/4ϕ	7"	34	Cos α	1.513	170.0	5.00	423
			9'-0"							36		1.581	176.6	5.35	430
			6'-0"							32		1.260	107.7	4.60	355
			7'-0"							34	22	1.334	111.0	4.90	358
5'-0"	10A	10'-0"	8'-0"	10½"	12"	7/8ϕ	8"	1/2ϕ	8"	36	Cos α	1.408	114.4	5.20	363
			9'-0"							38		1.483	117.8	5.60	367
			10'-0"							40		1.558	121.1	5.95	371
			6'-0"							32		1.362	130.4	4.70	367
			7'-0"							34	22	1.443	139.4	5.00	372
10'-0"	10B	10'-0"	8'-0"	12"	12"	7/8ϕ	7"	5/8ϕ	7"	36	Cos α	1.517	140.4	5.30	378
			9'-0"							38	Cos α	1.591	145.3	5.65	383
			10'-0"							40		1.665	150.3	6.05	388
			6'-0"							32		1.362	150.7	4.80	443
			7'-0"							34	22	1.593	156.6	5.10	456
16'-0"	10C	10'-0"	8'-0"	14"	12"	1"ϕ	8"	3/4ϕ	8"	36	Cos α	1.666	162.5	5.40	464
			9'-0"							38		1.741	168.4	5.80	471
			10'-0"							40		1.815	174.3	6.15	478
			6'-0"							34		1.367	128.6	4.95	383
			7'-0"							36	24	1.441	132.2	5.25	387
5'-0"	11A	11'-0"	8'-0"	11"	12"	7/8ϕ	7"	1/2ϕ	7"	38	Cos α	1.515	135.9	5.55	391
			9'-0"							40		1.589	139.6	5.90	395
			10'-0"							42		1.664	143.1	6.25	399
			6'-0"							36		1.490	148.3	5.00	461
			7'-0"							38	24	1.564	152.8	5.30	472
9'-0"	11B	11'-0"	8'-0"	12½"	12"	1"ϕ	8"	5/8ϕ	8"	40	Cos α	1.638	157.3	5.65	478
			9'-0"							42		1.712	161.8	6.00	483
			10'-0"							44		1.783	166.4	6.35	489
			6'-0"							38		1.608	155.5	5.10	396
			7'-0"							36	24	1.682	165.1	5.40	401
13'-0"	11C	11'-0"	8'-0"	14"	12"	7/8ϕ	6"	5/8ϕ	6"	38	Cos α	1.756	170.7	5.70	407
			9'-0"							40	Cos α	1.830	176.2	6.10	412
			10'-0"							42		1.904	181.8	6.45	418
			6'-0"							36		1.525	174.5	5.25	411
			7'-0"							38	26	1.599	181.0	5.60	415
5'-0"	12A	12'-0"	8'-0"	12"	12"	7/8ϕ	7"	1/2ϕ	7"	40	Cos α	1.673	187.7	5.90	419
			9'-0"							42	Cos α	1.747	194.4	6.25	423
			10'-0"							44		1.821	1520	6.60	427
			6'-0"							36		1.697	177.7	5.40	502
			7'-0"							38	26	1.772	182.7	5.70	508
10'-0"	12B	12'-0"	8'-0"	14"	12"	1"ϕ	7"	5/8ϕ	7"	40	Cos α	1.846	187.7	6.00	513
			9'-0"							42		1.920	192.6	6.40	519
			10'-0"							44		1.994	197.6	6.70	524
			6'-0"							38		1.645	146.0	5.60	442
			7'-0"							40	28	1.720	149.7	5.90	446
4'-0"	13A	13'-0"	8'-0"	12½"	12"	7/8ϕ	7"	1/2ϕ	7"	42	Cos α	1.794	153.3	6.20	450
			9'-0"							44		1.868	157.0	6.55	454
			10'-0"							46		1.942	160.7	6.75	458
			6'-0"							38		1.787	188.4	5.70	538
			7'-0"							40	28	1.861	193.3	6.00	543
8'-0"	13B	13'-0"	8'-0"	14"	12"	1"ϕ	7"	5/8ϕ	7"	42	Cos α	1.935	198.3	6.30	549
			9'-0"							44		2.009	203.3	6.65	555
			10'-0"							46		2.083	208.2	7.05	560
			6'-0"							40		1.827	177.2	5.95	571
			7'-0"							42	30	1.901	181.7	6.25	577
4'-0"	14A	14'-0"	8'-0"	13½"	12"	1"ϕ	8"	5/8ϕ	8"	44	Cos α	1.975	186.2	6.55	582
			9'-0"							46	Cos α	2.049	190.7	6.95	588
			10'-0"							48		2.123	195.2	7.30	593
			6'-0"							40		1.975	199.5	6.25	572
			7'-0"							42	30	2.049	204.5	6.40	578
8'-0"	14B	14'-0"	8'-0"	15"	12"	1"ϕ	7"	5/8ϕ	7"	44	Cos α	2.123	209.4	6.70	583
			9'-0"							46	Cos α	2.198	214.4	7.05	589
			10'-0"							48		2.270	219.4	7.40	595

Quantities for one culvert shall be (quantity for one lin. ft. of box times L) plus (quantity for two Head Walls) plus (quantities for four wings).

Note: This design not to be used when height of fill exceeds the allowed amount tabulated.



Bar dimensions are to ℄ of bar unless marked "cl" (clear).

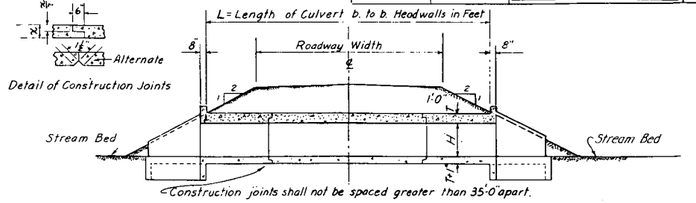
Bar List for Culvert & Headwalls (See Wingwall Standard for Wings)

Mark	Size	No. Req'd.	Type	Length
V_1	See table	10+ 24L/Spa.	I	S+2w-6"
W_1	See table	6+ 24L/Spa.	I	H+2T-5"
U_1	½ϕ	See table	I	L+1'-0"
M_1	½ϕ	See table	II	3'-6"
M_2	½ϕ	4	I	S+2w-6" / Cos α

(Bar dimensions are out to out of bar)

Possible Combinations (Span & Height)

2'-2'	5'-5'	9'-5'	10'-7'	11'-8' / 11'-10'
3'-2'	7'-4'	8'-6'	9'-8'	10'-9' / 14'-8'
4'-2'	6'-5'	7'-7'	12'-6'	13'-7' / 13'-9'
3'-3'	8'-4'	9'-6'	11'-7'	12'-8' / 12'-10'
4'-3'	7'-5'	8'-7'	13'-6'	14'-7' / 14'-9'
5'-3'	6'-6'	10'-6'	10'-8'	11'-9' / 13'-10'
4'-4'	8'-5'	9'-7'	9'-9'	10'-10' / 14'-10'
5'-4'	6'-7'	8'-8'	12'-7'	13'-8'
6'-4'	7'-6'	11'-6'	14'-6'	12'-9'



TYPICAL SECTION THROUGH CULVERT

Note: K, M, N, N₁ and D are dimensioned on Wingwall Standard for the various heights of culverts.

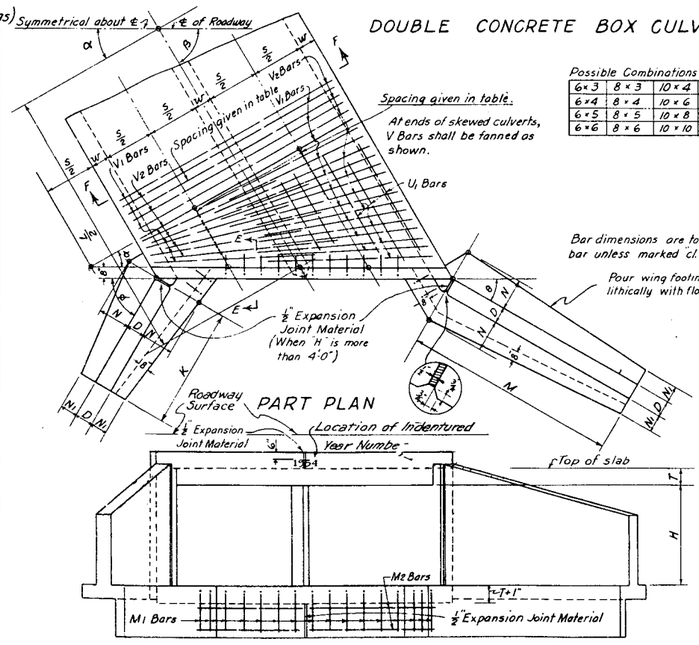
REVISIONS		
2-11-64	DEPT NAME	M.R.H

DOUBLE CONCRETE BOX CULVERT

Dimensions & Quantities (see Wingwall Standard for Wings)

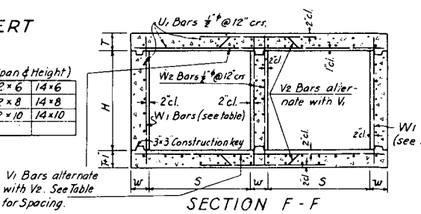
Height of fill allowed	Type	Span S	Height H	Slab T	Wall w	Bar Size & Spacing V_1	V_2	No. Bars Required U_1 Spac.	U_1	M_1	Quantities for One Lin. Ft. of Box: Concrete Cu Yds.	Steel Lbs.	Quantities for Two Headwalls: Concrete Cu Yds.	Steel Lbs.
10'-0"	6-6-A	6'-0"	3'-0"	8½"	8"	½ϕ 5" Spa.	5/8ϕ 5½ Spa.	12" 48	32		1.000	1123	3.85	327
			4'-0"					12" 52			1.073	1177	4.60	336
			5'-0"					12" 56	Cos α		1.148	1231	4.85	343
			6'-0"					12" 60			1.222	1285	5.05	351
15'-0	6-6-B	6'-0"	3'-0"	9½"	8"	½ϕ 5" Spa.	5/8ϕ 5½ Spa.	12" 48	32		1.085	1203	4.45	329
			4'-0"					12" 52			1.161	1257	4.65	337
			5'-0"					12" 56	Cos α		1.235	1311	4.90	346
			6'-0"					8" 60			1.309	1414	5.10	353
20'-0"	6-6-C	6'-0"	3'-0"	10½"	8"	½ϕ 4½ Spa.	5/8ϕ 5" Spa.	12" 48	32		1.173	1300	4.50	331
			4'-0"					12" 52			1.247	1354	4.75	339
			5'-0"					10" 54	Cos α		1.321	1425	4.95	347
			6'-0"					7" 60			1.395	1524	5.15	355
10'-0"	8-8-A	8'-0"	3'-0"	10"	10"	½ϕ 6" Spa.	5/8ϕ 5" Spa.	12" 60			1.477	1744	5.80	506
			4'-0"					12" 64	40		1.569	1798	6.05	514
			5'-0"					12" 68	Cos α		1.662	1852	6.30	522
			6'-0"					12" 72			1.755	1906	6.55	531
15'-0"	8-8-B	8'-0"	3'-0"	11"	10"	½ϕ 5½ Spa.	¾ϕ 4" Spa.	12" 60			1.592	1886	5.90	508
			4'-0"					12" 64	40		1.684	1920	6.15	516
			5'-0"					12" 68	Cos α		1.777	1974	6.40	524
			6'-0"					8" 72			1.869	2079	6.65	533
20'-0"	8-8-C	8'-0"	3'-0"	12½"	10"	½ϕ 5" Spa.	¾ϕ 4" Spa.	12" 60			1.763	2020	6.00	513
			4'-0"					12" 64	40		1.856	2074	6.30	521
			5'-0"					10" 68	Cos α		1.948	2146	6.55	529
			6'-0"					7" 72			2.041	2257	6.75	537
5'-0"	10-10-A	10'-0"	2'-0"	10"	12"	½ϕ 7" Spa.	⅝ϕ 5" Spa.	15" 78			1.935	2283	7.40	714
			6'-0"					15" 86	48		2.157	2398	7.95	733
			8'-0"					12" 94	Cos α		2.380	2552	8.70	752
			10'-0"					9" 102			2.602	2756	9.35	771
10'-0"	10-10-B	10'-0"	4'-0"	12"	12"	½ϕ 7" Spa.	⅝ϕ 5" Spa.	15" 78			2.220	2310	7.65	721
			6'-0"					15" 86	48		2.442	2425	8.20	740
			8'-0"					12" 94	Cos α		2.664	2580	8.90	759
			10'-0"					8" 102			2.886	2820	9.75	778
15'-0"	10-10-C	10'-0"	4'-0"	14"	12"	½ϕ 6" Spa.	⅝ϕ 5" Spa.	15" 78			2.503	2660	7.85	746
			6'-0"					15" 86	48		2.725	2756	8.40	746
			8'-0"					9" 94	Cos α		2.947	2950	9.15	765
			10'-0"					6" 102			3.170	3255	10.00	784
5'-0"	12-12-A	12'-0"	4'-0"	12"	12"	½ϕ 7" Spa.	⅝ϕ 5" Spa.	15" 88	56		2.751	2782	9.35	851
			6'-0"					12" 100	Cos α		2.973	2945	10.05	876
			8'-0"					9" 114			3.195	3150	10.90	895
			10'-0"					6" 128			3.418	3355	11.75	914
10'-0"	12-12-B	12'-0"	6'-0"	14"	12"	½ϕ 6" Spa.	⅝ϕ 5" Spa.	15" 88	56		3.083	3135	9.60	864
			8'-0"					12" 100	Cos α		3.305	3298	10.30	883
			10'-0"					8" 114			3.528	3541	11.15	902
15'-0"	12-12-C	12'-0"	6'-0"	16"	12"	½ϕ 5" Spa.	⅝ϕ 5" Spa.	15" 88	56		3.416	3651	9.85	870
			8'-0"					9" 106	Cos α		3.638	3847	10.55	889
			10'-0"					6" 114			3.860	4157	11.40	908
5'-0"	14-14-A	14'-0"	6'-0"	15"	12"	½ϕ 6" Spa.	⅝ϕ 5" Spa.	15" 100	64		3.633	3962	10.25	984
			8'-0"					12" 118	Cos α		3.855	4170	11.60	1003
			10'-0"					9" 126			4.077	4392	12.50	1023
10'-0"	14-14-B	14'-0"	6'-0"	16"	12"	½ϕ 5" Spa.	⅝ϕ 5" Spa.	15" 110	64		3.824	4094	11.05	988
			8'-0"					12" 118	Cos α		4.046	4352	11.75	1007
			10'-0"					8" 126			4.269	4505	12.65	1026

Quantities for one culvert shall be (quantity for one lin. ft. of box times L) plus (quantity for two head walls) plus (quantities for four wings).



Possible Combinations (Span & Height)

6'×3'	8'×3'	10'×4'	12'×6'	14'×6'
6'×4'	8'×4'	10'×6'	12'×8'	14'×8'
6'×5'	8'×5'	10'×8'	12'×10'	14'×10'
6'×6'	8'×6'	10'×10'		

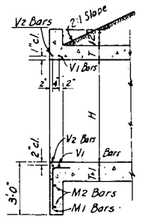


Bar List for Culvert and Two Headwalls (See Wingwall Std. for Wings)

Mark	Size	Number Required	Type	L	Total Length
V_1	See Table	24(L+2) Spacing	I	S+15w+4"	L
V_2			II	0.75S+4"	2L+m
W_1			I	H+2T-4"	L
W_2			I	H+2T-4"	L
U_1		See Table	I	L+12"	L
M_1		See Table	III		3'-6"
M_2		8	I	S-1.5w / Cos α	L

(Bar dimensions are out to out of bar.)

For General Notes, Loading and Design Data, see Wingwall Std.



DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
SINGLE AND DOUBLE CONCRETE BOX CULVERTS
(FOR SIZES SEE TABLE OF POSSIBLE COMBINATIONS)

Designed by: W.W.D. Made by: W.W.D. Checked by: T.J.M.
Approved by: [signature] Bridge Engineer
Date: Aug. 30, 1954

STANDARD M-46-E

(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	[redacted]	[redacted]

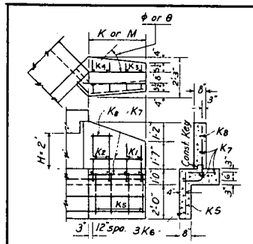
2-11-64 Rev. Dept. Name M.R.H.

TABLE SHOWING VALUES OF K AND M WHEN "B" AND "H" ARE GIVEN

β	α	φ	θ	H=2'0" K	H=2'0" M	H=3'0" K	H=3'0" M	H=4'0" K	H=4'0" M	H=5'0" K	H=5'0" M	H=6'0" K	H=6'0" M	H=7'0" K	H=7'0" M	H=8'0" K	H=8'0" M	H=9'0" K	H=9'0" M	H=10'0" K	H=10'0" M
45°	45°	67°30	22°30	2'-4"	6'-2"	3'-7"	8'-7"	4'-10"	11'-7"	5'-11"	14'-2"	6'-10"	16'-5"	7'-9"	18'-8"	8'-8"	20'-10"	9'-8"	23'-2"	10'-7"	25'-5"
60°	30°	60°	30°	2'-9"	6'-9"	3'-10"	9'-5"	5'-2"	12'-7"	6'-3"	15'-5"	7'-3"	18'-3"	8'-3"	21'-1"	9'-3"	23'-11"	10'-3"	26'-8"	11'-3"	29'-6"
75°	15°	52°30	37°30	3'-0"	7'-3"	4'-2"	10'-4"	5'-5"	13'-6"	6'-7"	16'-8"	7'-10"	19'-10"	8'-11"	23'-0"	10'-1"	26'-1"	11'-2"	29'-3"	12'-3"	32'-5"
90°	0°	45°	45°	3'-4"	8'-1"	4'-8"	11'-6"	6'-3"	15'-2"	7'-8"	18'-11"	9'-1"	22'-4"	10'-2"	25'-9"	11'-4"	29'-2"	12'-7"	32'-7"	13'-9"	36'-0"
105°	15°	37°30	52°30	3'-11"	9'-0"	5'-5"	14'-2"	7'-3"	19'-4"	8'-11"	24'-6"	10'-8"	29'-8"	12'-5"	34'-10"	14'-2"	40'-0"	15'-11"	45'-2"	17'-8"	50'-4"
120°	30°	30°	60°	4'-9"	10'-3"	6'-7"	16'-0"	8'-10"	21'-8"	11'-1"	27'-4"	13'-4"	33'-0"	15'-7"	38'-8"	17'-10"	44'-4"	20'-1"	50'-0"	22'-4"	55'-8"
135°	45°	22°30	67°30	6'-2"	12'-4"	9'-3"	18'-6"	12'-4"	24'-8"	15'-5"	30'-10"	18'-6"	37'-0"	21'-7"	43'-2"	24'-8"	49'-4"	27'-9"	55'-6"	30'-10"	61'-8"

β EQUALS THE ANGLE BETWEEN ℄ OF CULVERT AND ℄ OF ROADWAY. α EQUALS THE ANGLE BETWEEN ℄ OF CULVERT AND A NORMAL TO ℄ OF ROADWAY. φ AND θ ARE ANGLES BETWEEN THE WINGWALL AND A LINE PARALLEL WITH THE CENTER LINE OF ROADWAY.

EXAMPLE FOR USING THE ABOVE TABLE. SUPPOSE A STREAM MAKES AN ANGLE OF β=65° WITH THE CENTER LINE OF ROADWAY, THEN, FROM THE TABLE, SELECT THE NEAREST ANGLE β = 60°, THEN α, φ AND θ EQUAL 30°, 60° AND 30° RESPECTIVELY. IF THE DESIRED HEIGHT "H" OF CULVERT IS 8'-0", THEN "K" AND "M" WILL BE 9'-3" AND 16'-0". LOCATE THE WING DETAIL WHEN H = 8'-0" ON THIS SHEET.



	l	m	length
K1	1'-9"	3"	2'-8"
K2	2'-5"	6"	3'-7"

Type I

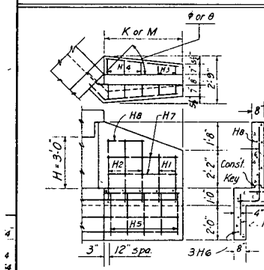
K3 = 1'-2"
K4 = 1'-5"
K5 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 2'-0"

When φ or θ equals	Number of bars required K1 Type I	K2 Type I	K3 Type I	K4 Type II	K5 Type II	Length of Bars 3-K6 Type II	3-K7 Type II	1-K8 Type II	Quantities For One Wing Concrete Cu Yds	Steel Lbs.
22°30	4	3	4	3	8	8'-3"	5'-10"	2'-2"	1.07	64
30°	3	2	3	2	6	6'-2"	4'-5"	1'-2"	0.82	47
37°30	2	2	2	2	6	5'-0"	3'-7"	1'-2"	0.68	40
45°	2	2	2	2	5	4'-4"	3'-0"	1'-2"	0.57	36
52°30	2	2	2	2	4	4'-0"	2'-8"	1'-2"	0.52	33
60°	2	1	2	1	4	3'-6"	2'-5"	1'-0"	0.48	28
67°30	2	1	2	1	4	3'-0"	2'-0"	1'-0"	0.40	26

WING DETAIL WHEN H = 2'-0"



	l	m	length
H1	2'-5"	5"	3'-6"
H2	3'-2"	8"	4'-6"

Type I

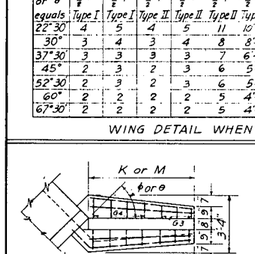
H3 = 1'-5"
H4 = 1'-7"
H5 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 3'-0"

When φ or θ equals	Number of Bars Required H1 Type I	H2 Type I	H3 Type II	H4 Type II	H5 Type II	Length of Bars 3-H6 Type II	4-H7 Type II	1-H8 Type II	Quantities for One Wing Concrete Cu Yds.	Steel lbs.
22°30	4	5	4	5	11	10'-10"	8'-3"	4'-2"	1.78	99
30°	3	4	3	4	8	8'-4"	6'-3"	3'-2"	1.36	76
37°30	3	3	3	3	7	6'-8"	5'-1"	2'-2"	1.12	63
45°	2	3	2	3	6	5'-10"	4'-4"	2'-2"	0.97	54
52°30	2	3	2	3	6	5'-4"	3'-10"	2'-2"	0.86	52
60°	2	2	2	2	5	4'-10"	3'-6"	1'-2"	0.79	44
67°30	2	2	2	2	5	4'-8"	3'-3"	1'-2"	0.74	43

WING DETAIL WHEN H = 3'-0"



	l	m	length
G1	3'-1"	6"	4'-3"
G2	4'-4"	10"	5'-10"

Type I

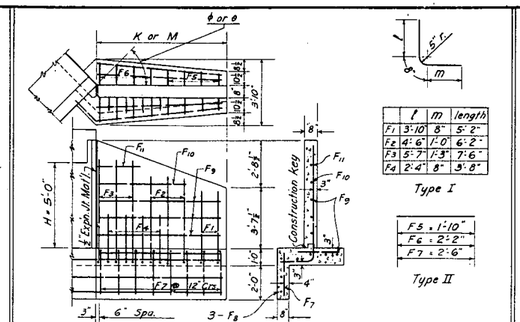
G3 = 1'-7"
G4 = 1'-11"
G5 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 4'-0"

When φ or θ equals	Number of Bars Required G1 Type I	G2 Type I	G3 Type II	G4 Type II	G5 Type II	Length of Bars 3-G6 Type II	7-G7 Type II	1-G8 Type II	Quantities for One Wing Concrete Cu Yds	Steel Lbs
22°30	6	6	6	6	14	14'-3"	11'-3"	5'-2"	2.89	164
30°	4	5	4	5	11	10'-9"	8'-6"	4'-2"	2.21	125
37°30	3	4	3	4	9	8'-9"	6'-11"	3'-2"	1.81	101
45°	3	4	3	4	8	7'-8"	5'-11"	3'-2"	1.56	92
52°30	3	3	3	3	7	6'-9"	5'-3"	2'-2"	1.40	79
60°	3	3	3	3	7	6'-4"	4'-10"	2'-2"	1.29	77
67°30	2	3	2	3	6	6'-0"	4'-6"	2'-2"	1.21	69

WING DETAIL WHEN H = 4'-0"



	l	m	length
F1	3'-10"	8"	5'-2"
F2	4'-6"	1'-0"	6'-2"
F3	5'-7"	1'-3"	7'-6"
F4	2'-4"	8"	3'-8"

Type I

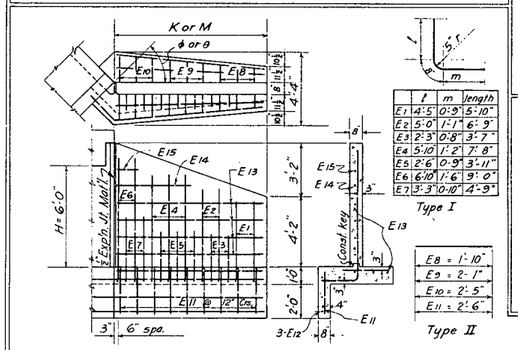
F5 = 1'-10"
F6 = 2'-2"
F7 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 5'-0"

When φ or θ equals	Number of bars required F1 Type I	F2 Type I	F3 Type II	F4 Type I	F5 Type II	F6 Type II	F7 Type II	Length of Bars 3-F8 Type II	7-F9 Type II	1-F10 Type II	1-F11 Type II	Quantities One Wing Concrete Cu Yds	Steel Lbs.
22°30	5	5	5	6	7	8	17	17'-3"	13'-10"	9'-2"	4'-2"	4.06	237
30°	3	4	4	5	5	6	13	13'-3"	10'-6"	7'-2"	3'-2"	3.10	180
37°30	3	3	3	4	4	5	11	11'-0"	8'-7"	5'-2"	2'-2"	2.55	147
45°	2	3	3	4	4	4	9	9'-6"	7'-4"	5'-2"	2'-2"	2.20	130
52°30	2	2	3	3	3	4	8	8'-6"	6'-6"	4'-2"	2'-2"	1.95	113
60°	2	2	3	3	3	4	8	7'-9"	5'-11"	4'-2"	2'-2"	1.79	109
67°30	2	2	2	3	3	3	7	7'-3"	5'-7"	3'-2"	1'-2"	1.69	97

WING DETAIL WHEN H = 5'-0"



	l	m	length
E1	4'-5"	0'-9"	5'-10"
E2	5'-0"	1'-1"	6'-9"
E3	2'-3"	0'-8"	3'-7"
E4	5'-10"	1'-2"	7'-8"
E5	2'-6"	0'-9"	3'-11"
E6	6'-10"	1'-6"	9'-0"
E7	3'-3"	0'-10"	4'-5"

Type I

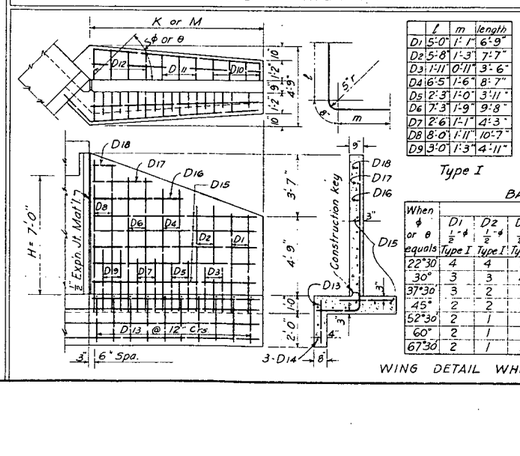
E8 = 1'-10"
E9 = 2'-1"
E10 = 2'-5"
E11 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 6'-0"

When φ or θ equals	Number of Bars Required E1 Type I	E2 Type I	E3 Type II	E4 Type I	E5 Type II	E6 Type II	E7 Type II	E8 Type II	E9 Type II	E10 Type II	E11 Type II	Length of Bars 3-E12 Type II	8-E13 Type II	1-E14 Type II	1-E15 Type II	Quantities for One Wing Concrete Cu Yds	Steel Lbs
22°30	4	4	4	5	4	4	5	6	6	20	19'-9"	16'-1"	8'-2"	3'-2"	5.21	317
30°	3	3	3	4	4	3	5	4	4	15	15'-0"	12'-3"	6'-2"	2'-2"	3.99	243
37°30	2	3	3	3	3	3	4	4	4	13	12'-6"	10'-0"	5'-2"	2'-2"	3.28	203
45°	2	2	2	3	3	2	3	3	3	11	10'-9"	8'-7"	4'-2"	1'-2"	2.83	171
52°30	1	2	2	3	3	2	2	3	3	10	9'-8"	7'-7"	4'-2"	1'-2"	2.51	156
60°	2	2	2	2	2	2	2	3	3	9	8'-9"	6'-11"	3'-2"	1'-2"	2.30	145
67°30	1	2	2	2	2	2	2	3	2	8	8'-3"	6'-6"	3'-2"	1'-2"	2.17	134

WING DETAIL WHEN H = 6'-0"



	l	m	length
D1	5'-0"	1'-1"	6'-9"
D2	5'-8"	1'-3"	7'-7"
D3	1'-11"	0'-11"	3'-6"
D4	6'-5"	1'-6"	8'-7"
D5	2'-3"	1'-0"	3'-11"
D6	7'-3"	1'-9"	9'-8"
D7	2'-6"	1'-7"	4'-3"
D8	8'-0"	1'-11"	10'-7"
D9	3'-0"	1'-3"	4'-11"

Type I

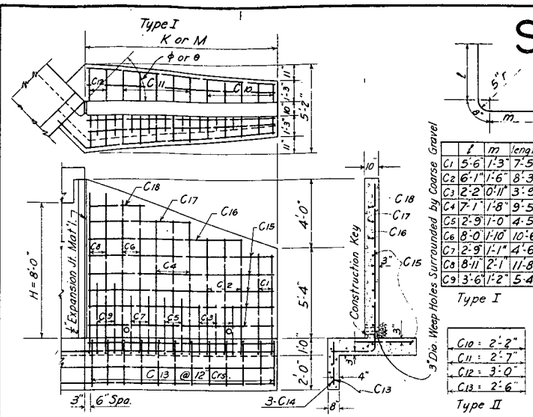
D10 = 2'-0"
D11 = 2'-3"
D12 = 2'-7"
D13 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 7'-0"

When φ or θ equals	Number of Bars Required D1 Type I	D2 Type I	D3 Type II	D4 Type I	D5 Type II	D6 Type II	D7 Type II	D8 Type II	D9 Type II	D10 Type II	D11 Type II	D12 Type II	D13 Type II	Length of Bars 3-D14 Type II	10-D15 Type II	1-D16 Type II	1-D17 Type II	1-D18 Type II	Quantities for One Wing Concrete Cu Yds	Steel Lbs.
22°30	4	4	5	4	4	4	3	3	3	6	6	7	22	22'-3"	18'-4"	10'-2"	6'-2"	2'-2"	7.01	436
30°	3	3	4	4	3	3	3	2	2	5	5	5	18	17'-6"	14'-1"	8'-2"	4'-2"	1'-2"	5.42	339
37°30	3	2	2	3	3	2	2	2	2	4	4	4	14	14'-0"	11'-5"	6'-2"	3'-2"	1'-2"	4.41	267
45°	2	2	2	2	2	2	2	2	2	4	3	4	12	12'-3"	9'-10"	5'-2"	3'-2"	1'-2"	3.82	238
52°30	2	1	2	2	2	2	2	1	1	3	3	3	11	10'-9"	8'-8"	5'-2"	3'-2"	1'-2"	3.38	212
60°	2	1	2	2	2	2	2	1	1	3	3	3	10	10'-0"	7'-11"	4'-2"	2'-2"	1'-2"	3.10	191
67°30	2	1	2	2	2	2	2	1	1	2	3	3	9	9'-6"	7'-5"	4'-2"	2'-2"	1'-2"	2.91	184

WING DETAIL WHEN H = 7'-0"



	l	m	length
C1	5'-6"	1'-3"	7'-5"
C2	6'-1"	1'-6"	8'-3"
C3	2'-2"	0'-11"	3'-1"
C4	7'-1"	1'-8"	9'-5"
C5	2'-9"	1'-0"	4'-5"
C6	8'-0"	1'-10"	10'-6"
C7	2'-9"	1'-1"	4'-6"
C8	8'-11"	2'-1"	11'-8"
C9	3'-6"	1'-2"	5'-4"

Type I

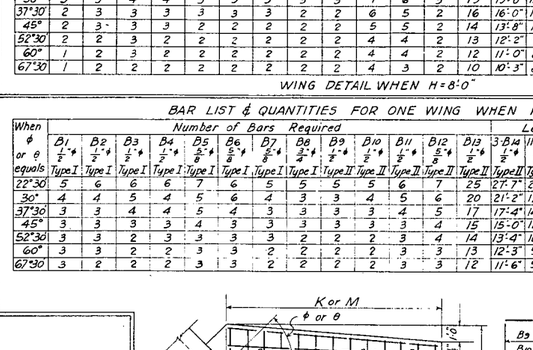
C10 = 2'-2"
C11 = 2'-7"
C12 = 3'-0"
C13 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 8'-0"

When φ or θ equals	Number of bars required C1 Type I	C2 Type I	C3 Type II	C4 Type I	C5 Type II	C6 Type II	C7 Type II	C8 Type II	C9 Type II	C10 Type II	C11 Type II	C12 Type II	C13 Type II	Length of Bars 3-C14 Type II	10-C15 Type II	1-C16 Type II	1-C17 Type II	1-C18 Type II	Quantities for One Wing Concrete Cu Yds	Steel Lbs.
22°30	4	4	5	5	4	4	4	4	4	9	9	3	25	24'-8"	20'-6"	16'-2"	12'-2"	7'-2"	9.00	526
30°	3	3	4	4	3	3	3	3	3	7	6	3	19	19'-0"	15'-8"	12'-2"	9'-2"	5'-2"	6.91	402
37°30	2	3	3	3	3	3	3	2	2	6	5	2	16	16'-0"	12'-10"	10'-2"	7'-2"	4'-2"	5.69	330
45°	2	3	3	3	2	2	2	2	2	5	5	2	14	13'-8"	11'-0"	9'-2"	6'-2"	3'-2"	4.89	287
52°30	2	2	3	2	2	2	2	2	2	4	4	2	13	12'-2"	9'-9"	7'-2"	5'-2"	3'-2"	4.35	257
60°	1	2	3	2	2	2	2	2	2	4	4	2	12	11'-0"	8'-11"	7'-2"	5'-2"	3'-2"	3.99	242
67°30	1	2	2	2	2	2	2	2	2	4	3	2	10	10'-3"	8'-4"	6'-9"	4'-6"	2'-4"	3.74	228

WING DETAIL WHEN H = 8'-0"



	l	m	length
A1	6'-9"	1'-3"	9'-0"
A2	2'-5"	1'-1"	4'-2"
A3	7'-9"	1'-10"	10'-3"
A4	3'-4"	1'-2"	5'-2"
A5	8'-10"	2'-1"	11'-7"
A6	3'-8"	1'-3"	5'-1"
A7	10'-3"	2'-4"	13'-3"
A8	5'-4"	1'-4"	7'-4"

Type I

A9 = 2'-4"
A10 = 2'-8"
A11 = 2'-11"
A12 = 3'-4"
A13 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 9'-0"

When φ or θ equals	Number of Bars Required B1 Type I	B2 Type I	B3 Type I	B4 Type I	B5 Type II	B6 Type II	B7 Type II	B8 Type II	B9 Type II	B10 Type II	B11 Type II	B12 Type II	B13 Type II	Length of Bars 3-B14 Type II	11-B15 Type II	1-B16 Type II	1-B17 Type II	1-B18 Type II	Quantities for One Wing Concrete Cu Yds	Steel Lbs.
22°30	5	6	6	6	7	6	5	5	5	5	6	7	25	27'-7"	22'-10"	17'-2"	11'-2"	4'-2"	11.56	666
30°	4	4	5	4	5	6	4	3	3	4	5	6	20	21'-2"	17'-5"	13'-2"	8'-2"	3'-2"	8.86	510
37°30	3	3	4	4	5	4	3	3	3	3	4	5	17	17'-4"	14'-3"	11'-2"	7'-2"	2'-2"	7.27	427
45°	3	3	3	3	4	3	3	3	3	3	3	4	15	15'-0"	12'-3"	9'-2"	6'-2"	2'-2"	6.28	370
52°30	3	3	2	3	3	3	3	2	2	2	3	4	14	13'-4"	10'-10"	7'-2"	5'-2"	2'-2"	5.57	322
60°	3	3	2	2	3	3	2	2	2	2	3	3	13	12'-3"	9'-11"	6'-2"	4'-2"	1'-2"	5.11	294
67°30	3	2	2	2	3	3	2	2	2	2	3	3	12	11'-6"	9'-4"	6'-2"	4'-2"	1'-2"	4.82	279

	l	m	length
B1	6'-1"	1'-5"	8'-2"
B2	2'-4"	0'-11"	3'-11"
B3	7'-2"	1'-8"	9'-6"
B4	2'-9"	1'-1"	4'-6"
B5	8'-3"	2'-0"	10'-11"
B6	3'-2"	1'-3"	5'-1"
B7	9'-8"	2'-4"	12'-8"
B8	4'-2"	1'-5"	6'-3"

Type I

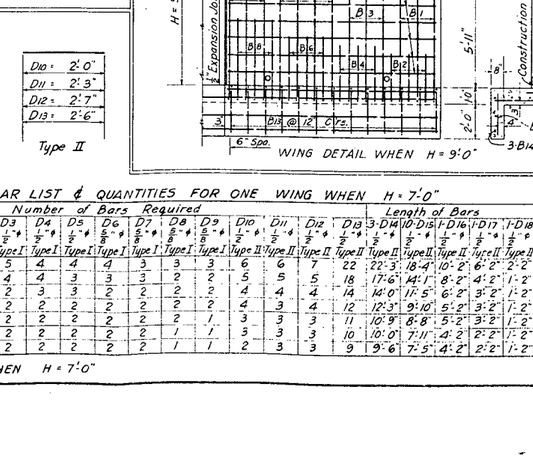
B9 = 2'-2"
B10 = 2'-5"
B11 = 2'-8"
B12 = 3'-2"
B13 = 2'-6"

Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 10'-0"

When φ or θ equals	Number of bars required A1 Type I	A2 Type I	A3 Type I	A4 Type I	A5 Type II	A6 Type II	A7 Type II	A8 Type II	A9 Type II	A10 Type II	A11 Type II	A12 Type II	A13 Type II	Length of Bars 3-A14 Type II	11-A15 Type II	1-A16 Type II	1-A17 Type II	2-A18 Type II	Quantities for One Wing Concrete Cu Yds	Steel Lbs.
22°30	6	6	5	5	8	8	7	6	8	7	5	6	30	30'-0"	25'-1"	19'-2"	14'-2"	6'-2"	14.35	830
30°	5	4	4	4	6	6	5	6	6	4	4	4	23	23'-0"	19'-2"	14'-2"	10'-2"	5'-2"	11.01	636
37°30	3	4	4	4	5	5	4	4	4	4	4	4	19	19'-0"	15'-8"	12'-2"	8'-2"	4'-2"	9.03	523
45°	3	3	3	3	4	4	4	3	4	4	3	3	16	16'-3"	13'-5"	10'-2"	7'-2"	3'-2"	7.76	440
52°30	3	3	2	3	3	3	3	3	4	3	3	3	14	14'-9"	11'-11"	8'-2"	6'-2"	3'-2"	6.92	394
60°	2	2	3	3	3	3	3	3	3	3	3	3	13	13'-6"	10'-7"	8'-2"	5'-2"	2'-2"	6.35	363
67°30	2	2	3	2	3	3	3	3	3	3	3	2	12	12'-10"	10'-3"	8'-2"	5'-2"	2'-2"	5.97	348

WING DETAIL WHEN H = 10'-0"



Type II

BAR LIST & QUANTITIES FOR ONE WING WHEN H = 9'-0"

When φ or θ equals	Number of Bars Required B1 Type I	B2 Type I	B3 Type II	B4 Type I	B5 Type II	B6 Type II	B7 Type II	B8 Type II	B9 Type II	B10 Type II	B11 Type II	B12 Type II	B13 Type II	Length of Bars 3-B14 Type II	11-B15 Type II	1-B16 Type II	1-B17 Type II	1-B18 Type II	Quantities for One Wing Concrete Cu Yds	Steel Lbs.
22°30	5	6	6	6	7	6	5	5	5	5	6	7	25	27'-7"	22'-10"	17'-2"	11'-2"	4'-2"	11.56	666
30°	4	4	5	4	5	6	4	3	3	4	5	6	20	21'-2"	17'-5"	13'-2"	8'-2"	3'-2"	8.86	510
37°30	3	3	4	4	5	4	3	3	3	3	4	5	17	17'-4"	14'-3"	11'-2"	7'-2"	2'-2"	7.27	427
45°	3	3	3	3	4	3	3	3	3	3	3	4	15	15'-0"	12'-3"	9'-2"	6'-2"	2'-2"	6.28	370
52°30	3	3	2	3	3	3	3	2	2	2	3	4	14	13'-4"	10'-10"	7'-2"	5'-2"	2'-2"	5.57	322
60°	3	3	2	2	3	3	2	2	2	2	3	3	13	12'-3"	9'-11"	6'-2"	4'-2"	1'-2"	5.11	294
67°30	3	2	2	2	3	3	2	2	2	2	3	3	12	11'-6"	9'-4"	6'-2"	4'-2"	1'-2"	4.82	279

	l	m	length
B1	6'-1"	1'-5"	8'-2"
B2	2'-4"	0'-11"	3'-11"
B3	7'-2"	1'-8"	9'-6"
B4	2'-9"	1'-1"	4'-6"
B5	8'-3"	2'-0"	10'-11"
B6	3'-2"	1'-3"	5'-1"
B7	9'-8"	2'-4"	12'-8"
B8	4'-2"	1'-5"	6'-3"

Type I

B9 = 2'-2"
B10 = 2'-5"
B11 = 2'-8"
B12 = 3'-2"
B13 = 2'-6"

Type II

GENERAL NOTES

ALL WORK SHALL BE DONE ACCORDING TO THE STANDARD SPECIFICATIONS OF THE COLORADO DEPARTMENT OF HIGHWAYS APPLICABLE TO THE PROJECT.

ALL CONCRETE SHALL BE CLASS "A"

ALL WING SURFACES TO RECEIVE ORDINARY SURFACE FINISH.

WING FOOTINGS AND FLOOR OF BOX SHALL BE POURED MONOLITHICALLY.

FOOTINGS IN ROCK SHALL BE POURED OUT TO ROCK AND NOT FORMED.
SOUNDINGS AND DEPTH OF FOOTING SHOWN ARE IN ACCORDANCE WITH THE BEST AVAILABLE DATA, AND WHEN DIFFERENT CONDITIONS ARE ENCOUNTERED THE BRIDGE ENGINEER WILL INSPECT AND DETERMINE IF REDESIGN IS NECESSARY.

ALL REINFORCING STEEL SHALL BE INTERMEDIATE GRADE STEEL OF A DEFORMED TYPE. EACH BAR SHALL BE TAGGED WITH THE NUMBER DESIGNATION AND THE STATION NUMBER OF THE PROJECT.
17 DIAMETERS OF THE BAR DIMENSIONS FOR REINFORCING STEEL NOT SHOWN AS CLEAR SHALL BE TO THE CENTER LINE OF THE BAR. OUT TO OUT DIMENSIONS SHALL BE USED ON BAR BENDING DETAILS.
SUPPORTING SOILS FOR ALL CULVERTS MUST BE COMPOSED OF FIRM AND UNIFORM MATERIAL THROUGHOUT.
HORIZONTAL CONSTRUCTION KEYS ARE NOT REQUIRED WHEN FOOTINGS AND WALL ARE POURED MONOLITHICALLY.
ALL CONSTRUCTION KEYS SHOWN BETWEEN FOOTINGS AND WALLS ARE 3" X 3".

WHEN EXCAVATING FOR FOOTINGS THE FINAL ONE FOOT IN DEPTH SHALL BE DONE BY HAND, LABOR METHODS.

STEEL WEIGHTS INCLUDE 1% ± FOR OVERRUN.
EXPANSION JOINT MATERIAL IS TO BE INCLUDED IN THE PRICE OF CLASS "A" CONCRETE AND SHALL CONFORM TO AASHO SPECIFICATION M-153-52 TYPE III.
FOR CULVERTS REQUIRED AND GOVERNING DIMENSIONS SEE "LIST OF STRUCTURES".

LOADING DATA INTERSTATE ALTERNATE

LIVE LOAD : A.A.S.H.O. (H20-S16-44)
DEAD LOAD: CONCRETE 150 POUNDS PER CUBIC FOOT.
EARTH 84 POUNDS PER CUBIC FOOT.

DESIGNING DATA

A.A.S.H.O. 1953 UNIT STRESSES, EXCEPT AS NOTED

Reinforcing Steel	fs	20000 lbs. per sq. in.
Structural Steel	fs	18000 lbs. per sq. in.
	fc	1200 lbs. per sq. in.
	n	10

DEPARTMENT OF HIGHWAYS STATE OF COLORADO

WINGWALLS FOR

CONCRETE BOX CULVERTS

Designed by: W.W.D.	Approved by: L. L. Greenbaum
Made by W.W.D.	Bridge Engineer
Checked by T.J.M.	Date: Aug. 30, 1954

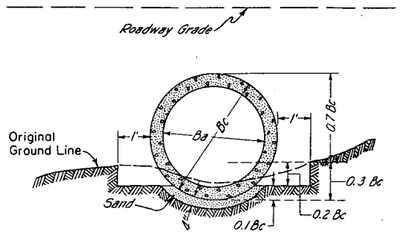
STANDARD M-46-E

STANDARD M-52-A

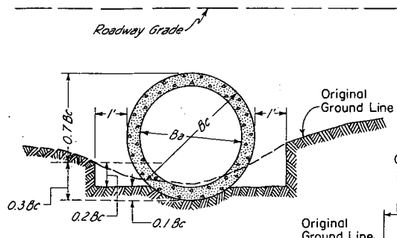
(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

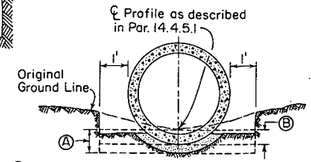
REVISIONS		
2-3-64	DEPT. NAME	M.R.H.



0.7 Projection Ratio
'B' Bedding

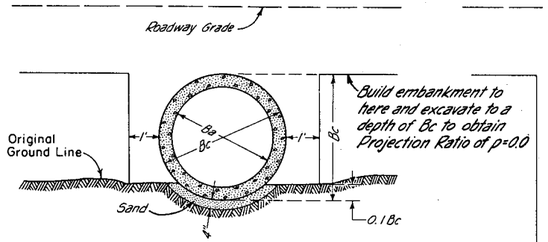


0.7 Projection Ratio
'C' Bedding



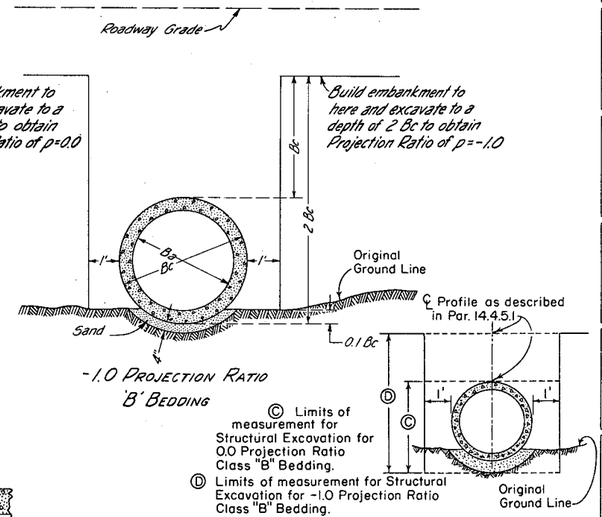
Ⓐ Limits of measurement for Structural Excavation for Class "B" Bedding.

Ⓑ Limits of measurement for Structural Excavation for Class "C" Bedding.



0.0 Projection Ratio
'B' Bedding

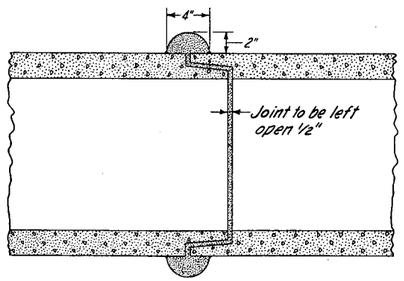
$$p = \frac{\text{top of pipe above or below top of trench}}{\text{O.D. of pipe}}$$



-1.0 Projection Ratio
'B' Bedding

Ⓒ Limits of measurement for Structural Excavation for 0.0 Projection Ratio Class "B" Bedding.

Ⓓ Limits of measurement for Structural Excavation for -1.0 Projection Ratio Class "B" Bedding.



Concrete or Mortar Pipe Joint

Where the flow line grade of the pipe is 10% or greater, all pipe shall be the Bell and Spigot type or shall be Tongue and Groove pipe with concrete collars as detailed above or a type approved in writing by the Engineer.

General Notes

All work shall be done according to the Standard Specifications of the Colorado Department of Highways applicable to the Project.

The Height of Fill for each culvert shall determine the bedding and class of concrete pipe to be used (See table herewith). Location, length and inside diameter of pipe, and class of pipe required shall be shown on plans.

Type 'B' bedding is to be used in solid rock.

Details for placement of structure backfill materials are shown elsewhere in plans.

When projection ratios of 0.0 or -1.0 are used, backfilling above structure backfill material shall be made with materials excavated in order to produce the projection ratio. Cost of this backfilling is to be included in the contract unit price for Item 52. If material does not stand with a vertical face when attempting to produce 0.0 or -1.0 projection ratios, this standard is not applicable.

Approved Combinations of Height of Fill - Projection Ratio - Bedding - Class

Ba		⓪ Height of Fill	Projection Ratio	Bedding	Class
12"		#-7'	0.7	C	II
		7'-10'	0.7	C	III
		10'-15'	0.7	C	IV
		15'-19'	0.7	B	IV
		19'-29'	0.0	B	IV
		29'-42'	0.0	B	V
15"		#-8'	0.7	C	II
		8'-11'	0.7	C	III
		11'-16'	0.7	C	IV
		16'-20'	0.7	B	IV
		20'-30'	0.0	B	IV
		30'-44'	0.0	B	V
		44'-67'	-1.0	B	V
18"		#-8'	0.7	C	II
		8'-11'	0.7	C	III
		11'-16'	0.7	C	IV
		16'-20'	0.7	B	IV
		20'-30'	0.0	B	IV
		30'-45'	0.0	B	V
		45'-91'	-1.0	B	V
21"		#-8'	0.7	C	II
		8'-11'	0.7	C	III
		11'-17'	0.7	C	IV
		17'-21'	0.7	B	IV
		21'-31'	0.0	B	IV
		31'-46'	0.0	B	V
		46'-55'	-1.0	B	V
24"		#-9'	0.7	C	II
		9'-12'	0.7	C	III
		12'-17'	0.7	C	IV
		17'-22'	0.7	B	IV
		22'-31'	0.0	B	IV
		31'-46'	0.0	B	V
		46'-58'	-1.0	B	V
27"		#-9'	0.7	C	II
		9'-13'	0.7	C	III
		13'-18'	0.7	C	IV
		18'-22'	0.7	B	IV
		22'-32'	0.0	B	IV
		32'-49'	0.0	B	V
		49'-61'	-1.0	B	V
30"		#-9'	0.7	C	II
		9'-12'	0.7	C	III
		12'-18'	0.7	C	IV
		18'-22'	0.7	B	IV
		22'-32'	0.0	B	IV
		32'-49'	0.0	B	V
		49'-62'	-1.0	B	V
33"		#-9'	0.7	C	II
		9'-13'	0.7	C	III
		13'-18'	0.7	C	IV
		18'-23'	0.7	B	IV
		23'-33'	0.0	B	IV
		33'-50'	0.0	B	V
		50'-65'	-1.0	B	V
36"		#-10'	0.7	C	II
		10'-13'	0.7	C	III
		13'-19'	0.7	C	IV
		19'-23'	0.7	B	IV
		23'-34'	0.0	B	IV
		34'-51'	0.0	B	V
		51'-67'	-1.0	B	V
42"		#-10'	0.7	C	II
		10'-13'	0.7	C	III
		13'-18'	0.7	C	IV
		18'-22'	0.7	B	IV
		22'-34'	0.0	B	IV
		34'-51'	0.0	B	V
		51'-69'	-1.0	B	V
48"		#-11'	0.7	C	II
		11'-14'	0.7	C	III
		14'-19'	0.7	C	IV
		19'-24'	0.7	B	IV
		24'-34'	0.0	B	IV
		34'-53'	0.0	B	V
		53'-71'	-1.0	B	V

Ba		⓪ Height of Fill	Projection Ratio	Bedding	Class
54"		#-10'	0.7	C	II
		10'-14'	0.7	C	III
		14'-19'	0.7	C	IV
		19'-23'	0.7	B	IV
		23'-34'	0.0	B	IV
		34'-53'	0.0	B	V
		53'-73'	-1.0	B	V
60"		#-11'	0.7	C	II
		11'-14'	0.7	C	III
		14'-20'	0.7	C	IV
		20'-24'	0.7	B	IV
		24'-35'	0.0	B	IV
		35'-53'	0.0	B	V
		53'-74'	-1.0	B	V
66"		#-11'	0.7	C	II
		11'-14'	0.7	C	III
		14'-20'	0.7	C	IV
		20'-24'	0.7	B	IV
		24'-34'	0.0	B	IV
		34'-54'	0.0	B	V
		54'-74'	-1.0	B	V
72"		#-12'	0.7	C	II
		12'-15'	0.7	C	III
		15'-21'	0.7	C	IV
		21'-25'	0.7	B	IV
		25'-35'	0.0	B	IV
		35'-54'	0.0	B	V
		54'-74'	-1.0	B	V
78"		#-11'	0.7	C	II
		11'-15'	0.7	C	III
		15'-20'	0.7	C	IV
		20'-25'	0.7	B	IV
		25'-34'	0.0	B	IV
		34'-43'	-1.0	B	IV
84"		#-11'	0.7	C	II
		11'-15'	0.7	C	III
		15'-21'	0.7	C	IV
		21'-26'	0.7	B	IV
		26'-35'	0.0	B	IV
		35'-44'	-1.0	B	IV
90"		#-12'	0.7	C	II
		12'-15'	0.7	C	III
		15'-18'	0.7	B	III
		18'-22'	0.0	B	III
		22'-25'	-1.0	B	III
96"		#-12'	0.7	C	II
		12'-15'	0.7	C	III
		15'-19'	0.7	B	III
		19'-23'	0.0	B	III
		23'-25'	-1.0	B	III
102"		#-12'	0.7	C	II
		12'-15'	0.7	C	III
		15'-18'	0.7	B	III
		18'-23'	0.0	B	III
		23'-25'	-1.0	B	III
108"		#-13'	0.7	C	II
		13'-16'	0.7	C	III
		16'-19'	0.7	B	III
		19'-23'	0.0	B	III
		23'-25'	-1.0	B	III

⓪ Height above Top of Pipe

* Minimum cover with concrete pavement shall be 1.25' and with asphalt or gravel 1.75.'

Minimum cover on Side Drains shall be 1.0'

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

REINFORCED CONCRETE PIPE

Designed by S.C.P. & L.L.S.	Approved by C. D. Thurlow
Made by D.M.E.	Bridge Engineer
Checked by L.E.O.	Date: May 16, 1960

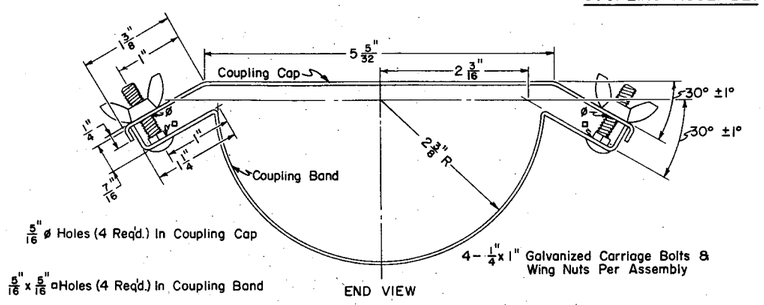
STANDARD M-71-A

(FEBRUARY 28, 1964)

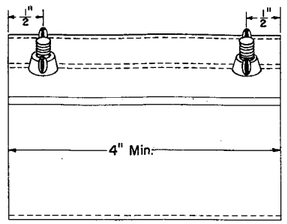
FED. ROAD DIV. NO.	DISTRICT	PROJECT NO.	SHEET NO.
9	COLO.		

REVISIONS		

COUPLING ASSEMBLY

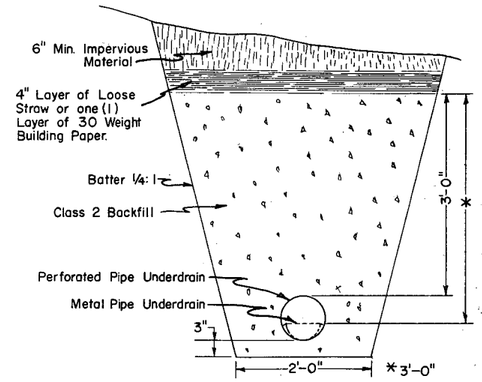


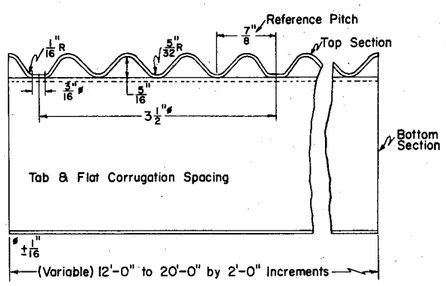
END VIEW



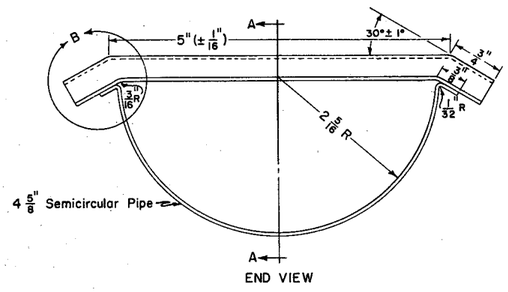
SIDE VIEW

TRENCH FOR PIPE UNDERDRAIN



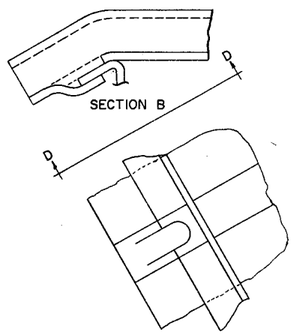


SECTION A-A



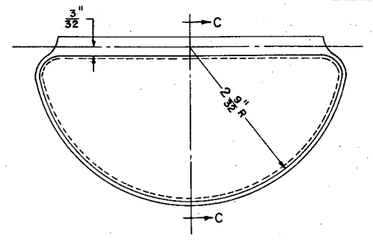
END VIEW

TAB ASSEMBLY

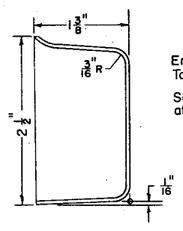


SECTION D-D

END CAP



END VIEW



SECTION C-C

End Caps to be a drive fit.
To be used at dead end of pipe.

Screen End Caps to be used at outlet of pipe.

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Department of Highways, State of Colorado, applicable to the Project.

Materials for the Bottom, Cap, Band and Corrugated Top Section to be 18 Gage Copper Bearing Galvanized Steel.

Screen for Screen End Cap, shall be 2 x 2 mesh No. 19 Gage, Woven Wire Hardware Cloth. (Approx. 1/2 inch by 1/2 inch mesh openings)

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

METAL PIPE UNDERDRAIN

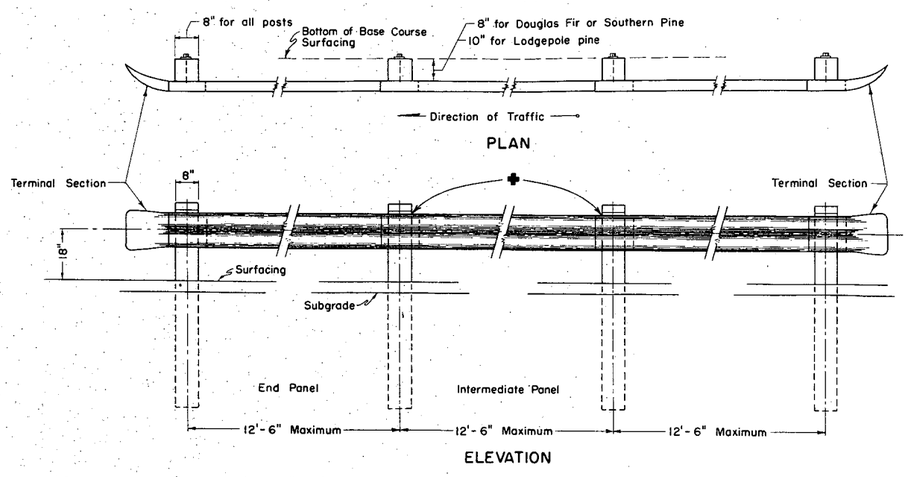
Designed by	R.J.H.	Approved by	L. E. Olson
Made by	R.J.H.		Design Engineer
Checked by	J.R.W.	Date:	March 3, 1964

STANDARD M-75-A

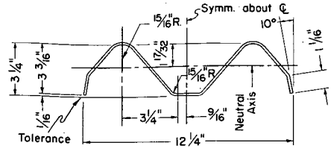
(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

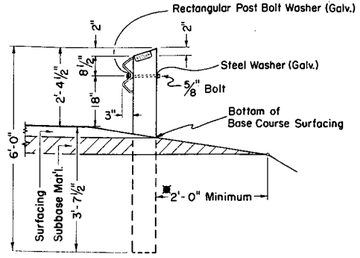
REVISIONS		
1-3-63	Add. 25' Sect. & Rect Washer	L.E.O.
7-1-63	Add. Coating Class	L.E.O.
8-7-63	Rev. General Note	L.E.O.
2-3-64	DEPT. NAME	M.R.H.



TYPICAL METAL PLATE GUARD RAIL

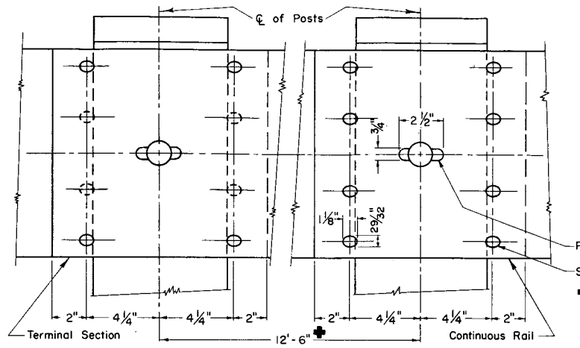


SECTION THRU RAIL ELEMENT



✖ Where Subbase width does not give the two feet, subgrade shall be widened for lateral support.

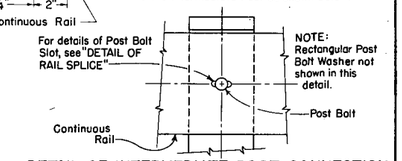
DETAIL SHOWING TYPICAL LOCATION OF GUARD FENCE



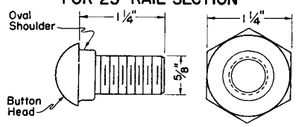
✚ When a 25'-0" section of Rail is used, fasten to the intermediate Post as shown below.

DETAIL OF RAIL SPLICE

(Rectangular Post Bolt Washer not shown in this detail)

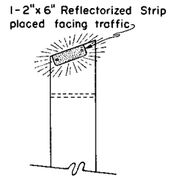


DETAIL OF INTERMEDIATE POST CONNECTION FOR 25' RAIL SECTION

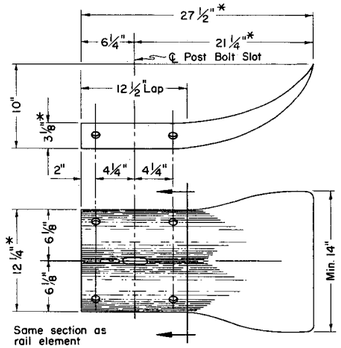


SPLICE BOLT
8 Req'd. per splice
4 Req'd. per terminal

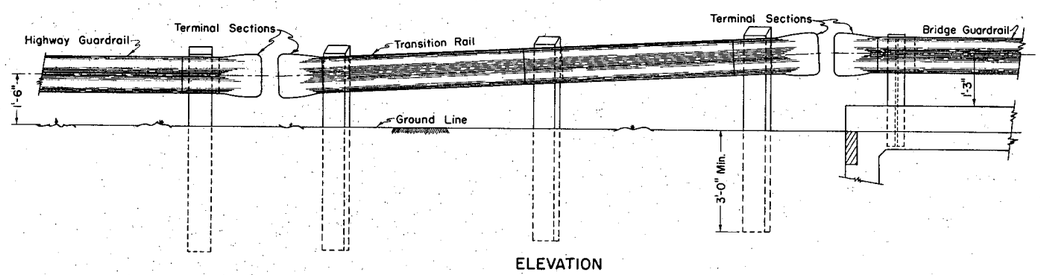
NUT

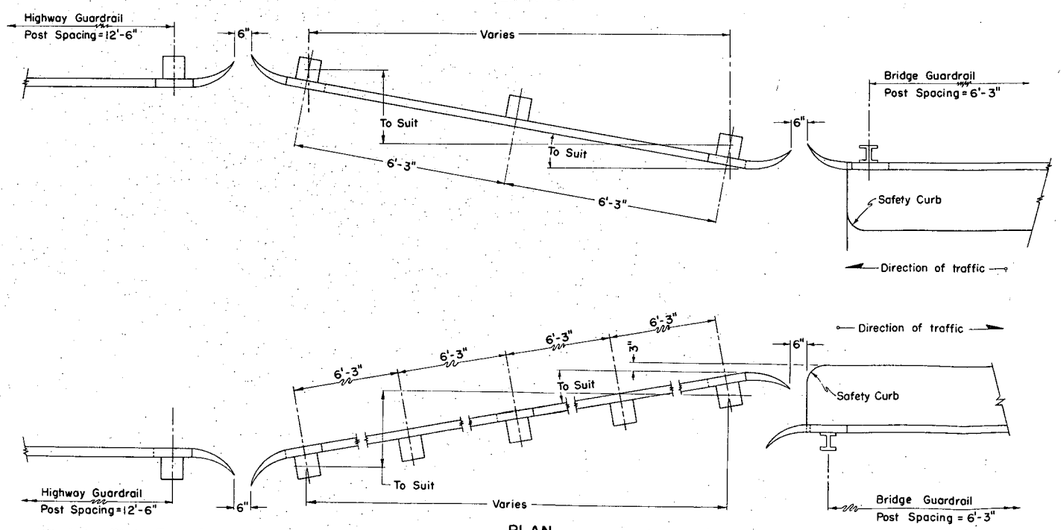


INSTALLATION DETAILS OF REFLECTORIZED STRIP
(Work by State Forces)



DETAIL OF TERMINAL SECTION





TRANSITION RAIL AT BRIDGES ONLY

(Work by State Forces)

Reflective delineators shall be furnished and installed by State Forces after the Contractor has finished his operations.

GENERAL NOTES

All work shall be done according to the Standard Specifications of the Colorado Department of Highways, applicable to the project.

All wood posts shall be close grained Douglas Fir of the Coast Region, Dense Longleaf or Shortleaf Southern Pine or Lodgepole Pine.

All wood posts shall be square edged, full sawn, with tops beveled as shown. All bolt holes are to be drilled 1/16 inch larger than diameter of bolt before treatment is applied. All wood posts shall be pressure treated for the full length of the posts with "Creosote Oil" as provided for in the Specifications.

Timber posts fabricated from Douglas Fir or Southern Pine shall be 8" x 8" square. Timber posts fabricated from Lodgepole Pine shall be 8" x 10" and shall be installed with the 8" face parallel to the center line of the roadway.

All wood posts shall be set and tamped in plumb and firm to the lines and grades as directed by the Engineer.

Where sidewalks are constructed adjacent to the lane for traffic, guard fence shall be placed in such a manner that the fence lies on the line between the sidewalk area and the normal roadway shoulder.

Where guard fences are constructed on the approaches to bridges with sidewalks, the fence at bridge shall be placed in line with the face of the curbing on the bridge.

METAL PLATE GUARD FENCE (STEEL) SPECIFICATIONS

Metal plate guard rail shall be painted in accordance with standard specifications.

Metal plate guard rail galvanized in accordance with Coating Class 2.50 of Table I of ASTM A-93 may be furnished in lieu of painting requirements.

Metal plates shall not be lighter than No. 12 U.S. standard gauge.

Standard galvanized wrought steel washers shall be used under all bolt heads and nuts coming in contact with wood posts.

METAL PLATE GUARD FENCE (ALUMINUM) SPECIFICATIONS

Aluminum plates shall have a nominal thickness of not less than 0.125 inches.

No painting of the aluminum guard rail elements, end sections or fasteners will be required.

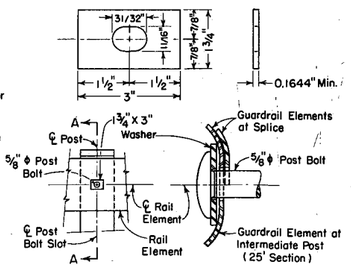
MATERIAL SPECIFICATIONS: The following members shall be of the alloy and temper specified, and shall conform to the ASTM specification listed below.

Member	▲ Alloy	ASTM Specification
Rail elements	2024-T3	B 209
Terminal Sections	2024-T42	B 209
Bolts	2024-T4	B 211
Nuts	6061-T6	B 211
Washers	2024-T4	B 211

Dimensions marked by (*) may vary by no more than 1/2 inch.

▲ All rail elements, terminal sections and appurtenances shall be treated to prevent oxidation.

RECTANGULAR POST BOLT WASHER
MIN. 8 GAGE (GALV.)
(REQUIRED AT ALL POSTS)



POST CONNECTION

SECTION A-A

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

METAL PLATE GUARD FENCE

Designed by	Approved by Carl Newbold
Made by V.A.V.	Bridge Engineer
Checked by	Date: May 15, 1956

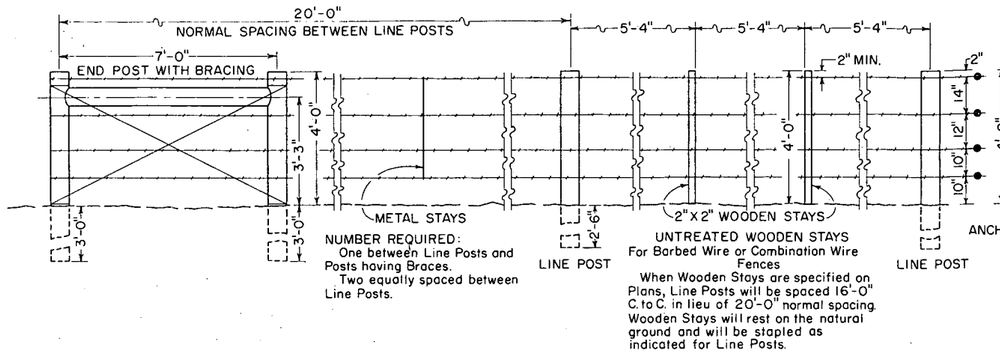
STANDARD M-76-A

(SHEET 1 OF 2 SHEETS)
(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		

REVISIONS		
5-23-62	Rev. Line Brace Detail For Metal Post	L.E.O.
6-6-62	Rev. Fc. Int. for Wood Posts	L.E.O.
8-9-62	Rev. Line Brace Detail For Metal Post	J.C.R.
9-18-62	Add. Alternate Brace Attach. Detail	L.E.O.
2-11-63	Rev. Bolt Holes in Posts & Braces	L.E.O.
4-15-63	Rev. Note on Wire Splice	J.C.R.
7-25-63		L.E.O.
2-3-64	DEPT. NAME	M.R.H.

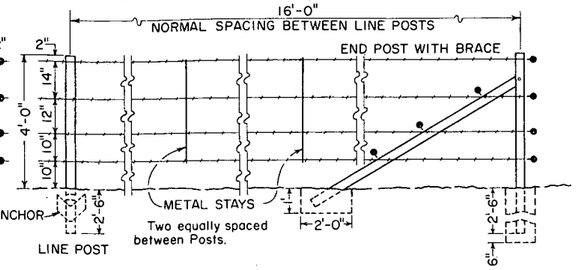
BARBED WIRE FENCE WITH WOODEN POSTS



NUMBER REQUIRED:
One between Line Posts and Posts having Braces.
Two equally spaced between Line Posts.

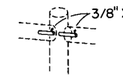
UNTREATED WOODEN STAYS
For Barbed Wire or Combination Wire Fences
When Wooden Stays are specified on Plans, Line Posts will be spaced 16'-0" C. to C. in lieu of 20'-0" normal spacing. Wooden Stays will rest on the natural ground and will be stapled as indicated for Line Posts.

BARBED WIRE FENCE WITH METAL POSTS



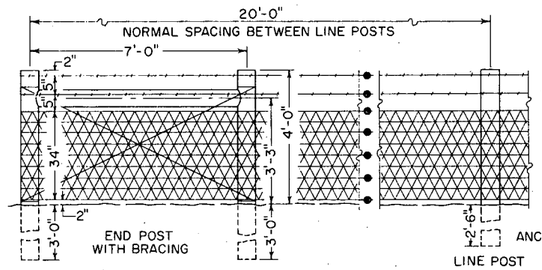
Two equally spaced between Posts.

CROSS BRACE DOWELING DETAIL

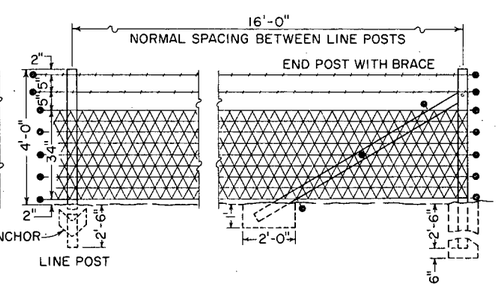


Bore a 3/8" X 2" Hole in each Post and Brace to receive the Pins. Wrap the ends of the Braces tightly with several turns of 12 1/2 ga. smooth Galv. Wire to prevent splitting or Notch Post and Nail with 40 d Common Nails.

COMBINATION WIRE FENCE WITH WOODEN POSTS

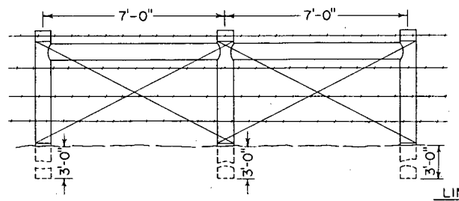


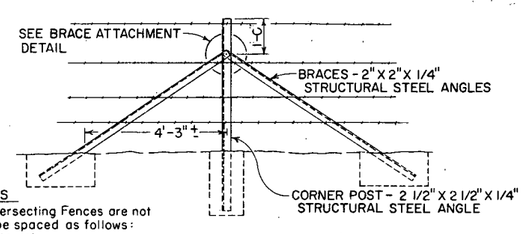
COMBINATION WIRE FENCE WITH METAL POSTS



● Fence wire will be stapled to wooden posts or tied to metal posts as shown marked ● on barbed wire or combination wire fence details.

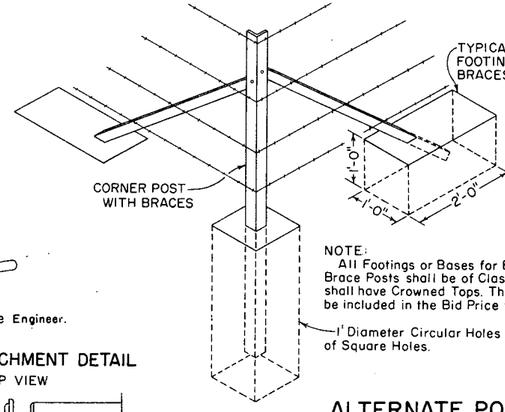
LINE BRACES



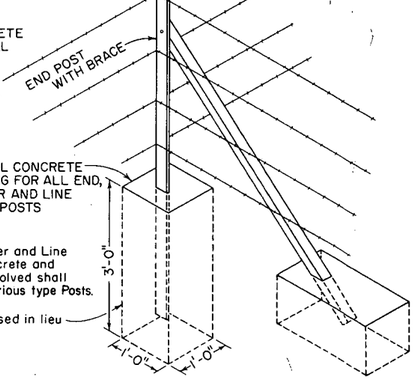


LINE BRACES
When Gates, Angles, Corners or Intersecting Fences are not specified therein, Line Braces shall be spaced as follows:
Metal Posts - 800' Intervals
Wooden Posts - 1,400' Intervals

TYPICAL CORNER POST INSTALLATION

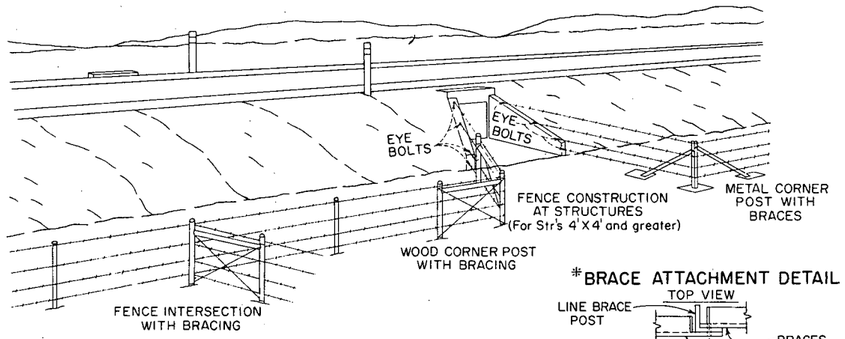


TYPICAL INSTALLATION AT FENCE INTERSECTIONS



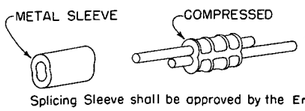
NOTE:
All Footings or Bases for End, Corner and Line Brace Posts shall be of Class "A" Concrete and shall have Crowned Tops. The Cost involved shall be included in the Bid Price for the various type Posts.
1' Diameter Circular Holes may be used in lieu of Square Holes.

ILLUSTRATIVE SKETCH SHOWING TYPICAL EXAMPLES FOR CONSTRUCTING FENCES



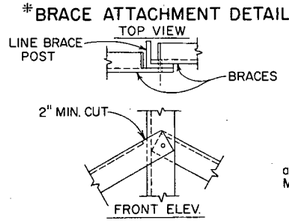
NOTE:
At all structures of 4'x4' and over, the fence shall be ended at eye-bolts in the wings of the structure. Where the type of structure prohibits the use of eye-bolts, an end post with brace shall be used.
Eye-bolts shall be made of 1/2" round bars with a minimum of six (6) inches of body length embedded in the concrete and a minimum of 1" inside eye diameter.

ACCEPTABLE WIRE SPLICE

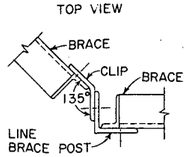


Splicing Sleeve shall be approved by the Engineer.

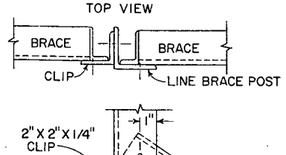
*BRACE ATTACHMENT DETAIL

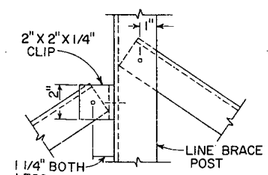


*ALTERNATE BRACE ATTACHMENT DETAIL



CLIP FOR ANGLE POINT



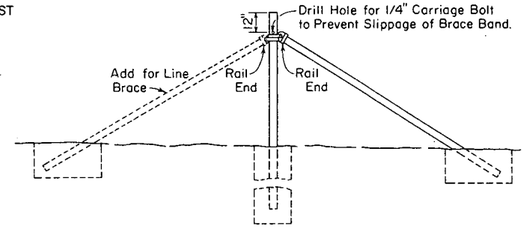


Holes in Posts, Braces and Clips shall accommodate 1/2" dia. Galvanized Machine Bolts.

*Alternate attachment methods, acceptable to the Engineer, may be used.

ALTERNATE POST

(FOR END, CORNER OR LINE BRACE POSTS)



DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
WIRE FENCES
AND
GATES

Designed by	L.E.O.	Approved by	R. J. Julian
Made by	T.E.F.	Engr. Surveys & Plans	
Checked by	E.E.O.	Date:	6-12-1961

STANDARD M-76-A

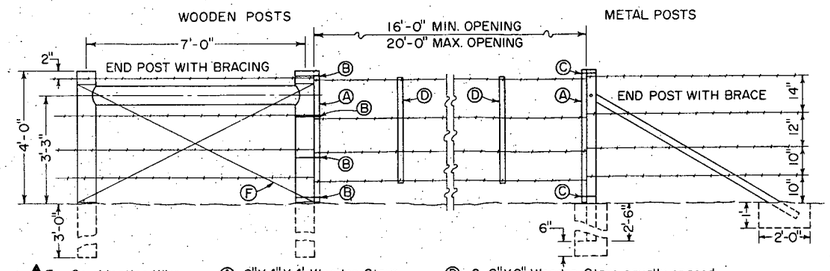
(SHEET 2 OF 2 SHEETS)

(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

REVISIONS		
5-23-62	Tie For Angle Post	L.E.O.
8-9-62	Brace Bolt Size	J.C.R.
9-21-62	Rev. Angle Post & Ties	L.E.O.
2-11-63	Rev. Gates & Posts	L.E.O.
4-15-63	———	J.C.R.
7-25-63	Rev. Ref. to Commercial Std. 184-51	L.E.O.
2-3-64	DEPT. NAME	M.R.H.

▲BARBED WIRE GATE



▲ For Combination Wire Gate use 34" Mesh and 2 strands of Barbed Wire. Extend Wooden Stays to Ground.

Ⓐ 2"X4"X4' Wooden Stays.

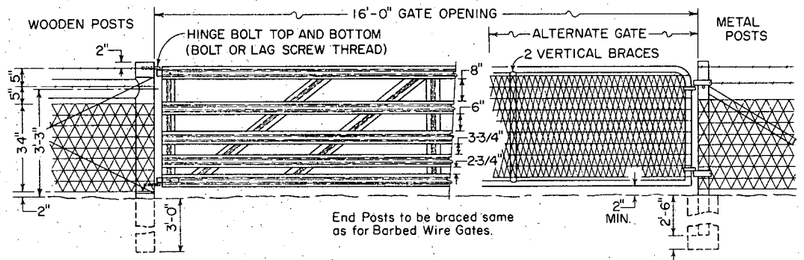
Ⓑ 4-No. 12 1/2 Ga. Wire Loops to act as Hinges.

Ⓒ No. 12 1/2 Ga. Wire Loops.

Ⓓ 2-2"X2" Wooden Stays equally spaced.

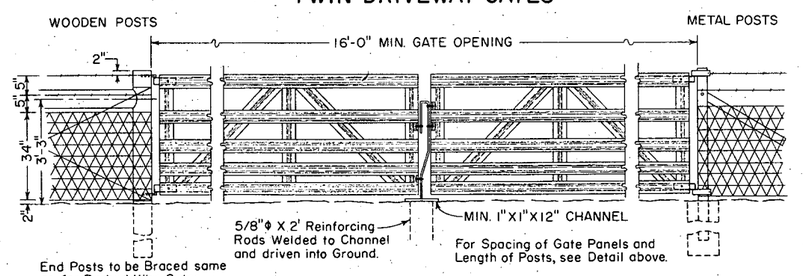
Ⓕ No. 12 1/2 Ga. Brace Wire.

DRIVEWAY GATES

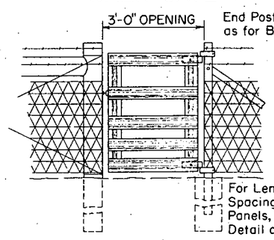


End Posts to be braced same as for Barbed Wire Gates.

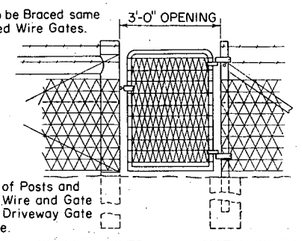
TWIN DRIVEWAY GATES



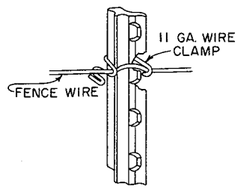
WALK GATE



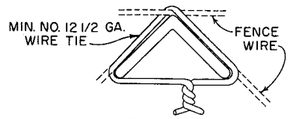
ALTERNATE WALK GATE



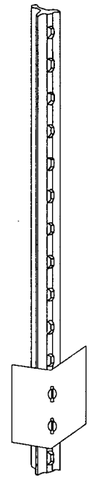
FENCE WIRE TIES



TIES FOR "STUDDED TEE" OR "U" POSTS

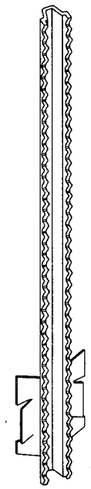


TIES FOR ANGLE POSTS



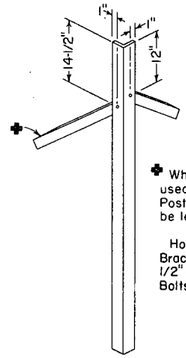
"STUDDED TEE" LINE POST

TYPICAL METAL POSTS



ALTERNATE LINE POST ("U" POST)

ANGLE POST (FOR END, CORNER AND LINE BRACE)

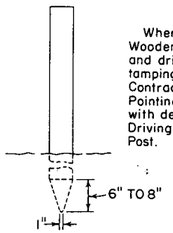


✤ When Post is to be used for an End Post, this Brace will be left off.

Holes in Angle Posts and Braces shall accommodate 1/2" dia. Galvanized Machine Bolts.

DETAILS FOR HOLE SPACING

POST POINTING DETAILS



Where field conditions permit, Wooden Posts may be pointed and driven in lieu of setting and tamping, at the option of the Contractor.
Pointing shall be in conformity with details shown at left.
Driving methods shall not damage Post.

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Colorado Department of Highways applicable to the Project.

Fence wire to be placed on either road or field side of posts depending on local conditions, i.e. on curves the wire should be placed on the side of the post which would prevent tension on fence ties. This will also apply where wind drift, tumble weeds or other conditions would exert unusual pressure against the wire.

WOOD POSTS:
All line posts shall have a min. dia. of four (4) inches & be 6'-6" long.
All end, corner, intersection and brace posts shall have a minimum diameter of five (5) inches and be 7'-0" long.
Fence wire will be stapled to wooden posts or tied to metal posts as shown marked -● on barbed wire or combination wire fence details.

METAL POSTS:
All posts and braces shall be of the types and weights shown or acceptable equivalents.
Holes to be provided in end, corner and gate posts as detailed.

CORNER POSTS:
Type - 2 1/2" X 2 1/2" X 1/4" Structural Steel Angles.
Weight - 3.81 lbs./lin. ft. Min.
Length - 6'-6" Min.
No. of Braces - 2.

LINE POSTS:
Type - "Studded Tee" or "U".
Weight - 1.28 lbs./lin. ft. Min. (without Anchor)
Length - 6'-6" Min.
Anchor - Securely fastened, with bearing surface sufficient to resist movement of post. Weight - 0.57 lb. Min.

END POSTS:
Type - 2 1/2" X 2 1/2" X 1/4" Structural Steel Angles.
Weight - 3.81 lbs./lin. ft. Min.
Length - 6'-6" Min.
No. of Braces - 1

BRACES: (For Corner, End or Line Brace Posts)
Type - 2" X 2" X 1/4" Structural Steel Angles.
Weight - 3.08 lbs./lin. ft. Min.
Length - Same as corner and end posts used.

Posts shall meet requirements of Par. 4.5 of U.S. Dept. of Commerce Commercial Standard 184-51. Acceptable material includes re-rolled railroad rails.

ALTERNATES:
END, CORNER AND LINE BRACE POSTS
Type - 2 1/2" O.D. Galvanized Tubular Steel.
Weight - 3.47 lbs./lin. ft. Min.

BRACES:
Type - 1 3/8" O.D. Tubular Steel with 2 1/2" Brace Band, Hinge Bolt and 1 3/8" I.D. Rail End; all Galvanized.
Weight - 1.6 lbs./lin. ft. Min.
Length - 6'-6" Min.

BARBED WIRE:
Barbed wire shall conform to Standard Specifications and shall have No. 14 Gauge Galvanized double wrapped barbs. 80 rod reels shall weigh a min. of 78 lbs. net & shall meet ASTM A121-57, Class I.

4"X4" WIRE MESH:
Wire mesh used in combination wire fence as shown shall be galvanized and conform to the following:
Width - 34"
Weight - 0.76 lbs./lin. ft. Min.
Horizontal Wires - 2 strands, No. 12 1/2 ga. wire.
Cross Wires - 1 strand, No. 14 ga. wire.
Construction - cross wires to be woven with horizontal wires making a one piece fabric.
Shall meet ASTM A116-57, Class I.

GATES:
DRIVEWAY GATES:
Height - approximately 42" (5 panels) --- Width of gate opening - 16'-0"
Weight - Galvanized Steel, 90 lbs. Min. --- Tempered Aluminum, 45 lbs. Min.
① Gates to be of Riveted construction as follows: Min. 4 No. 10 rivets at each right angle connection and where diagonal braces connect to horizontal panels; Min. 3 No. 10 rivets where diagonal braces connect to top and bottom panels.
ALTERNATE DRIVEWAY GATES:
Height - 42"
Weight - Not less than 79 lbs. complete with latch and hinges.
Width of gate opening - 16'-0"
Gate Frame - 1" I.D. Standard Galvanized Pipe or acceptable equivalent and shall be of all welded construction.
Mesh to be of same construction as shown for 4"X4" wire mesh except it shall be 2"X4" mesh 42" high.

① WALK GATES:
Height - approx. 42" (5 panels)
Weight - (Galvanized Steel, 18 lbs. Min. / Tempered Aluminum, 10 lbs. Min.)
Width of gate opening - 3'-0"

ALTERNATE WALK GATES:
Height - 42"
Weight - Not less than 16 lbs. complete with latch and hinges.
Width of gate opening - 3'-0"
Gate Frame - 3/4" I.D. Standard Galvanized Pipe or acceptable equivalent and shall be of all welded construction.
Mesh to be of same construction as shown for Driveway Gate.

Alternate equivalent standard metal gates other than shown will be acceptable subject to the Engineer's approval.

In lieu of galvanized finish on gate frames, Cadmium Plated pipe or Aluminum painting with Zinc Chromate Primer as per Specifications will be considered to be equivalent.

LATCHES AND HINGES:
Galvanized steel or Aluminum of standard make.
Hinges shall be placed as shown, to prevent theft.
In lieu of standard make latches it will be permissible to use an electro-galvanized chain, eyebolt and snaphook type latch. Eyebolt, chain and snaphook assembly to be secured to latch side of gate. Gate closure effected by wrapping chain around end post and snapping hook into chain.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
WIRE FENCES
AND
GATES

Designed by L.E.O.	Approved by C. T. Sullivan
Made by T.E.F.	Engr. Surveys & Plans
Checked by E.E.O.	Date: 6-12-1961

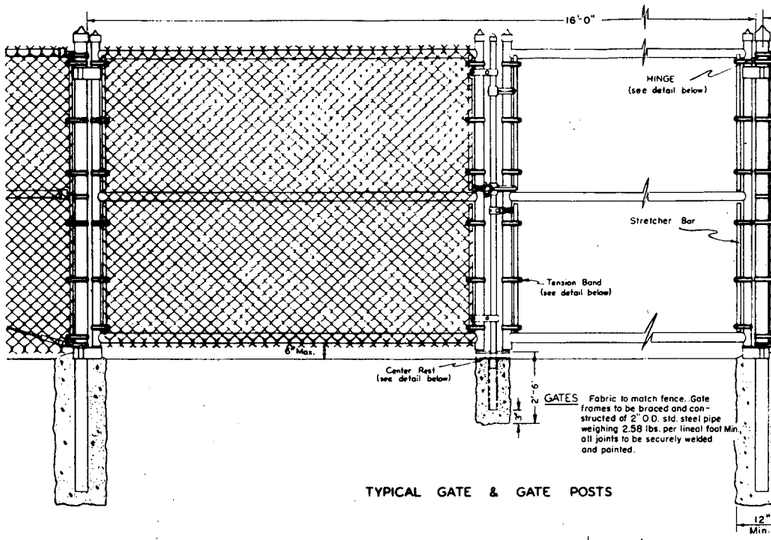
STANDARD M-78-A

(MAY 1, 1962)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	[redacted]	[redacted]

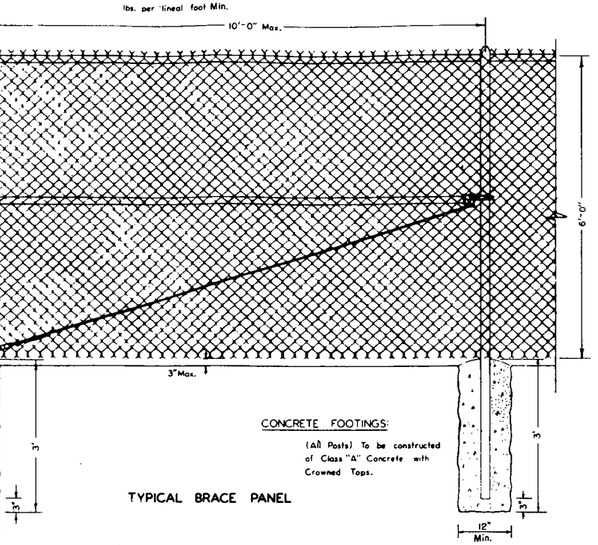
TOP RAIL: To be constructed of 1-5/8" O.D. Std. Steel Pipe weighing 2.16 lbs. per lineal foot Min.

GATE POSTS: To be constructed of 3" O.D. std. steel pipe weighing 5.50 lbs. per lineal foot Min.



GATES: Fabric to match fence. Gate frames to be braced and constructed of 2" O.D. std. steel pipe weighing 2.58 lbs. per lineal foot Min., all joints to be securely welded and painted.

TYPICAL GATE & GATE POSTS

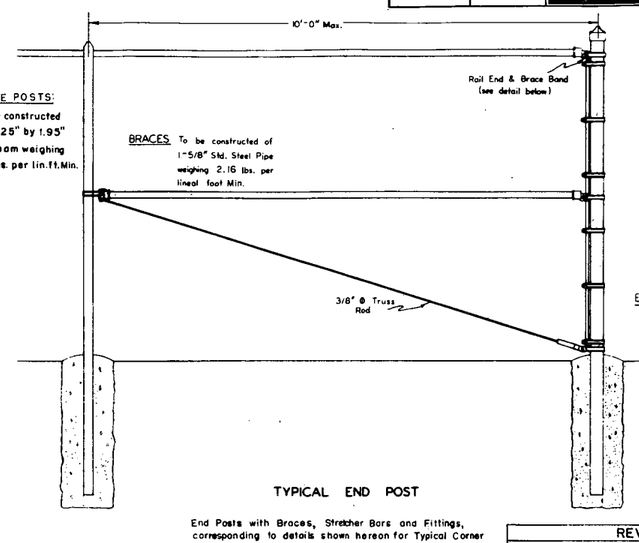


CONCRETE FOOTINGS: (All Posts) To be constructed of Class "A" Concrete with Crowned Tops.

TYPICAL BRACE PANEL

LINE POSTS: To be constructed of 2.25" by 1.95" H-Beam weighing 4.0 lbs. per lin. ft. Min.

TYPICAL LINE POST (See alternate below)



END POST: To be constructed of 3" OD. Std. Steel Pipe weighing 5.50 lbs. per lineal foot Min.

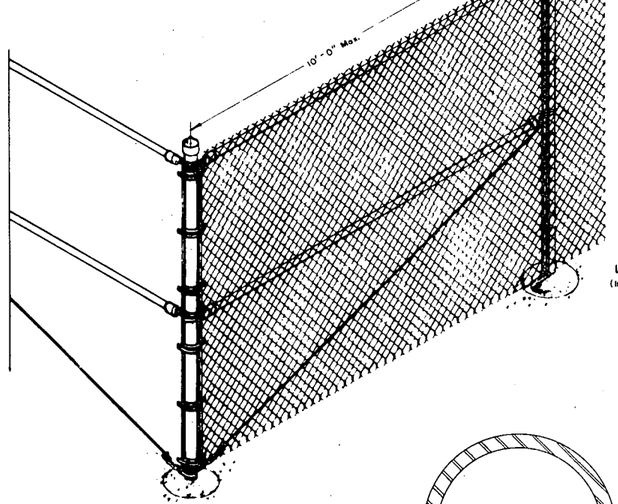
TYPICAL END POST

End Posts with Braces, Stretcher Bars and Fittings, corresponding to details shown hereon for Typical Corner Section with End Posts and Braces, are to be used in fence at intervals of not more than four hundred (400) feet.

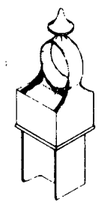
REVISIONS		
2-14-64	DEPT. NAME	M.R.H.

SPECIFICATION NUMBERS

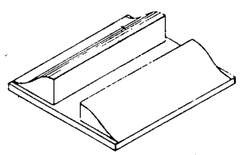
ITEM NO.	ITEM	UNIT
78	Chain Link Wire Mesh Fence	Lin. Ft.
78	Double Driveway Gates	Each



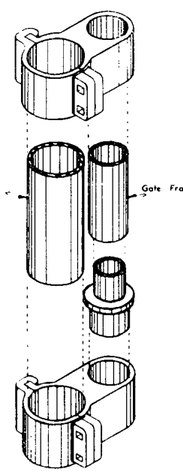
TYPICAL CORNER SECTION WITH POST & BRACES



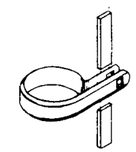
LINE POST TOP (In lieu of punched & pointed posts)



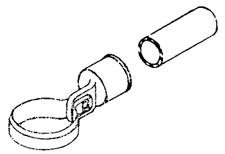
CENTER REST



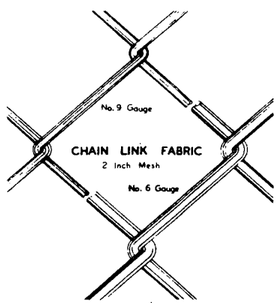
HINGE ASSEMBLY



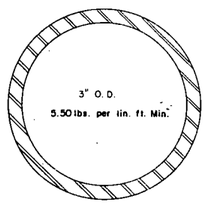
TENSION BAND



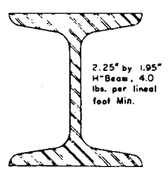
BRACE BAND & RAIL END



All Fabric shall be No. 9 Gauge with a barbed finish on the top and bottom selvage unless otherwise specified & shall meet ASTM 392-59T, Class I.

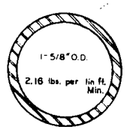


TERMINAL POSTS



H-BEAM LINE POST

ALTERNATE LINE POST



BRACE RAIL & TOP RAIL

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Colorado State Highway Department applicable to the project.

Weights of Pipe as shown are the minimum allowed for the Nominal Diameters designated.

Alternate Equivalent Standard Fittings, Gates, Posts, and Rails of other than sections shown will be acceptable subject to the Engineer's approval.

See Plan Sheets for Location and Number of Gates and Length of Fence required.

Wire Mesh Fabric shall be securely fastened to all Line Posts, Rails and Braces with No. 7 (B&S) Gauge Aluminum and/or No. 12-1/2 (W&M) Gauge Galvanized Steel Wire and spaced at a minimum of 6 per 10 feet Horizontally & 1 per foot Vertically. Suitable Attachment Bands shall used on all Gate Posts, End Posts, Braces and Stretcher Bars.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

CHAIN LINK FENCE

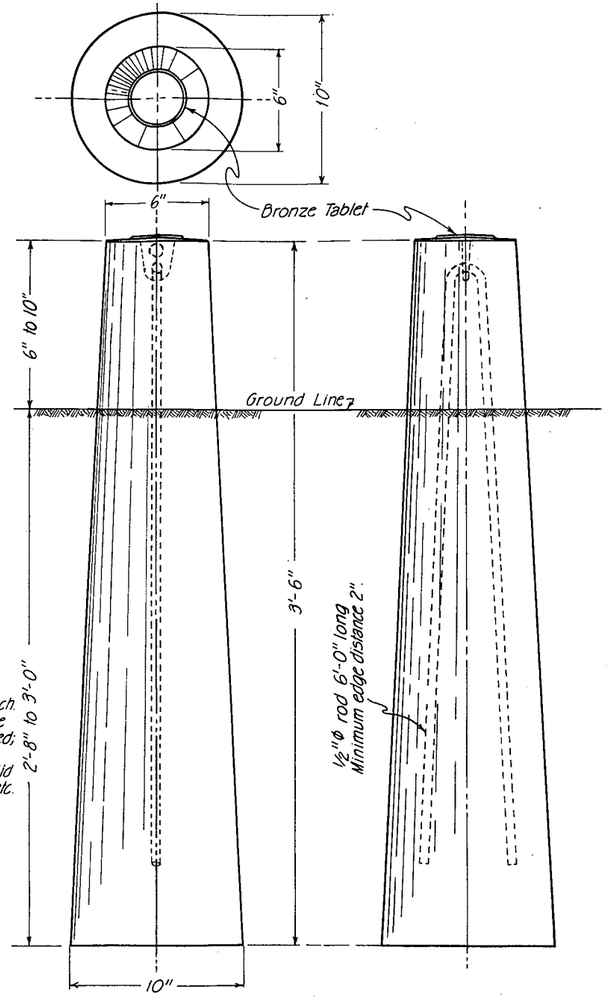
Designed by: V.L.A.	Approved by: C. Julian
Made by: E.L.H.	Design Engineer
Checked by:	Date: 9-1-56

RIGHT OF WAY MARKER POST STANDARD M-81-A

(MAY 1, 1962)

FEDERAL ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	[redacted]	[redacted]

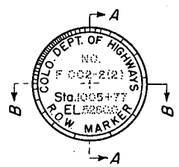
REVISIONS		
1-31-64	DEPT. NAME	M.R.H.

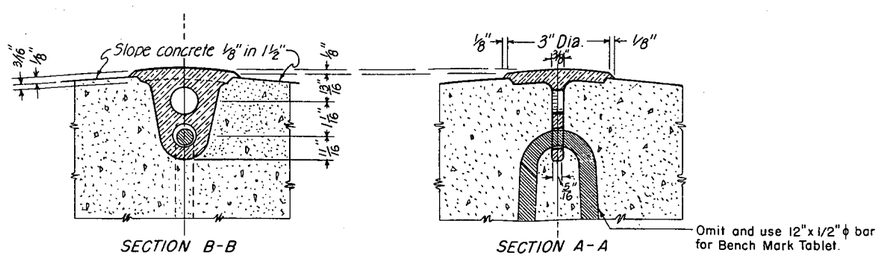


NOTES FOR R.O.W. MARKER POSTS

All work shall be done in accordance with the Standard Specifications of the Colorado Department of Highways applicable to the project. Posts shall be made of Class 'A' Concrete. The upper 12 inches of marker-posts shall be rubbed free of form marks, and the top surface of the post must be constructed to drain thoroughly.

All exposed surfaces of the bronze tablet are to be ground to a smooth surface. All letters are to be depressed a minimum of 1/16 inch. Information on the bronze tablet indicated by pin lines is to be stamped in field by the engineering party after post is placed; 3/16 inch letters and figures to be used. Project designations on tablets shall be properly shown (i.e.; I for Fed. Aid Interstate; F for Fed. Aid Primary; S for Fed. Aid Secondary, etc. & C for State Projects, see detail below.)





DETAIL OF BRONZE TABLET FOR RIGHT OF WAY MARKER POST AND BENCH MARK

BENCH MARK

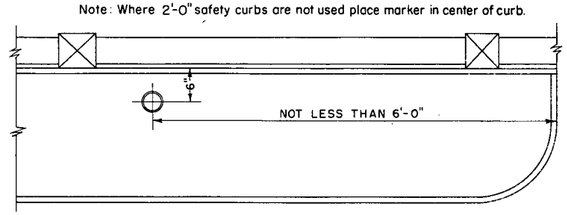
All work shall be done in accordance with Standard Specifications of the Colorado Department of Highways applicable to the project.

All exposed surfaces of the bronze tablet are to be ground to a smooth surface. All letters are to be depressed a minimum of 1/16 inch. Information on the bronze tablet indicated by pin lines is to be stamped in field by the engineering party after marker is placed. 3/16 inch letters and figures to be used. Project designation on tablets shall be properly shown (i.e.; I for Fed. Aid Interstate, F for Fed. Aid Primary, S for Fed. Aid Secondary, etc. & C for State Projects. See details below).

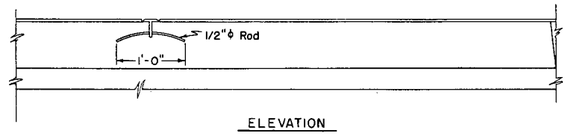
Bronze Bench Mark Tablets will be furnished by the Department at no expense to the Contractor.

Installation of Bronze Bench Mark Tablets will not be paid for directly, but shall be included in the price bid for Concrete

Note: Where 2'-0" safety curbs are not used place marker in center of curb.



PLAN



ELEVATION

One marker to be placed on Bridges as shown. The station shown on marker shall be the centerline stationing directly opposite the marker.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

MARKER POSTS AND BENCH MARKS

Designed by R.E.L.	Approved by E. Julian
Made by E.E.O.	
Checked by R.E.L.	Date: Nov. 12, 1953

STANDARD CURBS AND GUTTERS

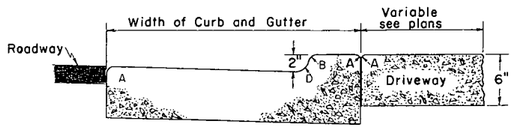
STANDARD M-84-A

(MAY 1, 1962)

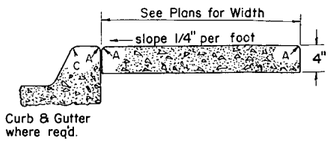
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

REVISIONS		
3-25-63	Added Approach Slab Curbs.	C.R.S.
2-3-64	DEPT. NAME	M.R.H.
8-24-64	Deleted Variable C. & G. details	M.R.H.

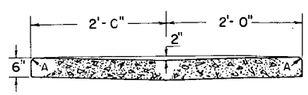
CONCRETE PAVEMENT (DRIVEWAYS)



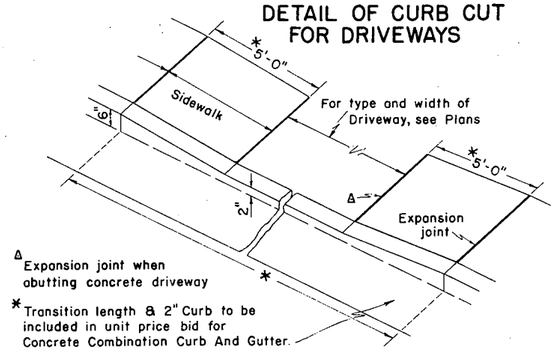
CONCRETE SIDEWALKS



CONCRETE GUTTER



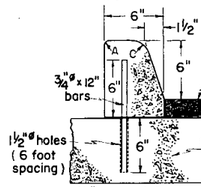
DETAIL OF CURB CUT FOR DRIVEWAYS



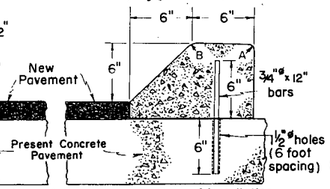
Δ Expansion joint when abutting concrete driveway

* Transition length & 2" Curb to be included in unit price bid for Concrete Combination Curb And Gutter.

CONCRETE CURB (6" Barrier-Doweled) (Type I)

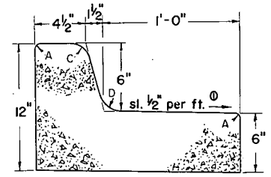


CONCRETE CURB (6" Mountable-Doweled) (Type I-M)



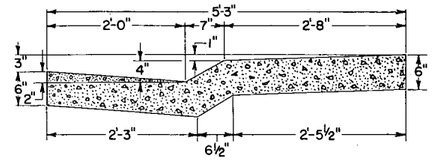
3/4"ø x 12" reinforcing bars at 6 foot spacing. Cost of installation to be included in unit price bid for Curb. Bars to be grouted in 1½"ø holes in present concrete. Grout to consist of 2 parts clean sand and 1 part cement.

CONCRETE COMBINATION CURB AND GUTTER (6" Barrier-1' Gutter) (Type I)

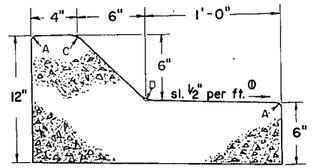


LEGEND FOR RADII
A = 1/8"
B = 1"
C = 1½"
D = 1½" to 2"

CONCRETE COMBINATION CURB, GUTTER AND SIDEWALK (TYPE II-M)

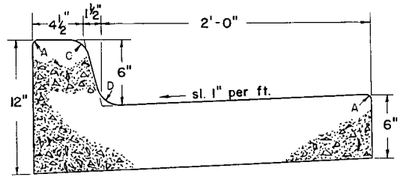


CONCRETE COMBINATION CURB AND GUTTER (6" Mountable-1' Gutter) (Type I-M)

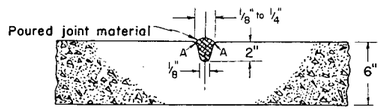


① Slope in opposite direction when required for curves or warped pavement sections.

CONCRETE COMBINATION CURB AND GUTTER (6" Barrier-2' Gutter) (Type II)

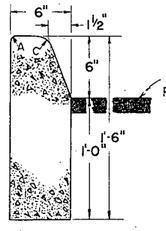


TRANSVERSE WEAKENED PLANE JOINT FOR CONCRETE PAVEMENT (DRIVEWAYS)

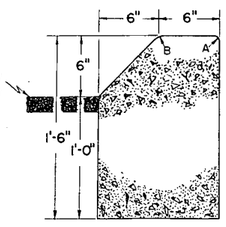


This joint required where length of slab exceeds 15 feet.

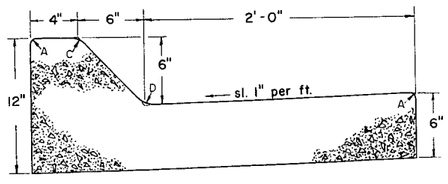
CONCRETE CURB (6" Barrier) (Type II)



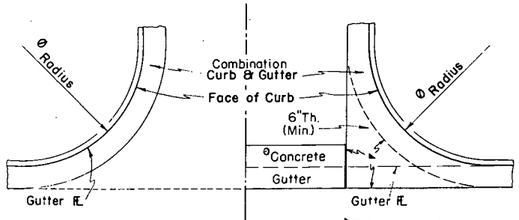
CONCRETE CURB (6" Mountable) (Type II-M)



CONCRETE COMBINATION CURB AND GUTTER (6" Mountable-2' Gutter) (Type II-M)



CONSTRUCTION OF CONCRETE GUTTERS AT INTERSECTIONS



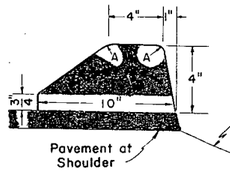
Ø Length of Radius as shown elsewhere on Plans.

This area shall be poured monolithically with curb and gutter and will be paid for as Concrete Pavement of specified thickness.

This section to be built when Concrete Gutter is not required.

This section to be built when ºConcrete Gutter is required.

ASPHALTIC SHOULDER ROLL



NOTE:
0.647 x Specific Gravity of Asphalt = Tons per Station.

GENERAL NOTES

All work shall be done in accordance with the Specifications of the Colorado Department of Highways.

On Curves 3 degrees and sharper, Curbs and/or Gutters are to be placed on the Arc of the Curve unless otherwise noted on plans. A maximum chord length of 10 feet may be used when the degree of curve is less than 3 degrees.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

CURBS AND GUTTERS

Designed by	Approved by
Made by	
Checked by C.R.S.	Date: Sept 29 19 58

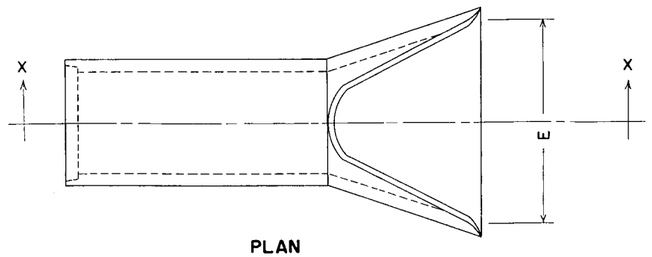
STANDARD M-152-A

(MAY 1, 1962)

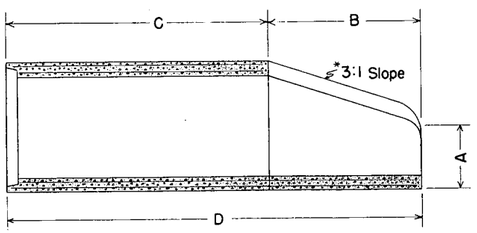
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	[redacted]	

REVISIONS		
2-11-64	Rev. Dept. Name	M.R.H.

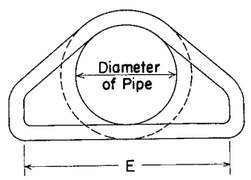
FLARED END SECTION FOR CONCRETE PIPE



PLAN

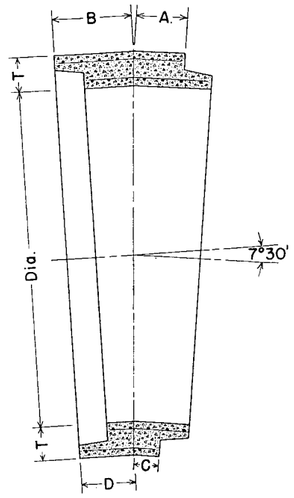


SECTION X-X



END VIEW

7°30' ANGLE SECTION FOR CONCRETE PIPE



DIMENSIONS FOR FLARED END SECTIONS

DIAMETER	A	B	C	D	E
12"	4"	2'-0"	4'-0⅞"	6'-0⅞"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
24"	9½"	3'-7½"	4'-6"	8'-1½"	4'-0"
30"	1'-0"	4'-6"	3'-7¾"	8'-1¾"	5'-0"
36"	1'-3"	5'-3"	2'-10¾"	8'-1¾"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	2'-6"	6'-0"	2'-3"	8'-3"	7'-6"
*60"	2'-6"	5'-0"	3'-3"	8'-3"	8'-0"

*60" end section is based on a slope of 2:1

NOTE:
Alternate equivalent designs for flared end sections may be submitted to the Department for approval. Payment for "Flared End Sections" will be based on the lengths as shown in Column D. Any additional culvert pipe required to provide the lengths as shown in Column D will be included in the unit price bid for "Flared End Sections" of the several sizes.

DIMENSIONS FOR 7°30' ANGLE SECTIONS

DIAMETER OF PIPE	LENGTH ON OUTSIDE OF PIPE				AVERAGE LAYING LENGTH ON ℄
	A	B	C	D	
12"	4½"	4½"	3½"	3½"	8"
15"	5½"	5⅛"	4¼"	3⅞"	9⅜"
18"	3½"	6½"	2"	5"	8½"
24"	4"	6½"	2"	4 9/16"	8½"
30"	4½"	7"	2"	4½"	9"
36"	4⅞"	8 7/16"	2"	5 9/16"	10 7/16"
42"	6"	9½"	2⅝"	6⅛"	12⅛"
48"	7"	11"	3 3/16"	7 3/16"	14 3/16"
54"	8⅛"	12⅛"	4"	8"	16⅛"
60"	9⅛"	14"	4⅜"	9¼"	18⅜"

A,B,C and D apply to Tongue and Groove type of Joint only and can be varied for other types of Joints.

GENERAL NOTES

Joints other than Tongue and Groove may be used for Flared End Sections, 7°30' Angle but all joints for any one pipe structure must be uniform.

Concrete, wall thickness and reinforcing steel in Flared End Sections and 7°30' Angle Sections must conform with the requirements of the pipe with which they are used.

Flared end sections are to be furnished with tongue or groove, and/or bell or spigot as required, in order that joints may be laid with the bell or groove end upstream.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

CONCRETE END AND ANGLE SECTIONS

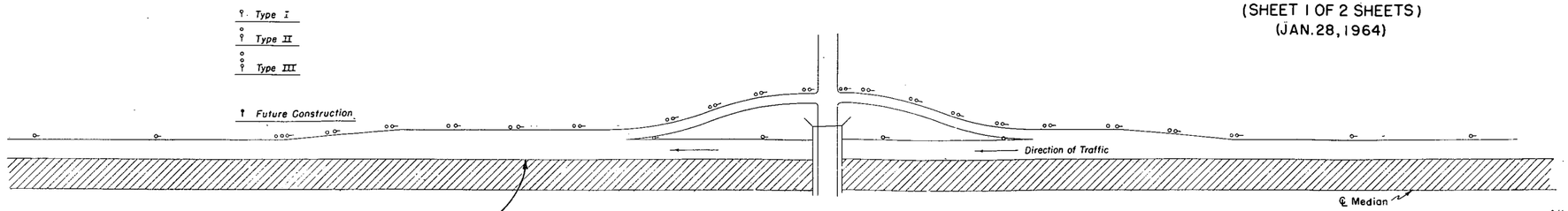
Designed by	R.S.M.	Approved by	C. Julian
Made by	J.M.K.		
Checked by	R.S.M.	Date:	January 14,

STANDARD M-192-AA

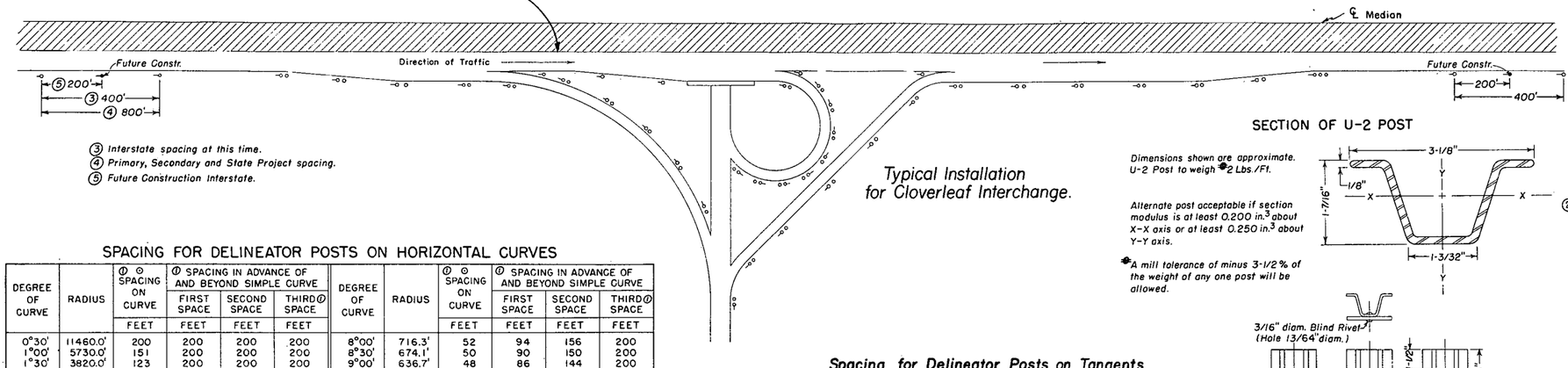
(SHEET 1 OF 2 SHEETS)
(JAN. 28, 1964)

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		

REVISIONS		



Typical Installation for Diamond Interchange.



③ Interstate spacing at this time.
④ Primary, Secondary and State Project spacing.
⑤ Future Construction Interstate.

Typical Installation for Cloverleaf Interchange.

SPACING FOR DELINEATOR POSTS ON HORIZONTAL CURVES

DEGREE OF CURVE	RADIUS	ⓘ ⊙ SPACING ON CURVE	ⓘ SPACING IN ADVANCE OF AND BEYOND SIMPLE CURVE			DEGREE OF CURVE	RADIUS	ⓘ ⊙ SPACING ON CURVE	ⓘ SPACING IN ADVANCE OF AND BEYOND SIMPLE CURVE		
			FIRST SPACE	SECOND SPACE	THIRD ⓘ SPACE				FIRST SPACE	SECOND SPACE	THIRD ⓘ SPACE
		FEET	FEET	FEET	FEET			FEET	FEET	FEET	FEET
0°30'	11460.0'	200	200	200	200	8°00'	716.3'	52	94	156	200
1°00'	5730.0'	151	200	200	200	8°30'	674.1'	50	90	150	200
1°30'	3820.0'	123	200	200	200	9°00'	636.7'	48	86	144	200
2°00'	2865.0'	106	191	200	200	9°30'	603.2'	47	85	141	200
2°30'	2292.0'	95	171	200	200	10°00'	573.0'	46	83	138	200
3°00'	1910.0'	86	155	200	200	10°30'	545.7'	45	81	135	200
3°30'	1637.1'	80	144	200	200	11°00'	520.9'	43	77	129	200
4°00'	1432.5'	74	133	200	200	11°30'	498.3'	42	76	126	200
4°30'	1273.3'	70	126	200	200	12°00'	477.5'	41	74	123	200
5°00'	1146.0'	66	119	198	200	15°00'	382.0'	36	65	108	200
5°30'	1041.8'	63	113	189	200	18°00'	318.3'	33	59	99	198
6°00'	955.0'	60	108	180	200	21°00'	272.9'	30	54	90	180
6°30'	881.5'	58	104	174	200	25°00'	229.2'	27	49	81	162
7°00'	818.6'	55	99	165	200	30°00'	191.0'	24	43	72	144
7°30'	764.0'	53	95	159	200						

⊙ S = 2 $\sqrt{R-50}$ 1-ST. SPACE = 1.8S 2-ND. SPACE = 3S 3-RD. SPACE = 6S
NO SPACES TO EXCEED 200 FT.

ⓘ Omit third space on Secondary and Primary Routes and double the distance on the curve and in advance of and beyond curve.

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications of the Colorado Department of Highways applicable to the project.

See tabulation in plans for delineator post requirements.

Spacing between Posts on acceleration and deceleration lanes and on relatively straight portions of interchange ramps shall be ②. Spacing between Posts on the outside of interchange ramp curves shall be as indicated in table for the appropriate degree of curve with a 24' min. spacing. Post spacing in advance and beyond curve shall not apply to ramp curves.

Posts shall meet requirements of Par. 4.5 of U.S. Dept. of Commerce Commercial Standard 184-51. Acceptable material includes re-rolled railroad rails.

When normal delineator spacing falls on a road approach or crossroad, move delineator either direction a distance not to exceed 1/4 normal spacing.

② 100' on Interstate and 200' on Primary and Secondary Projects.

Delineator Posts are not to be placed along Frontage Roads.

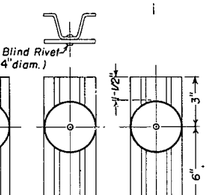
Color of Posts shall be Interstate Green.

SECTION OF U-2 POST

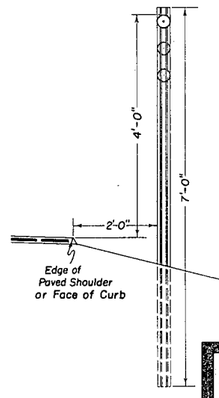
*Dimensions shown are approximate. U-2 Post to weigh *2 Lbs./Ft.*

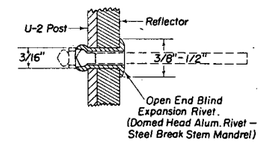
Alternate post acceptable if section modulus is at least 0.200 in.³ about X-X axis or at least 0.250 in.³ about Y-Y axis.

**A mill tolerance of minus 3-1/2% of the weight of any one post will be allowed.*



Min. 3 holes in all posts required as shown.

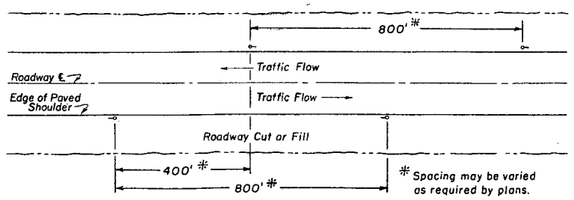




DETAIL
RIVETING REFLECTOR TO POST

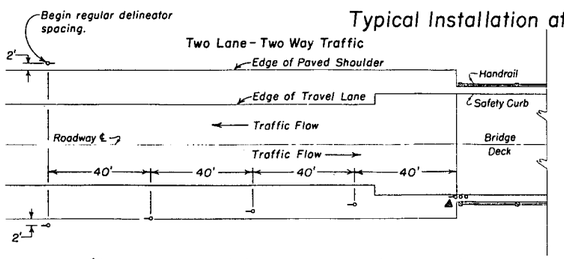
Spacing for Delineator Posts on Tangents

(Two Lane - Two Way Traffic)



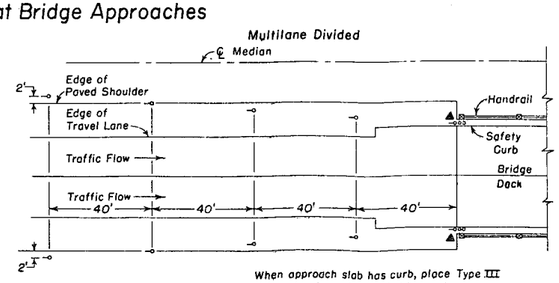
* Spacing may be varied as required by plans.

Typical Installation at Bridge Approaches



▲Where curb to curb width of bridge is equal to or greater than roadway width plus usable shoulder width, use this delineator only and omit all others.

Note: Where guard rail is present, place delineators outside of guard rail and at height which will permit clear view of all three Delineator buttons.



When approach slab has curb, place Type III delineator immediately behind curb.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

DELINEATORS

Designed by CKM Made by WNC Checked by LEO	Approved by E. Julian Engineer, Surveys & Plans Date: October 19, 1962

STANDARD M-192-AA

(SHEET 2 OF 2 SHEETS)

(JAN. 28, 1964)

FED. ROAD REG. NO.	DIVIS
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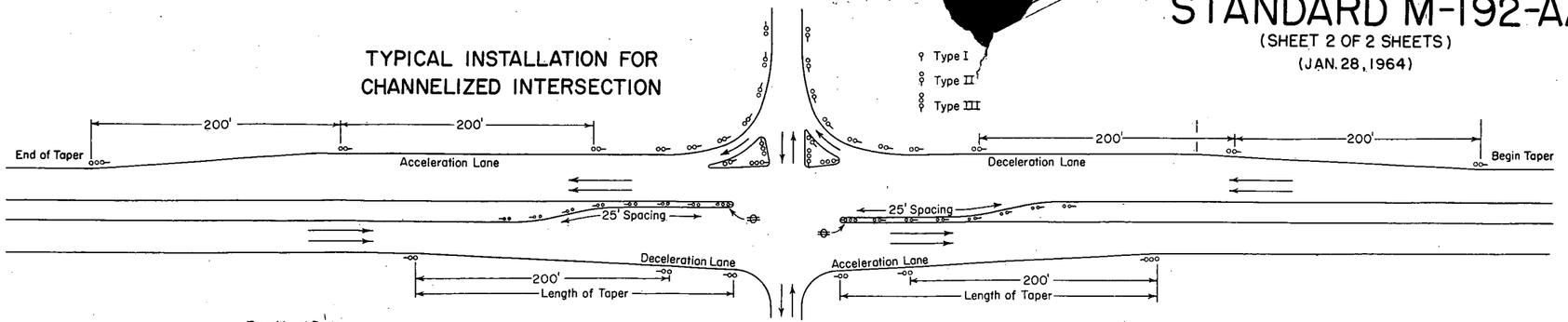
TYPICAL INSTALLATION FOR CHANNELIZED INTERSECTION



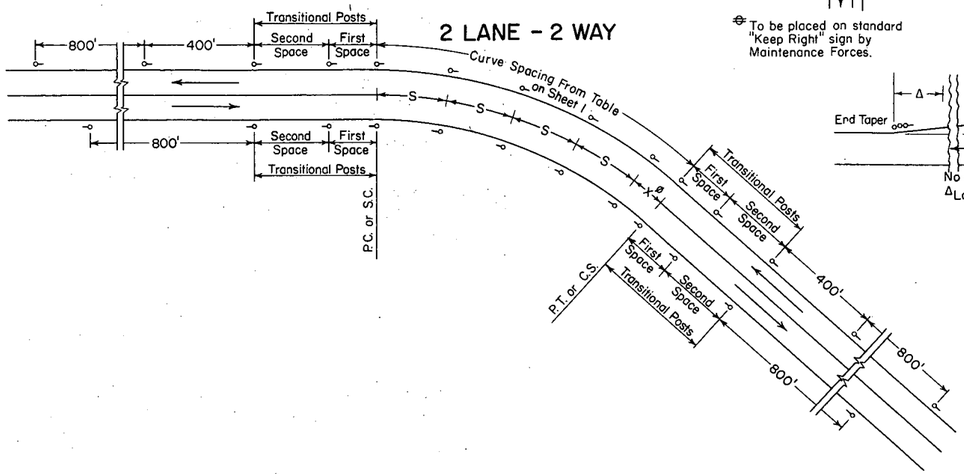
GENERAL NOTES

For Radii greater than 200 Feet, use spacing from Table incl... on Sheet 1 of this Standard.

For additional General Notes, see Sheet 1 of this Standard.

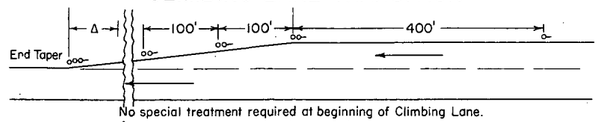
Place face of button at 90° to ℄ of roadway.

2 LANE - 2 WAY



⊖ To be placed on standard "Keep Right" sign by Maintenance Forces.

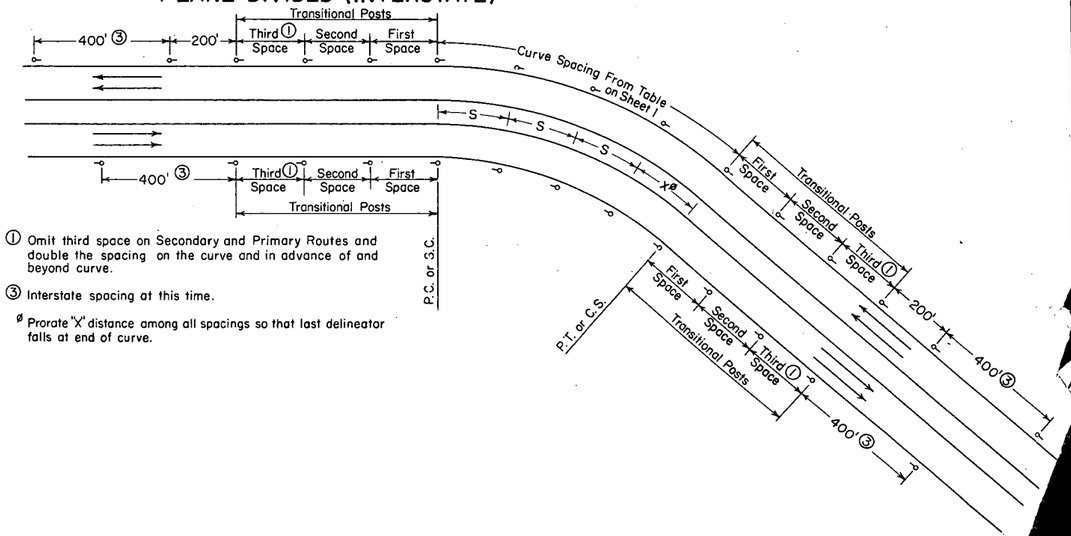
TYPICAL INSTALLATION FOR CLIMBING LANE TRANSITION



No special treatment required at beginning of Climbing Lane.

Δ Last space variable, not to exceed 100'

4 LANE DIVIDED (INTERSTATE)



① Omit third space on Secondary and Primary Routes and double the spacing on the curve and in advance of and beyond curve.

③ Interstate spacing at this time.

ø Prorate 'X' distance among all spacings so that last delineator falls at end of curve.

DEPARTMENT OF HIGHW...
STATE OF COLOR...

DELINEATO...

Designed by C.K.M.	App...
Made by T.E.F.	En...
Checked by	D...