4.0134

COLORADO DEPT. OF HIGHWAYS
Form C.D.H. 126
JANUARY 1954

TITLE SHEET

R.O.W. Purchased on F004-1(27)

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO	SHEET NO.
9	COLORADO	F004-1(34)	1

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

PLAN AND PROFILE OF PROPOSED

FEDERAL AID PROJECT NO. F 004-1(34)

STATE HIGHWAY NO. 1

ADAMS, JEFFERSON AND BOULDER COUNTIES

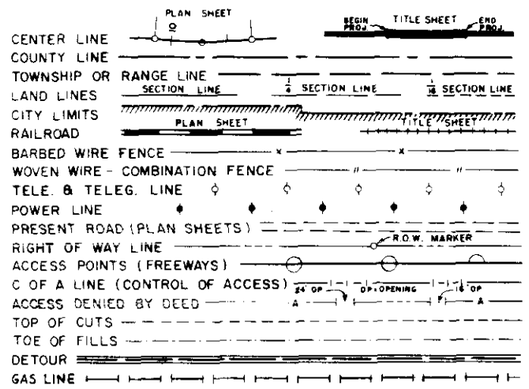
SCALES OF ORIGINAL DRAWINGS

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

INDEX OF SHEETS

CONVENTIONAL SIGNS



STA. 577+20.0 END F 004-1(34)=
STA. 577+20.0 BEGIN F 004-1(32)
4.4' Lt. of STA. 577+28.6 ON F.A.P. 222-A

TABULATION OF LENGTH AND DESIGN

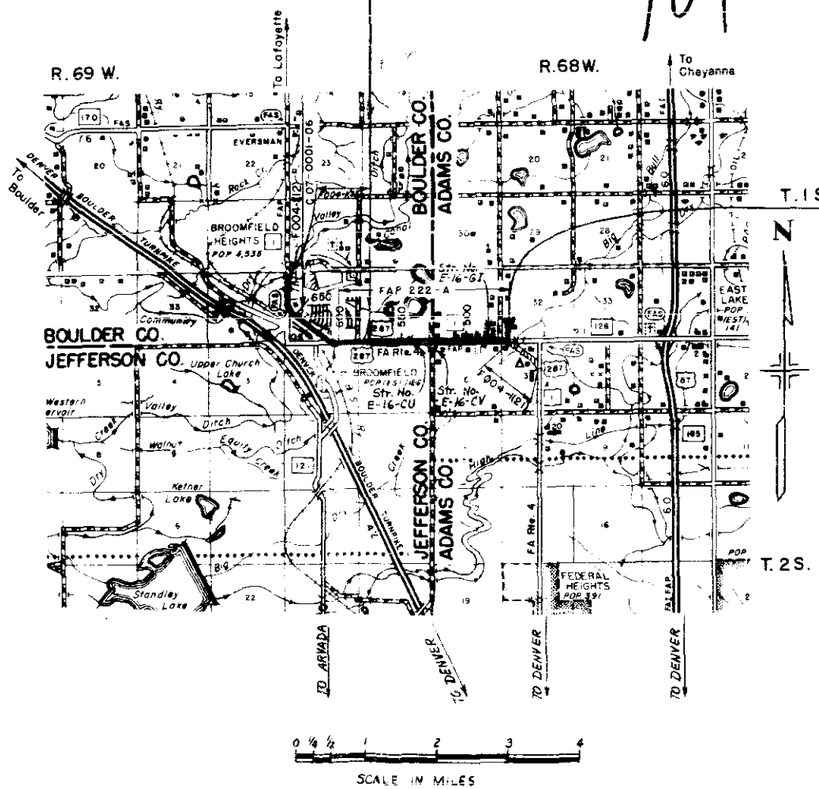
STATION	ROADWAY Adams Co.	ROADWAY Boulder Co.	MAJOR STRUCTURES Adams Co.	MAJOR STRUCTURES Boulder Co.	MAJOR STRUCTURES Loading
STA. 465+44.1 BEGIN F004-1(34) = STA. 465+44.1 END F004-1(21) 10' Lt. Sta. 465+44.1 on F.A.P. 222-A					
STA. 474+13.2 Bk. = STA. 474+02.0 Ah. } EQUATION	869.1				
STA. 481+56.7 } DOUBLE C.B.C. { STR. No. E-16-GI STA. 481+89.2 }	754.7		32.5		H-20-S-16-44
STA. 526+16.6 COUNTY LINE	4,427.4				
STA. 540+83.7 } DOUBLE C.B.C. { STR. No E-16-CU STA. 541+16.2 }		1,467.1		32.5	H-20-S-16-44
STA. 577+20 END F004-1(34) = STA. 577+20 BEGIN F004-1(32) 4.4' Lt. Sta. 577+28.6 on F.A.P. 222-A		3,603.8			
TOTALS	6,051.2	5,070.9	32.5	32.5	

SUMMARY

	LIN. FT.	MILES
ADAMS COUNTY		
ROADWAY	6,051.2	1.146
MAJOR STRUCTURE	32.5	0.006
TOTAL ADAMS COUNTY	6,083.7	1.152
BOULDER COUNTY		
ROADWAY	5,070.9	0.961
MAJOR STRUCTURE	32.5	0.006
TOTAL BOULDER COUNTY	5,103.4	0.967
PROJECT TOTAL (NET AND GROSS)	11,187.1	2.119

DESIGN DATA

MAXIMUM DEGREE OF CURVE	1°-15'
MAXIMUM GRADE	2.73 %
MINIMUM S.S.D. HORIZONTAL	>1,300'
MINIMUM S.S.D. VERTICAL	540'
MAXIMUM DESIGN SPEED	65 M.P.H.



STA. 465+44.1 BEGIN F004-1(34)=
STA. 465+44.1 END F004-1(21)
10' LT. STA. 465+44.1 on FAP 222-A

SEE SPECIAL PROVISIONS FOR NOTICE TO BIDDERS

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

APPROVED: _____ 7-24-64
CHIEF ENGINEER DATE

DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

APPROVED: _____ DATE

_____
DIVISION ENGINEER

J.L.C.

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F004-1(34)	2	

TYPICAL SECTIONS

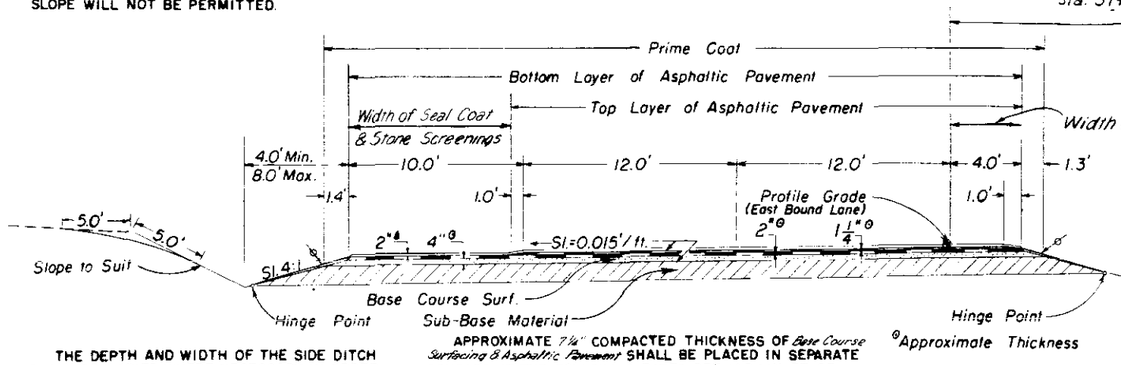
NOTE

SEE STANDARDS FOR DETAILS OF CUT SLOPE TREATMENT, FLARING AND WIDENING.

UNCL. EXCAVATION BELOW 4:1 SLOPE AND/OR 10:1 SLOPE WILL NOT BE PERMITTED.

TYPICAL SECTION A

Sta. 487+ to Sta. 510+ Lt. & Rt.
Sta. 510+ to Sta. 514+ Lt.
Sta. 514+ to Sta. 571+ Lt. & Rt.



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.

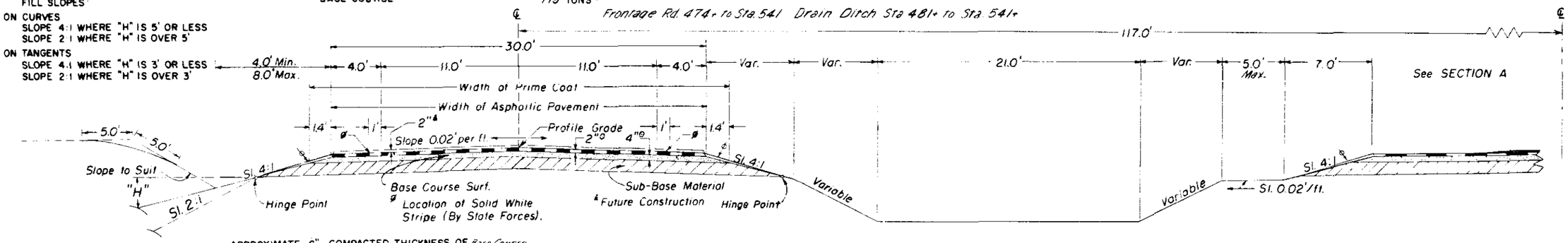
FILL SLOPES
ON CURVES
SLOPE 4:1 WHERE "H" IS 5' OR LESS
SLOPE 2:1 WHERE "H" IS OVER 5'
ON TANGENTS
SLOPE 4:1 WHERE "H" IS 3' OR LESS
SLOPE 2:1 WHERE "H" IS OVER 3'

APPROXIMATE 7½" COMPACTED THICKNESS OF *Base Course Surfacing & Asphaltic Pavement* SHALL BE PLACED IN SEPARATE COURSES AT THE FOLLOWING RATES PER 100 LIN. FT. OF ROADWAY:

ASPHALTIC PAVEMENT	TOP LAYER	43 TONS
BASE COURSE	BOTTOM LAYER	93 TONS
		175 TONS

TYPICAL SECTION OF FRONTAGE ROAD AND DRAINAGE DITCH

Frontage Rd. 474+ to Sta. 541 Drain Ditch Sta 481+ to Sta. 541+



APPROXIMATE 6" COMPACTED THICKNESS OF *Base Course Surfacing & Asphaltic Pavement* SHALL BE PLACED IN SEPARATE COURSES AT THE FOLLOWING RATES PER 100 LIN. FT. OF ROADWAY.

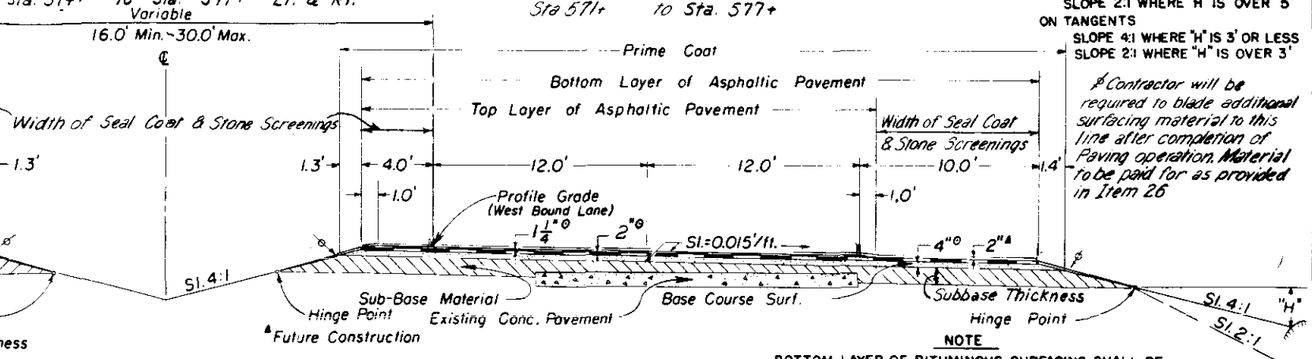
ASPHALTIC PAVEMENT	37 TONS
BASE COURSE	70 TONS

MATERIAL ABOVE THE SUBGRADE IS TO BE CONSTRUCTED OF SUB-BASE MATERIAL AT LOCATIONS DESIGNATED IN SUB-BASE MATERIAL TABULATION. ESTIMATED QUANTITIES INVOLVED IN THIS OPERATION AND THICKNESS OF MATERIAL REQUIRED ARE TABULATED IN THE SUB-BASE MATERIAL PLAN.

Transition Sec B to Sec A

Sta 482+ to Sta 487+

Sta 571+ to Sta 577+



FILL SLOPES:
ON CURVES
SLOPE 4:1 WHERE "H" IS 5' OR LESS
SLOPE 2:1 WHERE "H" IS OVER 5'
ON TANGENTS
SLOPE 4:1 WHERE "H" IS 3' OR LESS
SLOPE 2:1 WHERE "H" IS OVER 3'

@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

NOTE

BOTTOM LAYER OF BITUMINOUS SURFACING SHALL BE COMPLETED FOR FULL WIDTH BEFORE TOP LAYER OF BITUMINOUS SURFACING IS PLACED. PAVING JOINTS IN TOP LAYER WILL OVERLAP MIN. 1 FT. OVER JOINTS IN BOTTOM LAYER.

GENERAL NOTES

THIS PROJECT IS TO BE CONSTRUCTED IN CONFORMITY WITH THE STANDARD SPECIFICATIONS OF THE COLORADO DEPARTMENT OF HIGHWAYS, ADOPTED JANUARY 1, 1958.

ALL QUANTITIES ON PRELIMINARY PLANS ARE TO BE CONSIDERED APPROXIMATE ONLY.

ALL UTILITIES ENCROACHING ON CONSTRUCTION ARE TO BE MOVED BY THE OWNERS.
All Guard Posts and R.O.W. Markers are to be removed by State Forces.
All Advertising Signs to be moved by Owners.

APPLICATION METHODS, FOR LIQUID ASPHALTIC ROAD MATERIAL, WHICH RESULT IN THE DISCOLORATION OF CONCRETE PAVEMENT, CURBS OR GUTTERS WILL NOT BE PERMITTED.

THICKNESS OF SUB-BASE, 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

FOR PRELIMINARY PLAN QUANTITIES OF ASPHALTIC ROAD MATERIALS AND STONE SCREENINGS, THE FOLLOWING RATES OF APPLICATION WERE USED.

PRIME COAT	0.40 GALS. PER SQ. YD.
PRIME COAT (over Conc. Pavement)	*0.10 GALS. PER SQ. Yd.*
TACK COAT	*0.05 GALS PER SQ. Yd.*
SEAL COAT	0.35 GALS. PER SQ. YD.
STONE SCREENINGS	25 LBS. PER SQ. YD.

RATE OF APPLICATION AND GRADE OF ASPHALTIC MATERIAL SHALL BE AS DETERMINED BY THE ENGINEER AT TIME OF APPLICATION

During construction of this project, traffic will use the present traveled roadway.

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:
472+, Rt.; 499+, Lt.; 534+, Lt.

All side approach roads to the project shall be primed and paved with 2" of Asphaltic Surfacing to a distance out from edge of asphaltic surfacing as follows:
Field Approaches - 4 ft.
All other Approaches - 50 ft. or to the R.O.W. Line, whichever is less

COLORADO DEPARTMENT OF HIGHWAYS
FORM C. D. H. 128
JANUARY 1948

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F004-1(34)	3	

TYPICAL SECTIONS

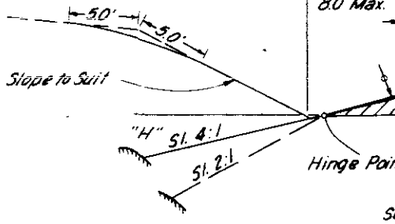
Note:
See Standards for Details of cut slope treatment, flaring and widening.

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

Fill Slopes:

On curves
Slope 4:1 where "H" is 5' or less
Slope 2:1 where "H" is over 5'

On tangents:
Slope 4:1 where "H" is 3' or less.
Slope 2:1 where "H" is over 3'

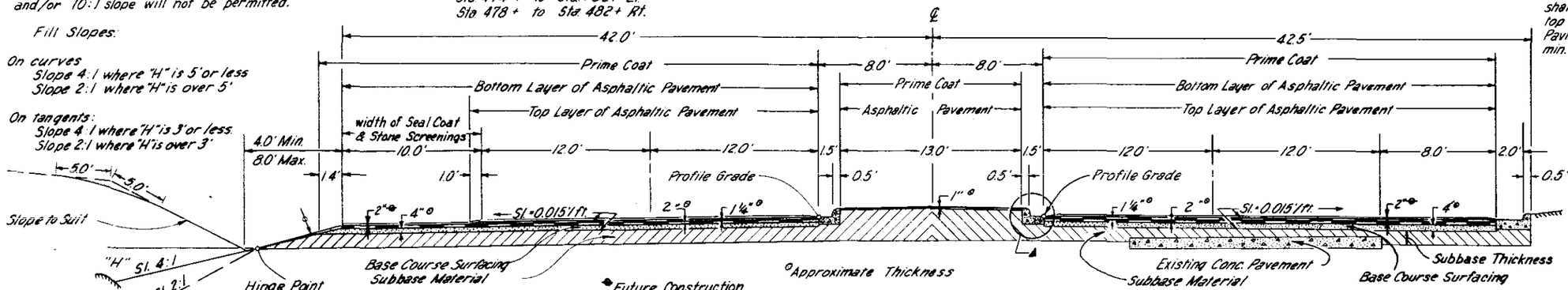


The depth and width of the side ditch shall be varied where necessary in order to provide proper drainage and/or entrance to drainage structures.

Contractor will be required to blade aditional surfacing material to this line after completion of paving operation. Material to be paid for as provided in Item 26.

1/2 TYPICAL SECTION B
Sta. 464 + to Sta. 474+ Rt. & Lt.
Sta. 474 + to Sta. 482+ Lt.
Sta. 478 + to Sta. 482+ Rt.

1/2 TYPICAL SECTION C
Sta. 474+ to Sta. 478+ Rt.

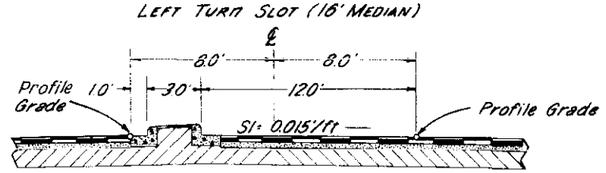


Approximate 7¼" compacted thickness of Base Course Surfacing and Asphaltic Pavement shall be placed in separate courses at the following rates per 100 lin. ft. of roadway:

* Asphaltic Pavement Top Layer	38	Tons
Asphaltic Pavement Bottom Layer	84	Tons
Base Course	155	Tons

* Does not include Median Pavement

LEFT TURN SLOT (16' MEDIAN)



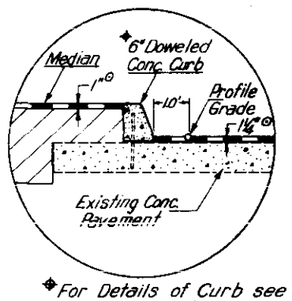
Approximate 7¼" compacted thickness of Base Course Surfacing and Asphaltic Pavement shall be placed in separate courses at the following rates per 100 lin. ft. of roadway:

* Asphaltic Pavement Top Layer	49	Tons
Asphaltic Pavement Bottom Layer	79	Tons
Base Course	143	Tons

* Does not include Median Pavement

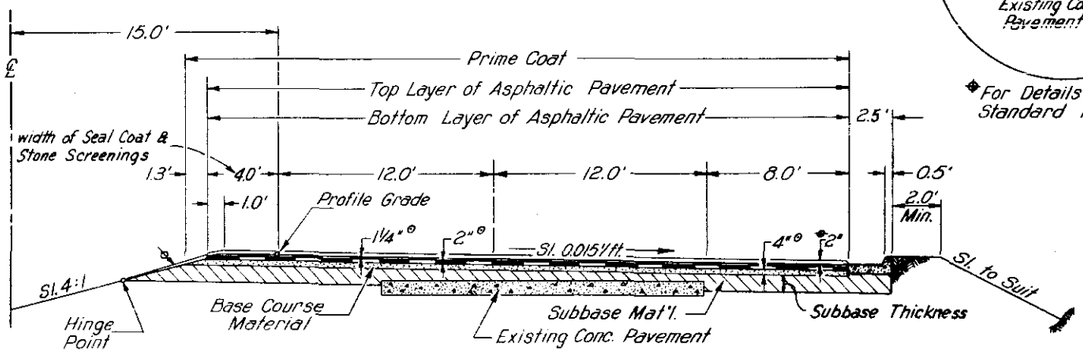
Note
Bottom layer of bituminous surfacing shall be completed for full width before top layer of bituminous surfacing is placed. Paving joints in top layer will overlap min. 1 ft. over joints in bottom layer.

◆ PLACEMENT OF DOWELED CURB
STA. 465+ to STA. 469+, Rt.



◆ For Details of Curb see Standard M-84-A.

1/2 TYPICAL SECTION D
STA. 510+ to STA. 514+, RT.



⊙ Approximate Thickness

◆ Future Construction

Approximate 7¼" compacted thickness of Base Course Surfacing and Asphaltic Pavement shall be placed in separate courses at the following rates per 100 lin. ft of roadway:

Asphaltic Pavement	Top Layer	55	Tons
	Bottom Layer	88	Tons
Base Course		163	Tons

SUMMARY OF APPROXIMATE QUANTITIES

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
•	COLORADO	F004-1(34)	4	

SPECIFICATION ITEM NO.	ITEM	UNIT	ADAMS COUNTY			BOULDER COUNTY			PROJECT TOTALS
			ROADWAY	C.B.C. STA. 481+	C.B.C. STA. 526+	ROADWAY	C.B.C. STA. 541+		
10	Clearing and Grubbing Entire Project	Lump Sum	•			•			•
11	Removal of Bridge, Sta. 541+	Each				1			1
11	Removal of Structures	Each	25			13			38
11	Reset Mailbox Structures	Each	6			6			12
11	Plug Culverts	Each	3			1			4
11	Removing Concrete Sidewalk	Sq. Ft.	10						10
11	Removing Concrete Pavement	Sq. Yd.	26	71		16	71		184
11	Removing Concrete Curb	Lin. Ft.	16			34			50
12	Reset Gates	Each	1						1
12	Removing Fence	Lin. Ft.	8,440			9,760			18,200
13	Unclassified Excavation	Cu. Yd.	42,800	2,000	300	27,100	800		73,000
13	Unclassified Ditch Excavation	Cu. Yd.	200			1,800			2,000
14	Unclassified Structural Excavation - Miscellaneous	Cu. Yd.	355	170	45	170	170		910
16	Structure Backfill (Class X)	Cu. Yd.	225	130	40	140	125		660
17	Compaction (Standard)	Cu. Yd.	66,000			29,000			95,000
17	Wetting	M Gal.	4,060			1,930			5,990
17	Water (Diluted Emulsified Asphalt)	M Gal.	105			85			190
18	Station Yard Overhaul	Sta. Yd.	169,400			10,600			180,000
18	Yard Mile Overhaul	Yd. Mi.	5,600						5,600
23	Subbase Material (Class 2)	Ton	74,325			37,675			112,000
26	Gravel or Crushed Rock Surfacing (Grading "C")	Ton	15,800			11,000			26,800
29	Asphalt (85-100 Penetration) (Tack Coat)	Ton	10			10			20
30	Asphaltic Road Material MC (Prime)	Gal.	31,700			21,200			52,900
30	Asphaltic Road Material RC (Seal)	Gal.	5,700			5,600			11,300
31	Stone Screenings (Type 1)	Ton	202			198			400
32	Plant Mixed Asphaltic Surfacing	Ton	10,962			7,678			18,640

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
FORM C. D. H. 113 (Mylar)

SUMMARY OF APPROXIMATE QUANTITIES

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F004-1(34)	5	

SPECIFICATION ITEM NO.	ITEM	UNIT	ADAMS COUNTY ROADWAY	ADAMS COUNTY C.B.C. STA. 481+	ADAMS COUNTY C.B.C. STA. 526+	BOULDER COUNTY ROADWAY	BOULDER COUNTY C.B.C. STA. 541+	PROJECT TOTALS
37	Concrete Pavement (6" Thick)	Sq. Yd.	26			16		42
45	18" Culvert Pipe	Lin. Ft.	686	15		692	30	1,423
45	24" Culvert Pipe	Lin. Ft.	124					124
46	Class "A" Concrete	Cu. Yd.	7	301	97	3	340	748
47	Reinforcing Steel	Lb.	220	32,600	10,080	100	36,900	79,900
65	Concrete Slope and Ditch Paving	Cu. Yd.	6			2		8
65	Concrete Slope and Ditch Paving (Wire Mesh)	Cu. Yd.		10			20	30
76	Barbed Wire Fence with Metal Posts	Lin. Ft.	6,200			6,800		13,000
76	Combination Wire Fence with Metal Posts	Lin. Ft.	2,850			2,150		5,000
76	Driveway Gates	Each	2			2		4
76	End Posts	Each	25			25		50
76	Corner and Line Brace Posts	Each	10			25		35
81	Right-of-Way Markers	Each	4			4		8
84	Concrete Curb (Type I)	Lin. Ft.	381					381
84	Concrete Combination Curb and Gutter (Type I)	Lin. Ft.	3,479					3,479
84	Concrete Combination Curb and Gutter (Type II)	Lin. Ft.	770					770
95	22"x13" Metal Aprons for Corrugated Metal Pipe Arch Culverts	Each	4			6		10
95	29"x18" Metal Aprons for Corrugated Metal Pipe Arch Culverts	Each	1					1
95	72"x44" Metal Aprons for Corrugated Metal Pipe Arch Culverts	Each	4					4
126	18" Slide Headgate (8 Ft. Frame)	Each	1					1
132	18" Reinforced Concrete Pipe Sewer (Class III)	Lin. Ft.				80		80
132	Inlet Grating and Frame (Median)	Each	2			1		3

SUMMARY OF APPROXIMATE QUANTITIES

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F004-1(34)	6	

SPECIFICATION ITEM NO.	ITEM	UNIT	ADAMS COUNTY			BOULDER COUNTY		PROJECT TOTALS
			ROADWAY	C.B.C. STA. 481+	C.B.C. STA. 526+	ROADWAY	C.B.C. STA. 541+	
134	22"x13" Corrugated Metal Pipe Arch Culverts	Lin. Ft.	104			126		230
134	29"x18" Corrugated Metal Pipe Arch Culverts	Lin. Ft.	120					120
134	72"x44" Corrugated Metal Pipe Arch Culverts	Lin. Ft.	60					60
192	Delineators (Type I)	Each	16			14		30
192	Delineators (Type II)	Each	65			40		105
192	Delineators (Type III)	Each	1					1
	FORCE ACCOUNT							
	Clearing of Building Sites, Etc.	Lump Sum	•			•		•
	Furnish and Install Identification Signs (Work by State Forces)	Each	1			1		2
	NON FEDERAL AID							
	Relocate Advertising Signs (Work by Owners)	Lump Sum						•
	Signing and Striping Entire Project (Work by State Forces)	Lump Sum						•
	Remove Flashing Yellow Units (Work by State Forces)	Lump Sum						•

COLORADO DEPARTMENT OF HIGHWAYS
FORM C. D. H. 126
JANUARY 1950

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F004-1(34)	7	

DELINEATORS

	STATION	TO	STATION	SIDE	SPACING	DELINEATORS TYPE I	DELINEATORS TYPE II	DELINEATORS TYPE III
ADAMS CO.	464+			Rt.	600'	1		
	464+	-	480+24	Lt.	800'	3		
	470+13	-	473+63	Rt.	Decl. Lane		3	
	474+50	-	479+80	Rt.	Accl. Lane		2	1
	480+24	-	525+	Rt. & Lt.	800'	12		
	498+50	-	503+50	Median	25'		20	#1
	514+40	-	519+40	Median	25'		20	#1
	520+97	-	525+97	Median	25'		20	#1
BOULDER CO.	526+37	-	531+37	Median	25'		20	#1
	526+	-	577+20	Rt. & Lt.	800'	14		
	535+80	-	540+80	Median	25'		20	#1
TOTAL - ADAMS COUNTY						16	65	1
TOTAL - BOULDER COUNTY						14	40	

To be furnished and to be placed on standard "Keep Right" sign by Maintenance Forces.

RIGHT-OF-WAY MARKERS

	STATION	SIDE	NEW EACH
ADAMS CO.	468+62	Rt.	
	480+00	Rt. & Lt.	2
	519+00	Rt. & Lt.	2
BOULDER CO.	545+00	Rt. & Lt.	2
	571+70.1	Rt. & Lt.	2
TOTALS - ADAMS COUNTY			4
TOTALS - BOULDER COUNTY			4

FENCING REQUIREMENTS

	STATION	TO	STATION	SIDE	REMOVING FENCE Lin. Ft.	BUILD FENCE B.W. Lin. Ft.	BUILD FENCE COMB. Lin. Ft.	GATES DRIVEWAY Each	GATES B.W Each	GATES RESET Each
ADAMS CO.	473+	-	499+	Lt.	3130				474+ Lt.	
	500+	-	525+	Lt.	2,670				491+ Lt.	
	468+	-	473+	Rt.	585					
	494+	-	495+	Rt.	195					
	500+	-	509+	Rt.	885					
	516+	-	526+	Rt.	950					
	473+	-	525+	Lt.		5,280			513+ Lt.	
	468+	-	473+	Rt.			570			
	478+	-	492+	Rt.			1,340			
	500+	-	509+	Rt.		920				
	516+	-	525+	Rt.			920			
	473+			Rt.						1
	480+			Rt.				1		
	492+			Rt.				1		
BOULDER CO.	526+	-	539+	Lt.	2,350					
	542+	-	572+	Lt.	3,180				552+ Lt.	
	529+	-	549+	Rt.	2,050				533+ Rt.	
	552+	-	574+	Rt.	2,150				535+ Rt.	
									539+ Rt.	
									546+ Rt.	
	526+	-	572+	Lt.		4,670			571+ Lt.	
	529+	-	549+	Rt.		2055				
	552+	-	574+	Rt.			2,105			
	565+			Rt.				1		
	571+			Rt.				1		
TOTAL - ADAMS COUNTY					8,415	6,200	2830	2		1
TOTAL - BOULDER COUNTY					9,730	6,725	2,105	2		-

If is estimated that 25 End Posts and 10 Corner and Line Brace Post for Adams County and 25 End Posts and 25 Corner and Line Brace Posts for Boulder County will be required.

Barbed Wire and Combination Wire spacing shown on Standard M-76-A is to be modified at locations designated by the Engineer.

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	F004-1(34)	8

SURFACING AND SUBBASE MATERIAL PLANS

The source of surfacing and subbase for this project is undesignated.

Estimated quantities involved in these operations are listed below.

Alteration of the surfacing or subbase plans as here outlined, will be allowed only on written permission from the department.

SUBBASE MATERIAL PLAN

	MATERIALS TO BE PLACED	SOURCE	*DESIGN THICKNESS (APPROX.)	SUBBASE (CLASS 2)			
			INCHES	TONS			
ADAMS COUNTY	465+44.1 to 468+70.7	UNDESIGNATED	16	2655			
	468+70.7 to 471+40.7		16	2,195			
	471+40.7 to 473+73.2		16	1,890			
	473+73.2 to 474+13.2 BK		16	325			
	474+02.0 AH to 474+42		16	325			
	474+42 to 476+72		16	1,771			
	476+72 to 478+30		16	1,252			
	478+30 to 479+42		16	859			
	479+42 to 482+00		16	2126			
	482+00 to 484+14		16	1,749			
	484+14 to 510+25		16	19,711			
	510+25 to 514+00		16	2,842			
	514+00 to 523+82		16	7,535			
	523+82 to 526+16.6		13	1,435			
	FRONTAGE ROAD						
	474+02.0 AH to 523+82		16	17,094			
	523+82 to 526+16.6		13	610			
	Est. for: Correcting irregularities.			0,622			
	Accel.-Decel Lanes						
	470+ to 479+		16	294			
	Median openings and turning lanes						
	497+ to 503+		16	457			
	507+ to 512+		16	457			
	516+ to 522+		16	457			
	521+ to 531+		16-13	642			
	468+ to 479+		16	≠			
	Add. to build median			975			
BOULDER COUNTY	526+16.6 to 575+66		13	28,881			
	575+66 to 577+20		13	773			
	FRONTAGE ROAD						
	526+16.6 to 541+00		13	4117			
	Est. for: Correcting irregularities.			3,415			
	Median opening and turning lane						
	536+ to 541+		13	374			
	Add. to build median			112			
	Adams Co. Totals			74,278			
	Boulder Co. Totals			37,672			

* Based on design curve "E"

SURFACING MATERIAL PLAN

	MATERIALS TO BE PLACED	SOURCE	TONS USED: TOP LAYER PLANT MIX		BOTTOM LAYER PLANT MIX		BASE COURSE GRADING E*			
ADAMS COUNTY	465+44.1 to 468+70.7	UNDESIGNATED	124		204		376			
	468+70.7 to 471+40.7		113		186		343			
	471+40.7 to 473+73.2		107		174		321			
	473+73.2 to 474+13.2 BK		20		41		76			
	474+02.0 AH to 474+42		20		41		76			
	474+42 to 476+72		120		219		398			
	476+72 to 478+30		80		147		267			
	478+30 to 479+42		47		93		171			
	479+42 to 482+00		98		217		400			
	482+00 to 484+14		88		190		353			
	484+14 to 510+25		1,123		2,428		4,569			
	510+25 to 514+00		188		341		638			
	514+00 to 523+82		422		913		1,719			
	523+82 to 526+16.6		101		218		411			
	FRONTAGE ROAD									
	474+02.0 AH to 523+82				1,843		3,486			
	523+82 to 526+16.6				87		164			
	Est. for: Blading slope material From structure quantities				244		930 488			
	Accel-Decel Lanes									
	470+ to 479+		66		42		74			
	Median opening and turning lanes									
	497+ to 503+		39		66		118			
	507+ to 512+		39		66		118			
	516+ to 522+		39		66		100			
	521+ to 531+		70		114		204			
	468+ to 479+		≠		≠		≠			
	Appr. to Project		2		2					
	Add. to build median (1" thick)				105					
BOULDER COUNTY	526+16.6 to 575+66		2128		4603		8661			
	575+66 to 577+20		63		137		254			
	FRONTAGE ROAD									
	526+16.6 to 541+00				549		1,038			
	Est. for: Blading slope material. from list of structures.				78		692 207			
	Median opening and turning lane									
	536+ to 541+		41		66		118			
	Add. to build median (1" thick)				12					
	Sub Totals ADAMS CO. / BOULDER CO.		2,906 / 2,232		8,047 / 5,445					
	Adams Co. Totals			10,953			15,800			
	Boulder Co. Totals			7,677			10,970			

≠ Included in main line quantities

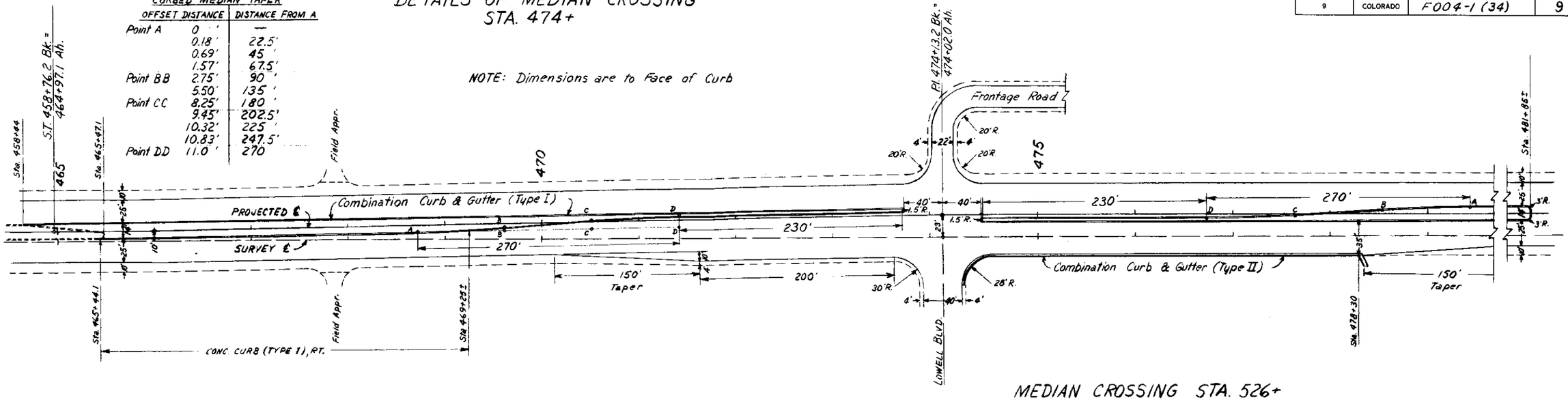
FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	F004-1 (34)	9

DETAILS OF MEDIAN CROSSING STA. 474+

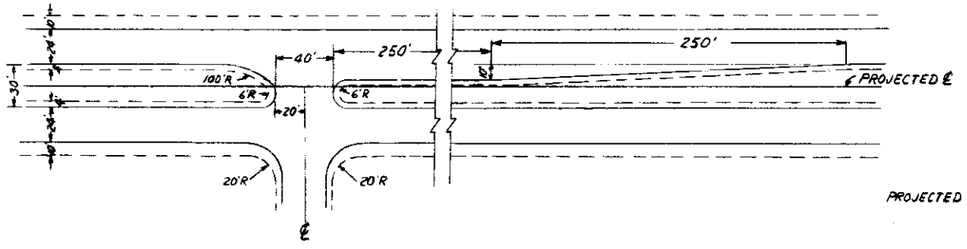
NOTE: Dimensions are to Face of Curb

CURBED MEDIAN TAPER

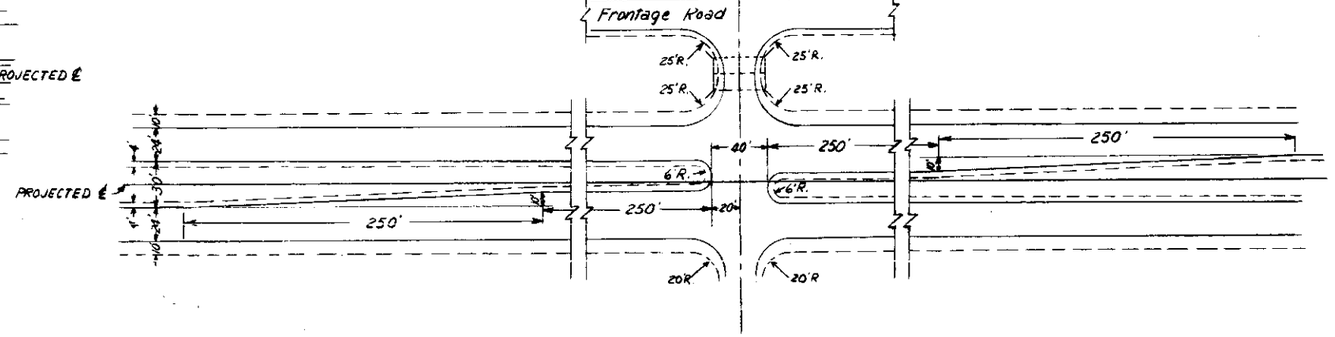
	OFFSET DISTANCE	DISTANCE FROM A
Point A	0 '	—
	0.18 '	22.5 '
	0.69 '	45 '
	1.57 '	67.5 '
Point BB	2.75 '	90 '
	5.50 '	135 '
Point CC	8.25 '	180 '
	9.45 '	202.5 '
	10.32 '	225 '
	10.83 '	247.5 '
Point DD	11.0 '	270



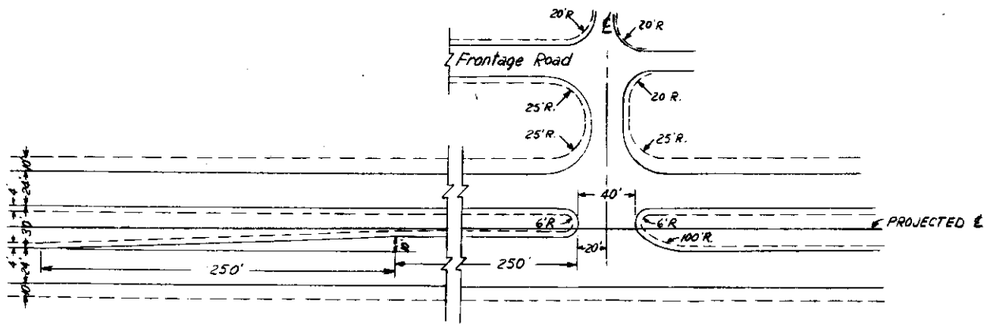
MEDIAN CROSSING STA. 498+ , 507+ & 516+



MEDIAN CROSSING STA. 526+



MEDIAN CROSSING STA. 541+



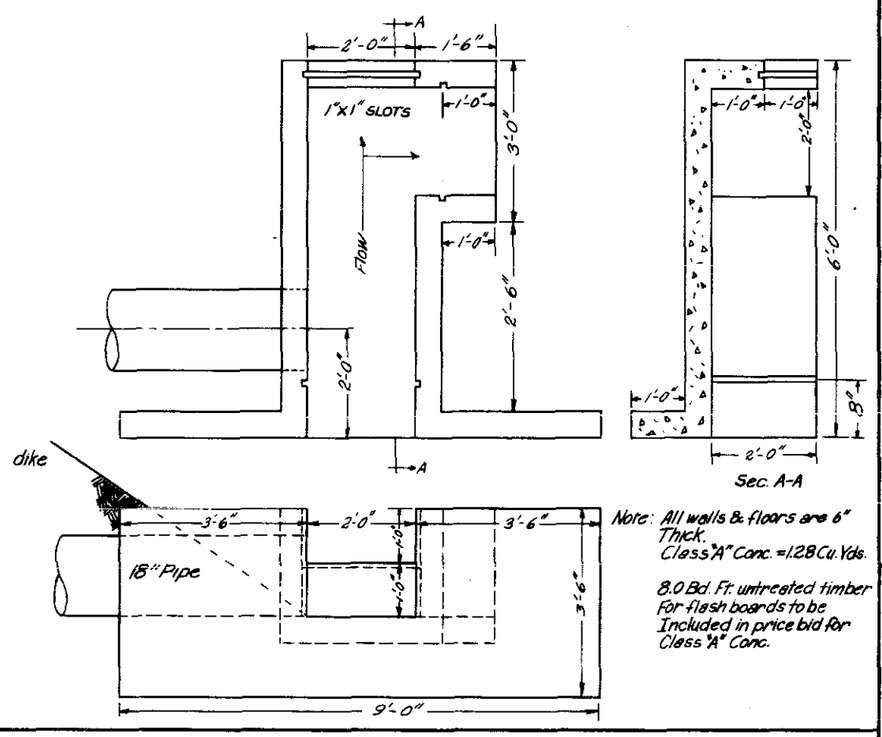
CONCRETE REQUIREMENTS

	STATION TO STATION	SIDE	CONCRETE CURB TYPE I LIN. FT.		CONCRETE CURB & GUTTER TYPE I LIN. FT.		COMBINATION CURB & GUTTER TYPE II LIN. FT.		REMOVE CONCRETE CURB LIN. FT.	
ADAMS CO.	465+44.1 - 469+	Rt. Median	381							
	458+	Lt. Median							11	
	458+44 - 473+73.2	Median			1,977					
	465+	Rt. Median							5	
	474+42 - 481+85	Median			1,502					
	474+24 - 478+30	Rt.					400			
	510+25 - 514+00	Rt.					370			
BOULDER CO.	549+	Rt.							14	
	551+	Rt.							20	
	TOTALS ADAMS CO.		381		3,479		770		16	
	TOTALS BOULDER CO.								34	

DEPARTMENT OF HIGHWAYS—STATE OF COLORADO
FORM NO. H. 126
MARCH 1964

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F004-1(34)	10	

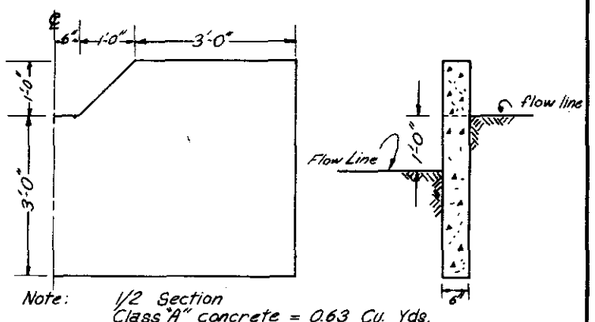
DETAIL OF DIVISION BOX STA. 521+



Note: All walls & floors are 6" Thick.
Class "A" Conc. = 1.28 Cu. Yds.

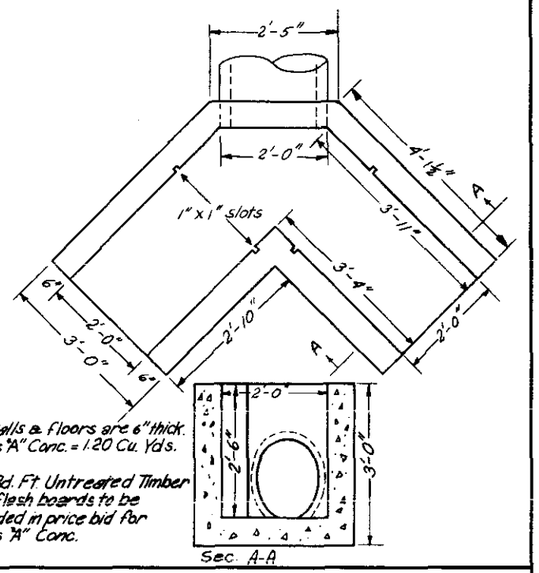
8.0 Bd. Ft. untreated timber For flash boards to be Included in price bid for Class "A" Conc.

DETAIL OF CONCRETE DITCH CHECK



Note: 1/2 Section
Class "A" concrete = 0.63 Cu. Yds.

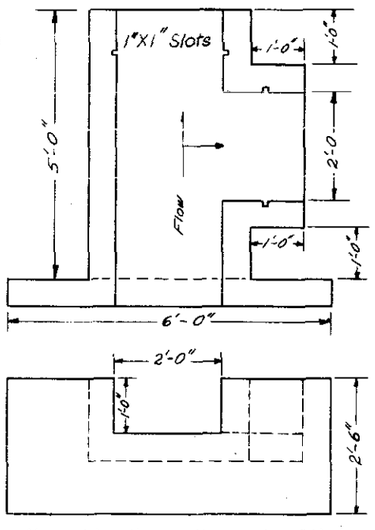
DETAIL OF DIVISION BOX STA. 578+00



Note: All walls & floors are 6" thick.
Class "A" Conc. = 1.20 Cu. Yds.

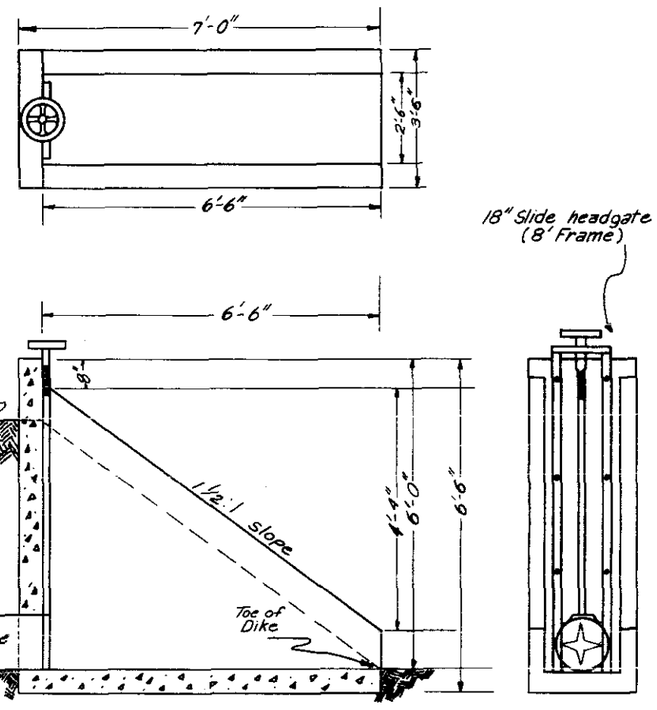
4.0 Bd. Ft. Untreated Timber For flash boards to be Included in price bid For Class "A" Conc.

DETAIL OF DIVISION BOX STA. 513+70 554+90



Note: All walls and floors to be 6" thick.
Class "A" Concrete = 0.76 Cu. Yds.
2.0 Bd. Ft. Unt timber for flash Boards to be included in price bid For class "A" Conc.

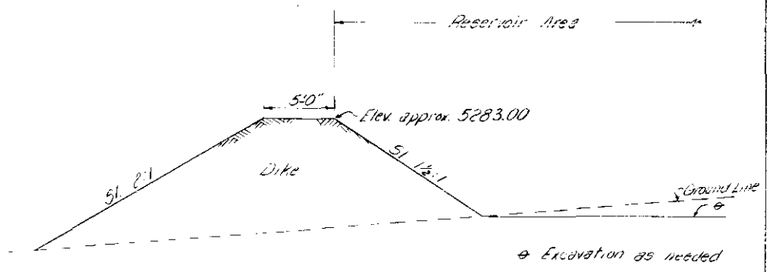
DETAIL OF CONC. OUTLET & SLIDE HEADGATE INSTALLATION FOR RESERVOIR STA. 521+



Note: All walls & floors to Be 6" thick.
Class "A" Conc. = 1.60 Cu. Yds.

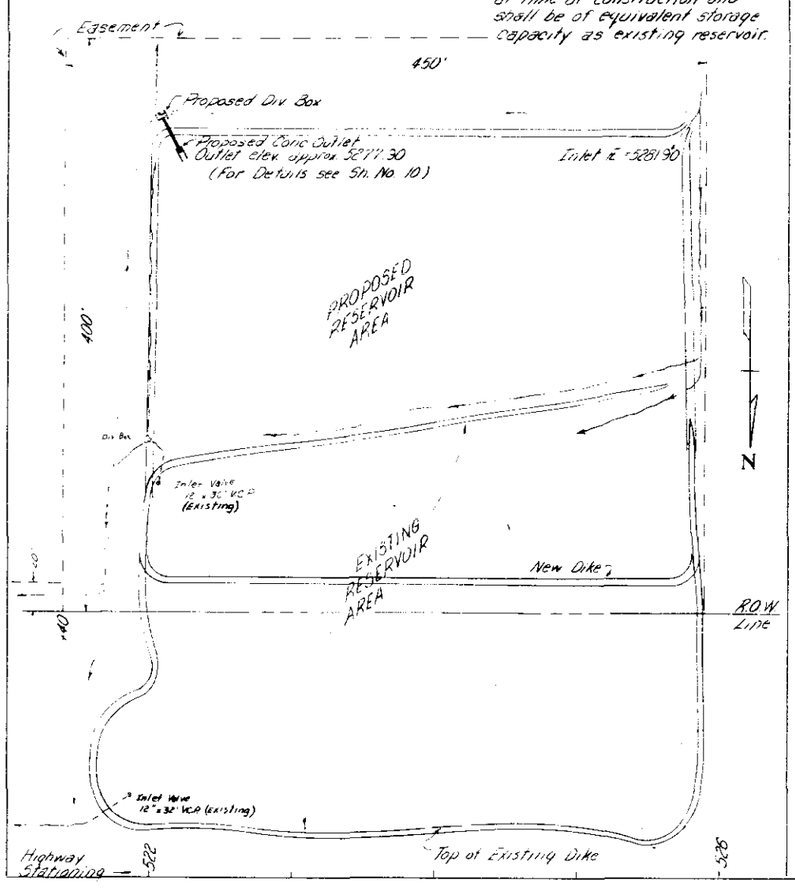
COLORADO DEPARTMENT OF HIGHWAYS
FORM NO. D. H. 126
JANUARY 1969

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	F 004 - 1(34)	11	

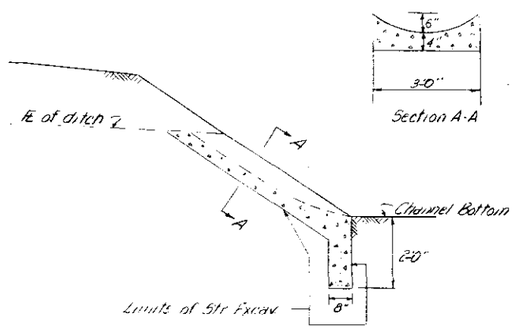


DETAIL OF RESERVOIR RELOCATION STA. 521+ LT.

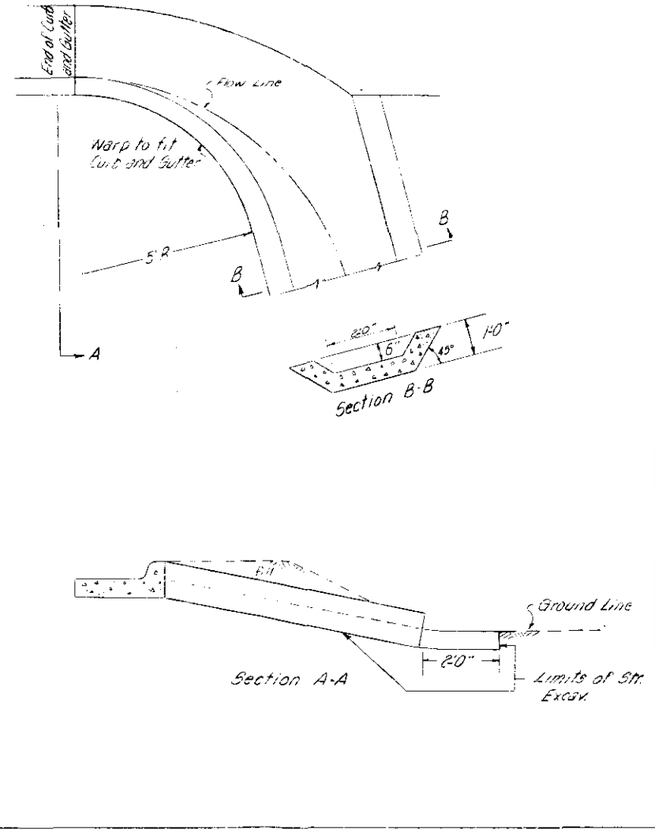
NOTE: The sketch below is shown for the convenience of the Contractor only. The actual dimensions of the proposed reservoir are to be determined at time of construction and shall be of equivalent storage capacity as existing reservoir.



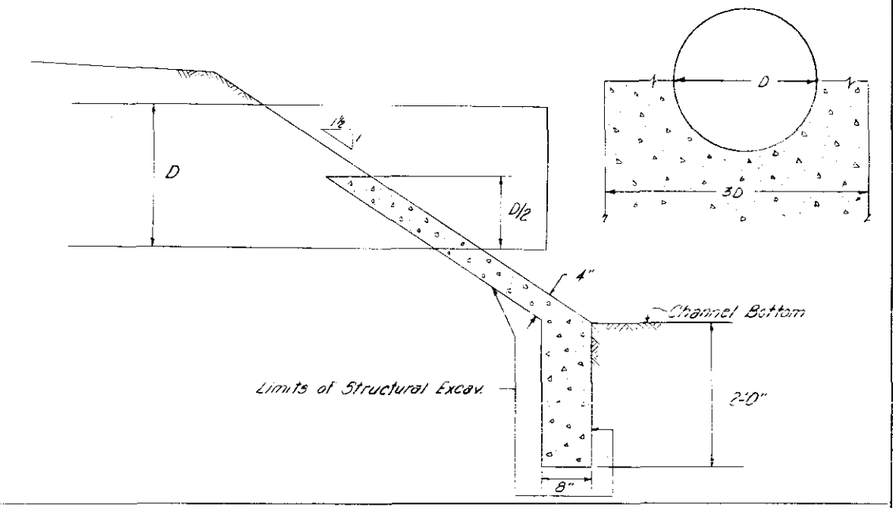
DETAIL OF
CONC. PAVED RUNDOWN
STA. 481+



DETAIL OF
CONC. PAVED RUNDOWN
STA. 478+30 Rt
510+25 Rt

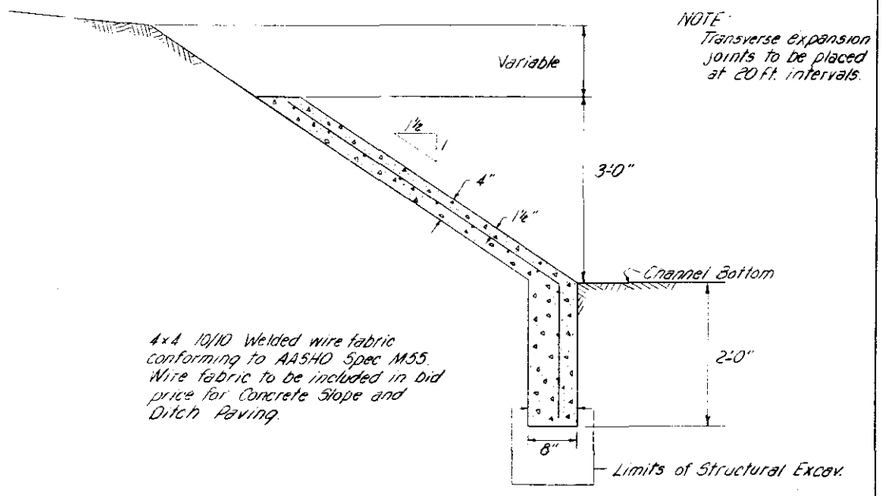


DETAIL OF
CONCRETE SLOPE AND DITCH PAVING
FOR CULVERT OUTLETS



DETAIL OF
CONCRETE SLOPE AND DITCH PAVING
FOR CHANNEL

INLET STA. 481+
INLET AND OUTLET STA. 541+



4x4 10/10 Welded wire fabric conforming to AASHO Spec M55. Wire fabric to be included in bid price for Concrete Slope and Ditch Paving.

COLORADO DEPARTMENT OF HIGHWAYS
FORM C.D.H. 125
OCTOBER 1960

STRUCTURE QUANTITIES

FED. ROAD REGION NO.	DIVISION	PROJECT NUMBER	SHEET NO.
9	COLO.	F004-1(34)	12

ADAMS COUNTY

LOCATION	MISCELLANEOUS	REMOVAL OF STRUCTURES	EXCAVATION CUBIC YARDS			UNCLASSIFIED STRUCTURAL EXCAVATION	STRUCTURE BACKFILL	GRAVEL OR CRUSHED ROCK SURFACING	PLANT MIXED ASPHALTIC SURFACING	CONCRETE	REINFORCING STEEL	HEIGHT OF COVER	CULVERT PIPE LINEAR FEET		CORRUGATED METAL PIPE ARCH CULVERT LINEAR FEET		CONCRETE SLOPE AND DITCH PAVING	CULVERT END SECTIONS NO.	
		NO.	UNCL.	EMB.	UNCL. DITCH	CUBIC YARDS MISC.	CUBIC YARDS CL. X	TONS	TONS	CUBIC YARDS CL. "A"	LBS.	FT.	18"	24"	22"x13"	29"x18" 72"x44"	CU. YDS.	18"	24"
464+ to 465+									ø										
467+86		2	10			25	10	26	4			1	{36 36					4	
474+020 Ah.			50					72	36										
474+020 Ah	4-72"x44" Metal Aprons for Corrugated Metal Pipe Arch Culverts					75	40									{30 30			
474+			4					ø	ø										
474+ to 541+			4	4				ø	ø										
475+	10 Sq. Ft. - Remove Conc. Sidewalk																		
475+05				5				4	2										
476+80				5				4	2										
478+30						5											1		
481+	1- Plug Culverts																		
T 481+56.7 to 481+89.2	T71 Sq. Yds. - Remove Conc. Pavement; 10 Cu. Yds Conc. Slope & Ditch Paving (Wire Mesh)		T2000			T170	T130			T30.96	T32,570	T2	T15					T1	
481+ to 540+			4																
481+						5											1		
488+00	1- Plug Culverts																		
491+00				20		5	6	12	6			1	34					2	
492+20		1		20		10	10	25	14			1	56					2	
493+40		1		10		5	6	12	6			1	34					2	
497+10		1	20			10	10	25	14			1	56					2	
498+33		1	10					30	16										
498+				4				ø	ø										
499+		1																	
499+00	8 Sq. Yds. - Remove Conc. Pavement, 8 Sq. Yds. Conc. Pavement (6" Thick) 1- Inlet Grating & Frame (Median)					55	25			1.26	116	3.5	{70 54				1	1	
500+00				35				12	6										
500+10		3		5		10	6	12	6			1	34					2	
500+42	1- Plug Culverts	1																	
504+ to 521+					130														
507+60	2- Metal Aprons for 22"x13" C.M.A.P.			15		20	14	30	16			1	56		52			2	
507+				4				ø	ø										
509+90		1				4	3			0.63									
509+90		1		20		5	6	12	6			1	34					2	
510+25						5											1		
511+34		1																	
513+25		1																	
513+50				10		5	11	12	6			1	{26 38					4	

COLORADO DEPARTMENT OF HIGHWAYS
FORM C.D.H. 125
OCTOBER 1960

STRUCTURE QUANTITIES

FED. ROAD REGION NO.	DIVISION	PROJECT NUMBER	SHEET NO.
9	COLO.	F004-1(34)	13

LOCATION	MISCELLANEOUS	REMOVAL OF STRUCTURES	EXCAVATION CUBIC YARDS			UNCLASSIFIED STRUCTURAL EXCAVATION	STRUCTURE BACKFILL	GRAVEL OR CRUSHED ROCK SURFACING	PLANT MIXED ASPHALTIC SURFACING	CONCRETE	REINFORCING STEEL	HEIGHT C/F COVER	CULVERT PIPE LINEAR FEET	CORRUGATED METAL PIPE ARCH CULVERT LINEAR FEET	CONCRETE SLOPE AND DITCH PAVING	CULVERT END SECTIONS NO.	
		NO.	UNCL.	EMB.	UNCL. DITCH	CUBIC YARDS MISC.	CUBIC YARDS CL. X	TONS	TONS	CUBIC YARDS CL. "A"	LBS.	FT.	18" 24"	22"x13" 29"x18" 72"x44"	CU. YDS.	18" 24"	
ADAMS COUNTY	513+70	1				5	2			0.78							
	514+20			30				30	16								
	514+50	2															
	514+90	1															
	515+00	9 Sq. Yds.-Remove Conc. Pavement; 9 Sq. Yds. Conc. Pavement (8" Thick) 1-Inlet Grating & Frame (Median)				25	20			1.13	100	3	55 67		1	1	
	516+80	2-Metal Aprons for 22"x13" C.M.A.P.	1	15		20	14	30	16			1	56	52		2	
	516+ 521+ to 525+	1-18" Slide Headgate (8 Foot Frame)	3	4000		15	10	ø	ø	1.60		6	20				
	521+				20	5	2			1.28							
	521+ to 525+				30												
	525+60	9 Sq. Yds.-Remove Conc. Pavement; 9 Sq. Yds. Conc. Pavement (8" Thick) 1-Metal Apron for 29"x18" C.M.A.P.				30	20							120	1		
	526+17		2	75		5	10	140	72			1	48			2	
	T 526+17			T 300		T 45	T 40			T 96.92	T 10,050						
	526+			▲				ø	ø								
BOULDER COUNTY	526+70	1-Inlet Grating and Frame (Median)				25	20			1.00	93	2	51 67		2	1	
	527+75		1	10		5	5	12	6			1	34			2	
	528+75		1	10		5	5	12	6			1	34			2	
	533+ to 578+				1600												
	534+25	2-Metal Aprons for 22"x13" C.M.A.P.	1	25		5	9	12	6			1	34	22		2	
	535+55		1	5		5	6	11	2			1	34			2	
	541+00			10				11	2								
	T 540+83.7 to 541+16.2	T 71 Sq. Yds.-Remove Conc. Pavement; T 20 Cu. Yds. Conc. Slope & Ditch Paving (with wire mesh).		T 800		T 170	T 125			T 33.979	T 36,886		T 30			T 1	
	541+00	1-Remove Bridge	1	75		25	16	55	28			1	40 56			4	
	541+15			20		5	5	11	2			1	26			2	
	541+			▲				ø	ø								
	541+ to 546+			▲													
	544+10		1														
	546+00			30		15	6	11	2			2.5	36			2	
	549+65		1	15		5	6	12	6			1	32			2	

COLORADO DEPARTMENT OF HIGHWAYS
FORM C.D.H. 125
OCTOBER 1960

STRUCTURE QUANTITIES

FED. ROAD REGION NO.	DIVISION	PROJECT NUMBER	SHEET NO.
9	COLO.	F004-1(34)	14

BOULDER COUNTY

LOCATION	MISCELLANEOUS	REMOVAL OF STRUCTURES	EXCAVATION CUBIC YARDS			UNCLASSIFIED STRUCTURAL EXCAVATION	STRUCTURE BACKFILL	GRAVEL OR CRUSHED ROCK SURFACING	PLANT MIXED ASPHALTIC SURFACING	CONCRETE	REINFORCING STEEL	HEIGHT OF COVER	CULVERT PIPE LINEAR FEET	CORRUGATED METAL PIPE ARCH CULVERT LINEAR FEET	CONCRETE SLOPE AND DITCH PAVING	CULVERT END SECTIONS NO.	
		NO.	UNCL.	EMB.	UNCL. DITCH	CUBIC YARDS MISC.	CUBIC YARDS CL. X	TONS	TONS	CUBIC YARDS CL. "A"	LBS.	FT.	18" 24"	22"x13" 29"x18" 72"x44"	CU. YDS.	18" 24"	
551+50		1		10		5	6	12	6			1	32			2	
552+50		1	15			15	10	11	2			1	{26 38			4	
552+ to 571+					150												
554+00	8 Sq. Yds - Remove Conc. Pavement; 8 Sq. Yds - Conc. Pavement (6" Thick) 2-Metal Aprons for 22"x13" C.M.A.P.			5		10	6							52			
554+90						5	2			0.76							
556+70	1-Plug Culverts																
559+00		1															
565+60		1		25		10	10	11	2			1	{26 32			4	
566+00	8 Sq. Yds - Remove Conc. Pavement; 8 Sq. Yds - Conc. Pavement (6" Thick) 2-Metal Aprons for 22"x13" C.M.A.P.			5	5	10	6							52			
571+25		1		10		5	6	11	2			1	34			2	
572+00		1	30			10	10	15	6			1	{34 26			4	
578+00						5	2			1.20							
578+00 to 578+80	*80 Lin. Ft. - 18" Reinforced Concrete Pipe Sewer (Class II)																
TOTALS ADAMS CO		25	90	4265	180	349	225	488	244	666	216		686 124	104 120 60	6		
TOTALS BOULDER CO		13	45	255	1755	170	136	207	78	296	93		692	126	2		

◊ Quantities included in Subbase & Surfacing Plans
▲ Quantities included in Earthwork Profile
* Includes one (1) 7°30' Angle Section
† Quantities not included in Structure Quantities Totals

PROFILE FRONTAGE ROAD
STA. 474+ TO STA. 541+

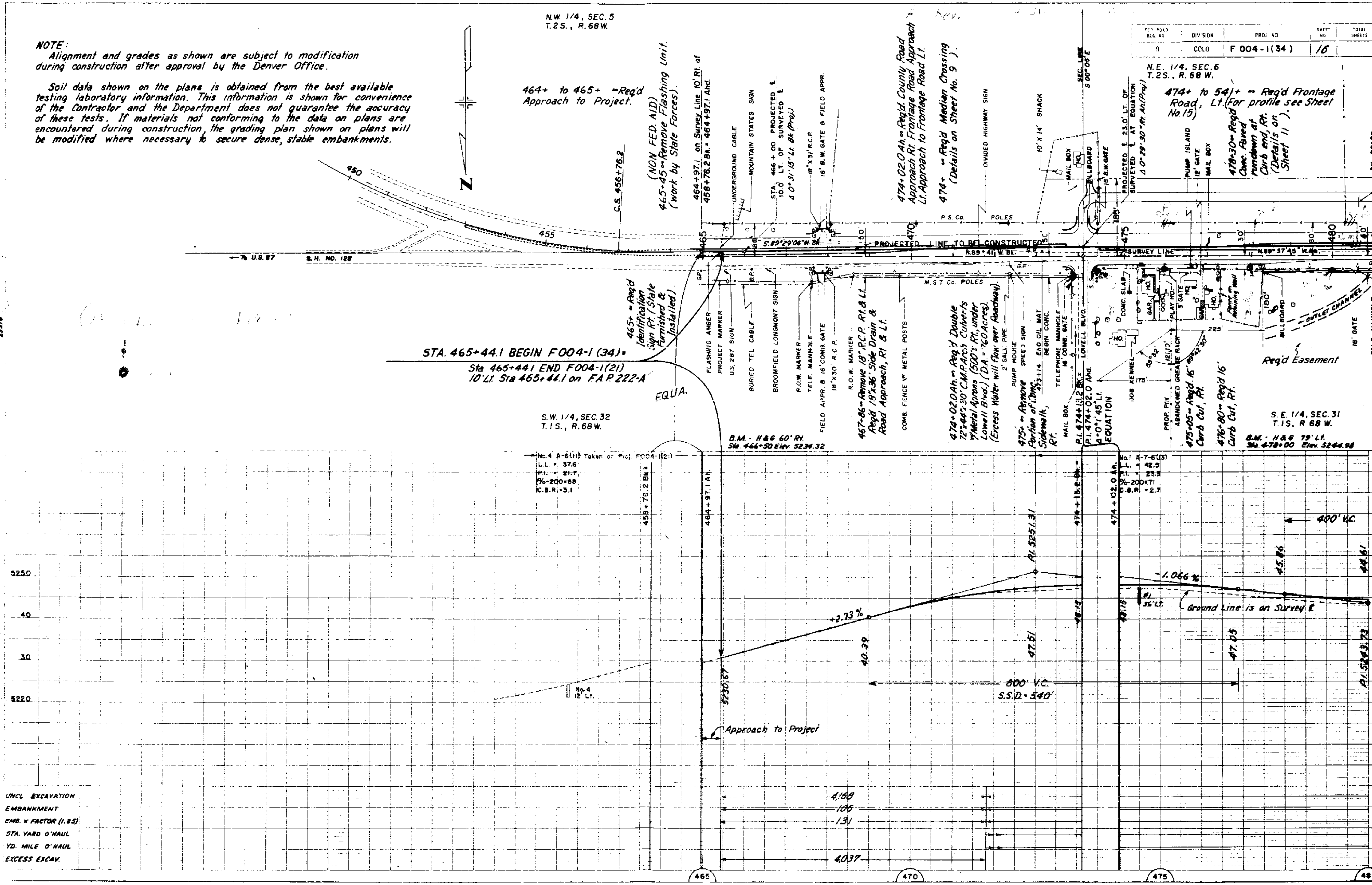
FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.
9	COLORADO	F004-1(34)	15

BEGIN FRONTAGE RD. STA. 474+02.0
46.70
- 0.275 %
45.05
400' V.C.
15.21
P.I. 5244.50
46.80
+ 1.15 %
49.10
P.I. 5251.40
50.99
400' V.C.
+ 0.33 %
52.06
53.38
54.83
P.I. 5254.04
400' V.C.
57.84
+ 1.90 %
61.64
60
50
5240
470
475
480
485
490
495
500
61.64
400' V.C.
P.I. 5265.41
65.09
67.84
+ 1.20 %
75.04
P.I. 5277.44
76.98
400' V.C.
78.00
+ 0.28 %
79.40
400' V.C.
80.28
P.I. 5279.96
81.81
+ 0.927 %
83.67
P.I. 5284.13
84.01
84.13
100' V.C.
0.00 %
84.13
84.27
100' V.C.
84.68
P.I. 5284.13
+ 1.10 %
90
80
70
5260
500
505
510
515
520
525
530
+ 1.10 %
91.83
P.I. 5292.93
92.77
200' V.C.
93.41
+ 0.475 %
95.78
END FRONTAGE ROAD STA. 541+00
300
5290
530
535
540

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO	F 004-1(34)	16	

NOTE:
Alignment and grades as shown are subject to modification during construction after approval by the Denver Office.

Soil data shown on the plans is obtained from the best available testing laboratory information. This information is shown for convenience of the Contractor and the Department does not guarantee the accuracy of these tests. If materials not conforming to the data on plans are encountered during construction, the grading plan shown on plans will be modified where necessary to secure dense, stable embankments.



N.W. 1/4, SEC. 5
T.2S., R.68W.
N.E. 1/4, SEC. 6
T.2S., R. 68 W.
S.W. 1/4, SEC. 32
T.1S., R.68W.
S.E. 1/4, SEC. 31
T.1S., R 68 W.
464+ to 465+ = Req'd Approach to Project.
(NON FED. AID) 465+45 = Remove Flashing Unit. (work by State Forces).
464+97.1 on Survey Line 10' Rt. of 458+76.2 Bk. = 464+97.1 Ahd.
C.S. 456+76.2
STA. 466+00 PROJECTED ℄ 10.0' LT. OF SURVEYED ℄ Δ 0°31'15" Lt. Bk (Proj.)
474+02.0 Ah. = Req'd County Road Approach Rt. Frontage Road Approach Lt. Approach to Frontage Road Lt.
474+ = Req'd Median Crossing (Details on Sheet No. 9).
474+ to 541+ = Req'd Frontage Road, Lt. (For profile see Sheet No. 15)
478+30 = Req'd Conc. Paved rundown at Curb end, Rt. (Details on Sheet 11).
PROJECTED ℄ 23.0' LT. OF SURVEYED ℄ AT EQUATION Δ 0°29'30" Rt. Ah (Proj.)
SEC. LINE S 00°05'E
P.S. Co. POLES
M.S.T. Co. POLES
PROJECTED LINE TO BE CONSTRUCTED
SURVEY LINE
S.89°29'06"W. Bk.
N.89°41' W. Bk.
N.89°37'45"W. Ah.
To U.S. 87
S.H. NO. 128
465+ = Req'd Identification Sign Rt. (State Furnished & Installed)
STA. 465+44.1 BEGIN F004-1 (34) = Sta. 465+44.1 END F004-1(21) 10' Lt. Sta 465+44.1 on F.A.P. 222-A
EQUA.
467+86 = Remove 18" R.C.P. Rt. & Lt. Req'd 18"x36" Side Drain & Road Approach, Rt. & Lt.
474+02.0 Ah. = Req'd Double 72"x44"x30' C.M.P. Arch Culverts w/Metal Aprons (500 ± Rt. under Lowell Blvd.) (D.A. = 760 Acres). (Excess Water will flow over Roadway).
475+ = Remove Portion of Conc. Sidewalk, Rt.
P.I. 474+13.2 Bk. = P.I. 474+02.0 Ahd. Δ 0°1'45" Lt. EQUATION
475+05 = Req'd 16' Curb Cut, Rt.
476+80 = Req'd 16' Curb Cut, Rt.
Req'd Easement
OUTLET CHANNEL
B.M. - H&6 60' Rt. Sta. 466+50 Elev. 5234.32
B.M. - H&6 79' Lt. Sta. 478+00 Elev. 5244.98
No. 4 A-6(11) Taken on Proj. F004-1(21) L.L. = 37.6 P.I. = 21.7 %-200 = 68 C.B.R. = 3.1
No. 1 A-7-6(13) L.L. = 42.5 P.I. = 23.3 %-200 = 71 C.B.R. = 2.7
458+76.2 Bk.
464+97.1 Ah.
474+13.2 Bk.
474+02.0 Ah.
P.I. 5251.31
P.I. 5243.73
+2.73%
-1.066%
800' V.C. S.S.D. = 540'
400' V.C.
5230.67
40.39
47.51
48.15
47.05
45.86
44.61
Ground Line is on Survey ℄
Approach to Project
No. 4 12' Lt.
5250
40
30
5220
UNCL. EXCAVATION
EMBANKMENT
EMB. x FACTOR (1.25)
STA. YARD O'HAUL
YD. MILE O'HAUL
EXCESS EXCAV.
4,168
105
131
4037
465
470
475
480

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	F 004-1(34)	17	

N.E. 1/4, SEC. 6
T. 2 S., R. 68 W.

481+ to 540+ ∞ Reqd
Drainage Channel Lt. (W=21')

491+00∞ Reqd 18'x34'
Side Drain & Road
Approach to Frontage
Road, Lt.

498+ ∞ Reqd Median
Crossing (Details on
Sheet No. 9).

500+00∞ Reqd
Road Approach to
Frontage Road, Lt.
Reqd Easement

500+42∞ Plug Conc.
Siphon. Remove Flume.

N.W. 1/4, Sec. 6
T. 2 S., R. 68 W.

504+ to 521+ ∞ Reqd.
Irrigation Ditch, Lt.

Reqd Irrig. Ditch Easement

481+ ∞ Plug 3'x2'
C.B.C., Rt.

481+ ∞ Reqd
Conc. Paved rundown
in waste ditch, Rt.
(Details on Sheet 11)

481+56.7 to 481+89.2 ∞
Remove Concrete Pavement;
Reqd Double 10'x6'x129' C.B.C.
(Type 10-10-A); Channel Lt. & Rt.
(W=21'); 18'x15' Culvert Pipe for
Median Drain (Connect to C.B.C.);
Concrete Slope & Ditch Paving w/ Wire Mesh
at inlet (Details on Sheet No. 11)
(D.A. = 7.60 Acres).

488+00 ∞ Plug 15"x15" C.B.C., Rt.

492+20 ∞ Remove 13" Pipe, Rt.
Reqd 18'x56' Side Drain &
Double Road Approach, Rt.

493+40 ∞ Remove 12" Pipe,
Rt. Reqd 18'x34'
Side Drain & Road
Approach, Rt.

497+10 ∞ Remove 18" R.C.P., Rt.,
Reqd 18'x56' Side Drain and
Double Road Approach, Rt.

498+33 ∞ Remove 18" R.C.P., Rt., Reqd
Road Approach, Rt.

499+ ∞ Remove
12" R.C.P., Rt.

499+00 ∞ Remove Conc. Pavement; Reqd
Conc. Pavement; 24'x10" Cross Culvert, Lt.,
Type "8" Inlet in Median (H=4'-0"), 24'x54"
Cross Culvert, Rt.; Conc. Slope & Ditch
Paving at Outlet (Details on Sheet 11).

500+10 ∞ Remove 12" R.C.P. & 18.5" Metal
Pipe and 18" C.M.P., Rt.; Reqd 18'x34'
Side Drain and Road Approach, Rt.

507+80 ∞ Reqd 18'x56' Side Drain and
Road Approach, Rt. 22'x13'x52' Culvert
in Median

507+ ∞ Reqd Median Crossing
(Details on Sheet No. 9)

509+90 ∞ Remove 13" Metal Pipe,
Lt.; Reqd Concrete Ditch Check
in Irrigation Ditch, Lt.
(Details on Sheet No. 10)

509+90 ∞ Remove 15" C.M.P., Rt.;
Reqd 18'x34' Side Drain and
Road Approach, Rt.

S.E. 1/4, SEC. 31
T. 1 S., R. 68 W.

S.W. 1/4, SEC. 31
T. 1 S., R. 68 W.

B.M. - H & G 30' Rt.
Sta. 490+18 Elev. 5248.55

B.M. - H & G 25' Rt.
Sta. 500+35 Elev. 5262.07

STR. No. E-16-GI

PUBLIC SERVICE CO.

PROJECTED-LINE-TO-BE-CONSTRUCTED

SURVEY LINE

N 89° 37' 45" W

M.S.T. & T. CO.

No. 2-A-7-6(13) Similar to No. 1

No. 3-A-7-6(13) Similar to No. 1

No. 3A-A-7-6(12)
L.L. = 40.8
P.I. = 23.4
%-200 = 66
C.B.R. = 3.6

No. 4-A-7-6(13) Similar to No. 1

No. 4A-A-7-6(12) Similar to No. 3A

400' V.C. (W.B.)

400' V.C. (E.B.)

400' V.C.

600' V.C. (E.B.) S.S.D.=900'

600' V.C. (W.B.) S.S.D.=935'

+0.70%

+0.82% (E.B.)
+0.70% (W.B.)

+1.35% (E.B.)

+1.567% (E.B.)
+1.50% (W.B.)

+1.37%

+1.347%

Ground Line is on Survey ℄

Drainage Channel Grade Line

UNCL. EXCAVATION	23,804
EMBANKMENT	19,043
EMB. × FACTOR (1.25)	23,804
STA. YARD O'HAUL	80,655
YD. MILE O'HAUL	2,611
EXCESS EXCAV.	

TEL. ROAD REG. NO.	DIVISION	PROJ NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	F 004-1(34)	18	

ADAMS CO.

JEFFERSON CO.

BOULDER CO.

N.W. 1/4, SEC. 6 T. 2 S., R. 68 W.

N.E. 1/4, SEC. 1 T. 2 S., R. 69 W.

S.W. 1/4, SEC. 31 T. 1 S., R. 68 W.

S.E. 1/4, SEC 36 T. 1 S., R. 69 W.

511+34 = Remove 10" Metal Pipe, Lt.

Reqd Irrig Ditch Easement

P.O.T. 510+00.0 Nail in Conc. Pavement

15'X39' C.M.P.

12'X15' V.C.P.

8'X20' C.M.P. w/ 1' H'dw'ls

4'X4' C.M.P.

GATE & FIELD APPR.

513+50 = Reqd 18'x26' Side Drain in Irrig. Ditch, Lt., 18'x38' Side Drain & Road Approach to Frontage Road, Lt.

513+70 = Remove 12" V.C.P., Lt.; Reqd Concrete Division Box, Lt. (Details on Sheet No. 10).

521+ = Reqd Conc. Division Box, Lt. (S.E. Corner of Reservoir) (Details on Sheet 10&11), Irrig. Ditch Change (East Side of Reservoir Berm).

450'

Reqd Easement for Reservoir Relocation

12'X30' V.C.P. DIV. BOX

2'X32' V.C.P.

40'

IRR. VALVE INLET

IRRIGATION RESERVOIR

Str. No. E-16-C.M.

Public Service Co. of Colo.

PROJECTED LINE TO BE CONSTRUCTED

SURVEY LINE

N 89° 37' 45" W

M.S.T.B.T. Co.

Sign Buried Telephone Cable

510 515 520 525 530 535 540

185' 185' 185' 185'

30' 30'

40'

MAIL BOX

HWY SIGN

PUBLIC SERVICE SIGN

SIGNS

P.I. 526+16.6

Δ = 0° 07' RT.

B.M. BOXES

Union R.E.A.

525+60 = Remove Conc. Pavement, Reqd Conc. Cross Culvert, Conc. Slope & Ditch Paving at Outlet (Details on Sheet 11).

526+17 = Reqd Double 10'x6.5'x36' C.B.C. (Type 10-10-4) (Under County Road 75'± Lt.) (D.A. = 760 Acres).

526+ = Reqd Median Crossing (Details on Sheet No. 9).

534+25 = Remove 18" C.M.P., Rt.; Reqd 22'x13'x22' Side Drain in Irrig. Ditch, Lt. 18'x34' Side Drain & Road Approach to Frontage Road, Lt.

1/16 SEC. LINE

WOOD FENCE

BARN

CHICKEN COOP

PROP. PIN

GAS LINE

WOOD SIGN 6'x16'

N

N 89° 30' 45" W

COUNTY LINE

510+25 = Reqd Concrete Paved rundown at Curb End, Rt. (Details on Sheet 11) TELE. MANHOLE NO. 1474

8" CONC. WALL

LAWN

H.D.

DOCK

POULTRY PLANT

3 TRANFORMERS - 5 POLES

15'X40' C.M.P.

8" CONC. SEWER PIPE 18"X40' C.M.P.

GAS LINE

GRAVEL DRIVE

CAR PORT

513+25 = Remove 18" C.M.P., Rt. & 15" C.M.P., Lt.

514+20 = Reqd Road Approach, Rt.

514+50 = Remove 18" C.M.P., Lt.

514+90 = Remove 18" C.M.P., Rt.

18"X16' C.M.P. SIGN

2" GAS LINE

TELE. MANHOLE NO. 734

515+00 = Remove Conc. Pavement, 18'x67', Reqd Conc. Pavement, 18'x67', Cross Culvert, Rt., Type 'B' Inlet in Median (H'=3'-6'), Conc. Slope & Ditch Paving at Outlet (Details on Sheet No. 11).

516+80 = Remove 18" C.M.P., Rt. Reqd 18'x56' Side Drain & Road Approach, Rt. 22'x/3'x32'

516+ = Reqd Median Opening (Details on Sheet No. 9)

521+ to 525+ = Remove 2-12" V.C. Pipes, with Irrigation Valves, Lt. and Conc. Division Box, Lt.; Reqd Dike for Irrig. Reservoir, Lt.; 18'x20' Pipe and 18" Side Headgate (3'Frame) in Conc. Irrig. Structure (S.E. Corner of Reservoir) (Details on Sheet No. 10&11).

521+ to 525+ = Reqd Irrig. Ditch Change Lt. (South Side of Reservoir).

18"X10' S.W.P.

12"X90' S.W.P.

18"X30' C.M.P. w/ H'dw'l

18"X30' S.W.P.

SIGNS

TELE. EQUIP. BLDG.

PARKING AREA

CONC. INCINERATOR

TEL. M.H.

TEL. GAR

RANGE LINE & COUNTY LINE

2" GAS MAIN

Public Service Co of Colo

526+46 = Relocate U.S.G.S. B.M. (Work by State Forces).

526+70 = Reqd 18'x 67' Cross Culvert, Lt., Type 'B' Inlet in Median (H'=3'-0"), 18'x 51' Cross Culvert (Under Frontage Road, w/End Section at Inlet) Conc. Slope & Ditch Paving at Outlets. (Details on Sheet No. 11).

526+17 = Remove 18"x40' C.M.P. & 18"x30' C.M.P. Reqd 18'x48' Side Drain, Rt. County Road Approach, Rt. & Lt.

21"x22' C.M.P. VERTICAL 6" PIPE

VET. BLDG.

GAS PUMP

WELL

SIGN

527+75 = Remove 21" C.M.P., Rt. Reqd 18"x34' Side Drain & Road Approach, Rt.

528+75 = Remove C.M.P., Rt. Reqd 18"x34' Side Drain & Road Approach, Rt.

TELE. MANHOLE

18" 11.5' GATE

MAIL BOX

15' GATE

FIELD APPR. 18'x20' C.M.P. w/ H'dw'ls

535+55 = Remove 18" C.M.P., Rt. Reqd 18'x34' Side Drain & Road Approach, Rt.

534+ = 36" Gas Line may have to be lowered. (No cost to project) (Work by Pub. Serv. Co. of Colo.)

12' GATE

TELE. MANHOLE

18"X16' C.M.P.

B.M. H&G 25' Rt. Sta. 511+00 Elev. 5275.93

B.M. U.S.C.&G.S. & State Surv. Tablet 38'Lt Sta 526+50 Elev. 5282.57

B.M. a chiseled on Conc. Hdwl 22' Rt. Sta. 526+03 Elev. 5282.10

No. 5-A-7-6(19) Similar to No. 6

No. 6-A-7-6(19) L.L. = 54.4 P.I. = 31.3 %-200=76 C.B.R. = 3.5

No. 7-A-7-6(19) Similar to No. 6

400' V.C. (E.B.)

400' V.C. (W.B.)

83.45 84.53 86.17

81.53 82.61 84.25

P.I. 527+85 (E.B.) P.I. 527+75 (W.B.)

+0.40% (E.B. & W.B.)

E 75.0 Test No. 5

+0.40%

Ground Line is on Survey ℄

+0.215%

Drainage Channel Grade Line

P.I. 528+33 (W.B.)

P.I. 528+25 (E.B.)

Channel P.I. 527+43

Channel P.I. 527+26

Channel P.I. 528+51

Δ E 80.1

E 81.7 Test No. 6

+1.707%

+0.961% (E.B. & W.B.)

P.I. 528+05 (W.B.) No. V.C.

P.I. 528+05 (E.B.) No. V.C.

+1.15% (E.B.)

+0.962%

P.I. 529+65 (E.B.)

Test No. 7

+0.01% (E.B.)

+0.80% (W.B.)

+0.20%

Channel P.I. 528+20

91.35 93.31 94.87

5300 90 80 70 5260

Channel P.I. 527+23 75.91 76.97

79.05 77.93

600' V.C. (E.B.) S.S.D. = 990'

600' V.C. (W.B.) S.S.D. = 935'

400' V.C. (E.B.) S.S.D. > 1300'

	Adams County	Boulder County
UNCL. EXCAVATION	820	5,668
EMBANKMENT	1987	3204
EMB x FACTOR (1.25)	2483	4005
STA. YARD O'HAUL		7970
YD. MILE O'HAUL		
EXCESS EXCAV.		

Rev. 9-24-62 - Row Plan Revision

F.O. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	F 004-1(34)	19	

N.E. 1/4, SEC. 1 T. 2 S., R. 68 W.

JEFFERSON CO.

N.W. 1/4, SEC. 1 T. 2 S., R. 68 W.

541+00 = Remove 18" C.M.P. & Wood Bridge Lt. Reg'd 18'x40' Side Drain & 18'x56' Side Drain in Irrig. Ditch, Lt. & Appr. to Frontage Road.

541+15 = Reg'd 18'x26' Side Drain and Road Approach to Frontage Road, Lt.

552+50 = Remove 18" C.M.P., Lt. Reg'd 18'x26' Side Drain in Irrig. Ditch & 18'x36' Side Drain & Road Approach, Lt.

554+90 = Reg'd Concrete Division Box Lt. (Details on Sheet No. 10).

WELL — WOOD BRIDGE — MAIL BOX — SIGN — R 1/6 — PROP. PIN — IRRIGATION DITCH — 18"x20' C.M.P. W 4.5' H'DW'LS — FENCE (POOR COND.) — 15"x20' R.C.P. — 18"x20' C.M.P. W 4.5' H'DW'LS — MAILBOX — 18"x20' C.M.P. W 4.5' H'DW'LS — GATE — SIGN — SIGN — 4.5' CONC. HEADWALL (15"x15"C.B.C.) — CONC. DIVISION BOX (Irrigation) — SIGN

Str. No. E-16-CU

PROJECTED LINE TO BE CONSTRUCTED

SURVEY LINE — N 89°30'45" W — N 89° 41' W

P.S. Co.

M.S.T.&T. Co. Underground Cable

541+00 = Reg'd Road Approach, Rt. 540+83.7 to 541+16.2 = Remove Conc. Pavement. Reg'd Double 10'x6'x14" C.B.C. (Type 10-10-A), Conc. Slope and Ditch Paving where mesh at Inlet & Outlet, 18"x30' Culvert for Median Drain (Connect to C.B.C.) (Details on Sheet No. 11). (D.A = 760 Acres)

BURIED TELE. CABLE — 2" GAS MAIN — EXPOSED 2" IRON PIPE — 16' GATE & FIELD APPR. — IRR. WASTE DITCH — 2 WIRE ELECTRIC FENCE — MOUNTAIN STATES ADV. BILLBOARD — 12.5' GATE — TELE. MANHOLE — SIGN — SIGN — GAR. — HEDGE — SHED — SILO — GATE — BARN — CONC. CURB — CISTERN — WELL — GAR. — HEDGE — TELE. MANHOLE — IRRIGATION DITCH — FENCE PARTIALLY BURIED — SIGN — 19' GATE — FIELD APPR. & 15"x20' C.M.P. W 4.5' H'DW'LS — 2" GAS MAIN

541+ = Reg'd Median Crossing (Details on Sheet No. 9).

544+10 = Remove 18" C.M.P., Rt.

546+00 = Reg'd 18'x36' Side Drain & Road Approach, Rt.

549+65 = Remove 15" C.M.P. Rt. Reg'd 18'x32' Side Drain & Road Approach, Rt.

551+50 = Remove 18" C.M.P. Rt. Reg'd 18'x32' Side Drain & Road Approach, Rt.

554+00 = Remove Conc. Pavement, Rt. Reg'd Conc. Pavement, Rt.; 22'x13'x52' C.M.P. Arch Cross Culvert, Rt., Dike in Median.

556+70 = Plug 15"x15" C.B.C., Rt.

559+00 = Remove Concrete Division Box, Rt.

565+60 = Remove 15" C.M.P., Rt.; Reg'd 18'x26' Side Drain in Irrig. Ditch, Rt., 18'x32' Side Drain & Road Approach, Rt.

566+00 = Remove Concrete Pavement, Rt.; Reg'd Concrete Pavement, Rt.; 22'x13'x52' C.M.P. Arch Cross Culvert, Rt., Outlet Ditch, Dike in Median

Remove

New

541+ to 546+ = Reg'd Drainage Channel, Rt. (W=21').

552+ to 571+ = Reg'd Irrig. Ditch Change, Rt.

P.I. 552+63.3 Δ=0°10'10" Lt.

BOULDER CO.

S.E. 1/4, SEC. 36 T. 1 S., R68W.

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

B.M. H&G 29' Rt. Sta. 540+04 Elev. 5293.86

B.M. H&G. 32' Lt. Sta 550+00 Elev. 5305.15

B.M. H&G. 34' Lt. Sta. 560+00 Elev. 5320.76

B.M. H&G. 31' Lt. Sta. 569+00 Elev. 5342.49

No. 8 - A-7-6(19) Similar to No. 6

No. 9 A-7-6(19) Similar to No. 6

No. 10 - A-7-6(19) Similar to No. 6

400' V.C. (E.B.)

400' V.C. (W.B.)

+2.214% (E.B. & W.B.)

+2.06 % (E.B.)

+2.214% (W.B.)

+1.46% (E.B.)

+1.58 %(W.B.)

+0.61% (E.B.)

+0.612 % (W.B.)

+0.80% (W.B.)

+0.20%

+1.324%

E 88.9

E 10.0

E 33.2

Test No. 8

Test No. 9

Test No. 10

Ground Line is on Survey ℄

Drainage Channel Grade Line

400' V.C. S.S.D. = 1300'

	540	545	550	555	560	565	570
UNCL. EXCAVATION	4,509		3,680	619		9,414	
EMBANKMENT	3,607		370	495	331		
EMB. x FACTOR (1.25)	4,509		463	619	414		
STA. YARD O'HAUL	1,631			F.H.			
YD. MILE O'HAUL							
EXCESS EXCAV.			3217			8,748	

FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	F 004-1(34)	20

NW¼ Sec. 1
T. 2 S., R. 68 W.

JEFFERSON CO.

578+00 to 578+80 ᵐ Extend 18" R.C.P. Sewer 80' East.

572+00 ᵐ Remove 18" C.M.P., Rf.; Regd 18"x26' Side Drain in Irrig. Ditch, Lt. & 18"x 34' Side Drain & Road Approach, Lt.

PROJECTED LINE TO BE CONSTRUCTED

P.I. 573+55.6 (Proj.)

REVERSE CURVE
Δ = 4°38'
D = 1°15'
T = 185.5'
L = 370.7'
R = 4584.0'
S = 0.351/19.
S.S.D. = >1300'
M.D.S. = 70 MPH.

577+20 ᵐ Regd Identification Sign, Lt. (State Furnished & Installed).

578+00 ᵐ Regd Concrete Division Box, Lt. (Connect to Sewer Outlet). (Details on Sheet No. 10)

P.T. 579+11.5 (Proj. Line) = 579+10.7 Bk. (Surv. Line) = 579+20.0 Ah. (Surv. Line)

N

570

575

N. 89°41' W.

Public Service Co.

N. 89°03' W.

Flashing Light

Conc. Curb

18" R.C.P. Sewer

2" Gas Main

BROOMFIELD

PROJ. LINE

SURV. LINE

Diversion Box

S.T. & T. Co. (Buried Cable)

Irrig. Ditch

IRRIGATION RESERVOIR

6" V.C. Pipe

Shed

Shed

Shed

PIERCE ST.

571+35 ᵐ Remove 15" C.M.P., Rf.; Regd 18"x 34" Side Drain & Road Approach, Rf.

16' Gate

15"x 20' C.M.P.

P.C. 571+70.1 (Proj.)

BOULDER CO.

S.W.¼ Sec. 36
T. 1 S., R. 68 W.

P.R.C. 575+40.8 (Proj.)

(NON FED. AID)
576+35 ᵐ Remove Flashing Unit. (work by State Forces)

P.I. 577+26.3 (Proj.)

STA. 577+200 END F004-1(34)=
STA. 577+20.0 BEGIN F004-1(32)
4.4 Lt. STA. 577+286 on F.A.P. 222-A

TEST NO. 11 A-7-6 (18)
STA. 579+80
L.L. 45.9
P.I. 28.4
% -200 79
C.B.R. 18

PROFILE

5370
5360
5350
5340

400' V.C.

5347.22 P.I.

47.08

51.02

5242 @ 90

56.97 @ 90

61.08 @ 90

64.15 @ 91.8

PLANE @ 90

+2.24%

-1.93%

+2.85%

Ground Line is on Survey ℄

400' V.C.

SSD > 1300'

UNCL. EXCAVATION		
EMBANKMENT	202	
EMB. x FACTOR (1.25)	252	
STA. YARD O'HAUL		
TO. MISC. O'HAUL		
EXCESS EXCAV.		

570 575

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

FED. ROAD REGION	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	F004-1(34)	21	

SUMMARY OF EARTHWORK QUANTITIES

		ADAMS CO.	BOULDER CO.	TOTALS
UNCLASSIFIED EXCAVATION				
FROM CROSS SECTIONS		28,792 CU. YD.	23,890 CU. YD.	52,682 CU. YD.
EST. FOR SUBSIDENCE		2,879 " "	2,389 " "	5,268 " "
LIST OF STRUCTURES AS EXCAVATION		90 " "	45 " "	135 " "
LIST OF STRUCTURES AS EMBANKMENT		4,265 " "	255 " "	4,520 " "
EST. FOR CUT SLOPE TREATMENT		374 " "	333 " "	707 " "
MUCK REMOVAL		5,850 " "	———	5,850 " "
	TOTALS	42,250 CU. YD.	26,912 CU. YD.	69,162 CU. YD.
EXCESS EXCAVATION		4,037 CU. YD.	11,965 CU. YD.	16,002 CU. YD.
EMBANKMENT X FACTOR		26,418 CU. YD.	10,262 CU. YD.	36,680 CU. YD.
STATION YARD OVERHAUL				
FROM MASS DIAGRAM		80,655 STA. YD.	9,601 STA. YD.	90,256 STA. YD.
EST. FOR SUBSIDENCE		8,066 " "	960 " "	9,026 " "
EST. FOR REPLACING MUCK REMOVAL		80,443 " "	———	80,443 " "
	TOTALS	169,164 STA. YD.	10,561 STA. YD.	179,725 STA. YD.
YARD MILE OVERHAUL				
FROM MASS DIAGRAM		2,611 YD. MI.	———	2,611 YD. MI.
EST. FOR SUBSIDENCE		261 " "	———	261 " "
EST. FOR REPLACING MUCK REMOVAL		2,662 " "	———	2,662 " "
	TOTALS	5,534 YD. MI.	———	5,534 YD. MI.
COMPACTION				
EMBANKMENT x FACTOR		26,418 CU. YD.	10,262 CU. YD.	36,680 CU. YD.
FROM STR. QUANTITIES AS EMBANKMENT		4,265 " "	255 " "	4,520 " "
EST. FOR REPLACING MUCK REMOVAL		7,313 " "	———	7,313 " "
BASE OF CUTS AND FILLS		27,177 " "	18,423 " "	45,600 " "
	TOTALS	65,173 CU. YD.	28,940 CU. YD.	94,113 CU. YD.
UNCLASSIFIED DITCH EXCAVATION				
FROM STRUCTURE QUANTITIES		180 CU. YD.	1,755 CU. YD.	1,935 CU. YD.

MUCK REMOVAL

STATION	UNCL. EXCAV. FOR MUCK REMOVAL CU. YDS.	UNCL. EXCAV. TO REPLACE MUCK REMOVAL CU. YDS.	OVERHAUL TO REPLACE MUCK REMOVAL STA. YD.	OVERHAUL TO REPLACE MUCK REMOVAL YD. MI.
522+ to 525+ (Adams County)	5,850	▲7,313	80,443	2,662

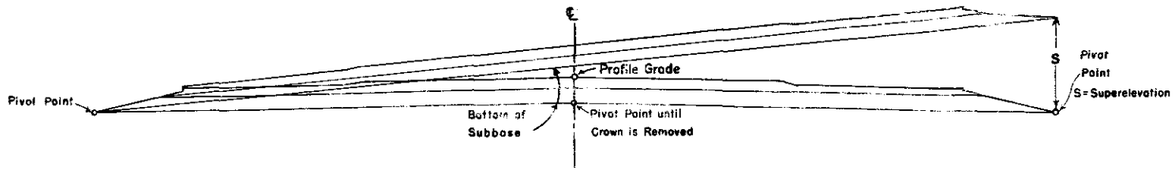
▲ Unclassified Excavation to replace Muck Removal To be obtained from excess excavation Sta. 547+ to Sta. 555+ and Sta. 561+ to Sta. 568+ (Boulder County).

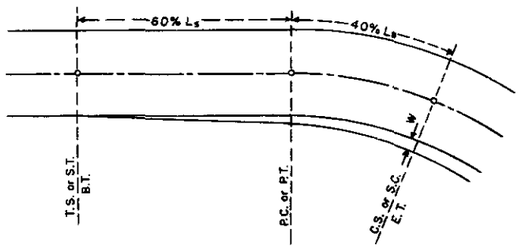
SHEET TOTALS		
	EXCAVATION	CU. YDS.
	EXCAVATION	CU. YDS.
	EMBANKMENT	CU. YDS.

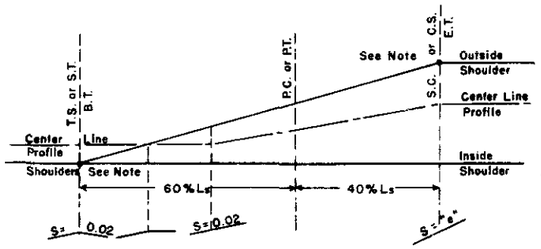
STANDARD M-1-D

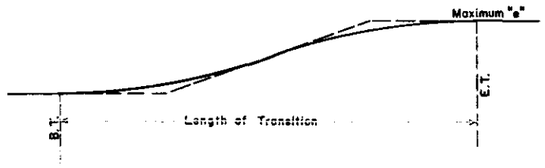
(MAY 1, 1962)

FEDERAL ROAD REGION NO.	DISTRICT	PROJECT NO.	SHEET NO.
9	COLORADO	[redacted]	[redacted]









* 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.

PAVEMENT WIDENING

Pavement Width	20 Ft.	22 Ft.	24 Ft.
Degree of Curve			
0° - 3°	0 Ft.	0 Ft.	0 Ft.
4° - 6°	2.0 Ft.	0 Ft.	0 Ft.
7° - 10°	2.5 Ft.	0 Ft.	0 Ft.
11° - 17°	3.0 Ft.	2.0 Ft.	0 Ft.
18° - 21°	3.5 Ft.	2.5 Ft.	0 Ft.
22° - Up	4.0 Ft.	3.0 Ft.	2.0 Ft.

Widening is to be on the inside edge of the pavement and the transition is to extend over the same transition length as the superelevation.

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

SUPERELEVATION RATES FOR TWO LANE CROWNED 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'	R C	70	200'	R C	70	200'
0°30'	R C	70	200'	R C	70	200'
0°45'	.021	70	200'	.021	70	200'
1°00'	.028	70	200'	.028	70	200'
1°30'	.042	70	200'	.042	70	200'
2°00'	.056	70	200'	.055	70	200'
2°30'	.069	70	200'	.069	70	200'
3°00'	.076	70	250'	.083	70	250'
3°30'	.080	70	250'	.096	70	300'
4°	.080	65	250'	.100	65	300'
5°	.080	60	250'	.100	60	300'
6°	.080	55	200'	.100	55	250'
7°	.080	50	200'	.100	50	250'
8°	.080	45	200'	.100	50	250'
9°	.080	45	200'	.100	45	250'
10°	.080	40	200'	.100	45	250'
11°	.080	40	200'	.100	40	200'
12°	.080	40	200'	.100	40	200'
13°	.080	35	150'	.100	40	200'
14°	.080	35	150'	.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	30	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.

SUPERELEVATION RATES FOR SPECIAL CASES[1]

TABLE 2

Degree of Curve	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 Superelevation Rate Ft./Ft.		Minimum Length of Transition	Required Superelevation Rate Ft./Ft.		Minimum Length of Transition	Required Superelevation Rate Ft./Ft.		Minimum Length of Transition	Required Superelevation Rate Ft./Ft.		Minimum Length of Transition	Required Superelevation Rate Ft./Ft.		Minimum Length of Transition	Required Superelevation Rate Ft./Ft.		Minimum Length of Transition	Required Superelevation 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°15'	N C	N C	0	N C	N C	0	N C	N C	0	N C	N C	0	N C	N C	0	N C	N C	0	N C	N C	0	0°15'
0°30'	N C	N C	0	N C	N C	0	N C	N C	0	N C	N C	0	R C	R C	150'	R C	R C	200'	R C	R C	200'	0°30'
0°45'	N C	N C	0	N C	N C	0	R C	R C	150'	R C	R C	150'	R C	R C	150'	R C	R C	200'	R C	R C	200'	0°45'
1°00'	N C	N C	0	R C	R C	150'	R C	R C	150'	R C	R C	150'	R C	R C	150'	.021	.021	200'	.022	.022	200'	1°00'
1°30'	R C	R C	100'	R C	R C	150'	R C	R C	150'	.023	.024	150'	.027	.027	150'	.031	.031	200'	.035	.034	200'	1°30'
2°00'	R C	R C	100'	R C	.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'	.025	.026	150'	.030	.033	150'	.036	.039	150'	.043	.045	150'	.050	.052	200'	.057	.059	200'	2°30'
3°00'	.023	.024	100'	.029	.031	150'	.035	.038	150'	.042	.046	150'	.050	.054	150'	.057	.062	200'	.066	.070	200'	3°00'
3°30'	.026	.027	100'	.033	.035	150'	.040	.045	150'	.048	.053	150'	.056	.063	150'	.064	.072	200'	.072	.081	250'	3°30'
4°	.029	.030	100'	.037	.040	150'	.044	.050	150'	.053	.060	150'	.062	.070	200'	.069	.079	200'	.076	.090	250'	4°
5°	.035	.038	100'	.044	.048	150'	.053	.060	150'	.062	.071	200'	.070	.083	200'	.077	.091	250'	.080	.099	300'	5°
6°	.041	.044	100'	.050	.056	150'	.060	.068	150'	.069	.080	200'	.076	.093	250'	.080	.098	250'		.100	300'	6°
7°	.045	.050	100'	.056	.063	150'	.066	.076	150'	.074	.088	200'	.079	.097	250'		.100	250'				7°
8°	.050	.055	100'	.061	.069	150'	.071	.084	200'	.076	.094	200'	.080	.100	250'							8°
9°	.054	.061	100'	.065	.075	150'	.074	.089	200'	.080	.097	250'										9°
10°	.058	.065	150'	.069	.081	150'	.077	.093	200'	.080	.100	250'										10°
11°	.061	.070	150'	.072	.085	200'	.079	.096	200'													11°
12°	.065	.074	150'	.075	.089	200'	.080	.098	200'													12°
13°	.067	.078	150'	.077	.092	200'		.100	200'													13°
14°	.070	.082	150'	.078	.095	200'																
15°	.072	.085	150'	.079	.097	200'																
16°	.074	.087	150'	.080	.099	200'																
17°	.076	.090	150'		.100	200'																
18°	.077	.093	200'		.100	200'																
19°	.078	.095	200'																			
20°	.079	.096	200'																			
21°	.080	.098	200'																			
22°	.080	.099	200'																			
23°	.080	.099	200'																			
24°		.100	200'																			
25°		.100	200'																			

[1] Table 2 data may be used for City Streets & Interchanges.
NC=Normal Crown section.
RC=Remove adverse crown, superelevate at normal crown slope.

NOTES—Transition or Spiral Lengths are shown in the tables for 2 Lane Crowned Highways.
For 3 Lane Crowned Highways use 1.2 times the lengths shown, rounded to the nearest 50 feet.
" 4 " " " " 1.5 " " " " " " " " " "
Width of Crowned Highway to be figured for Superelevation—left pivot point to right pivot point.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

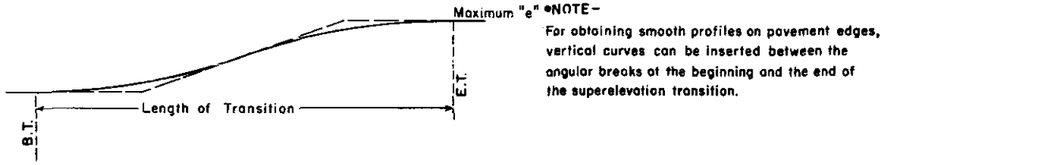
SUPERELEVATION & WIDENING OF CURVES CROWNED HIGHWAYS

Designed by S.B.L. Made by S.B.L. Checked by L.E.O.	Approved by C. Julian Date 5-4-61

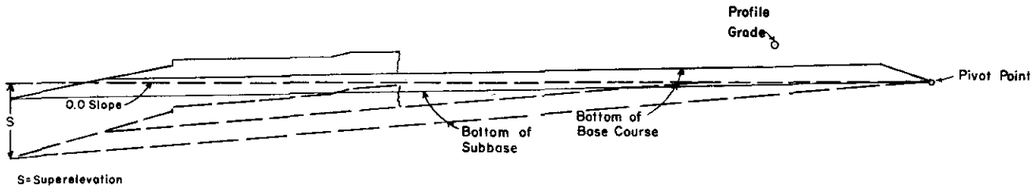
STANDARD M-1-D-1

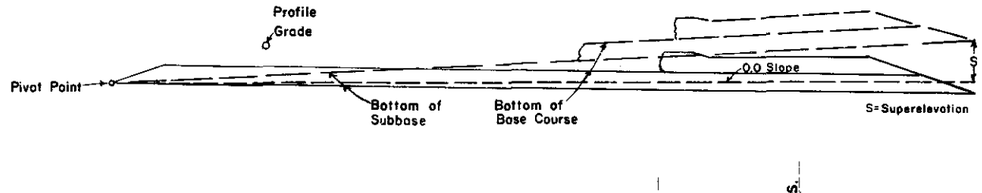
(MAY 1, 1962)

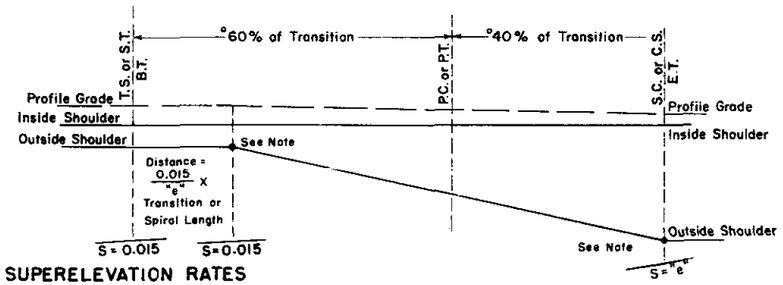
FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		



•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.







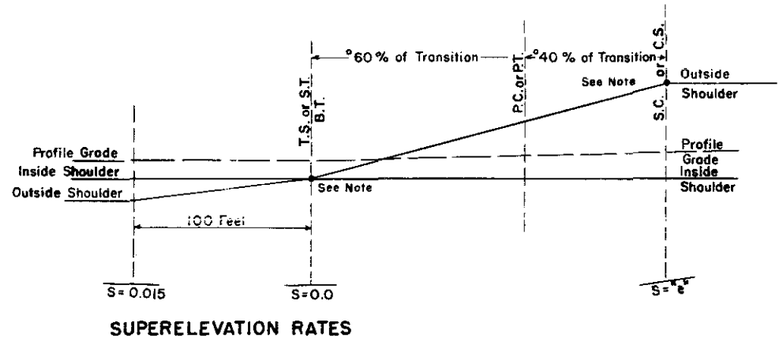
SUPERELEVATION RATES FOR FOUR LANE DIVIDED SECTION

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	0	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'	R C	R C	200'	R C	R C	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'	.018	.018	200'	1° 00'
1° 30'	N S	N S	0	R C	R C	100'	R C	R C	150'	R C	R C	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	.098	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.	Approved by
Made by S.B.L.	
Checked by L.E.O.	Date 2-5-64

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

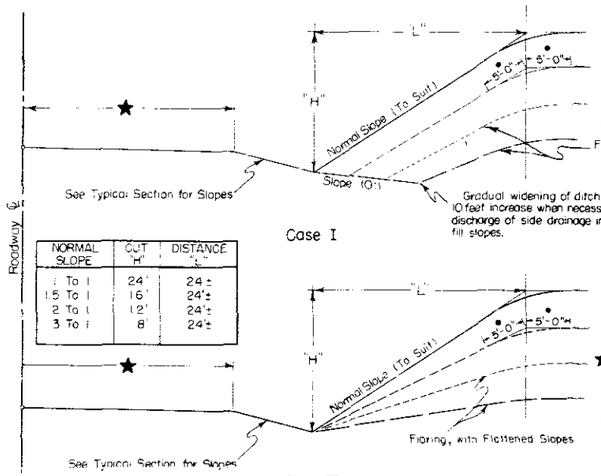
STANDARD M-2-A

(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' ±

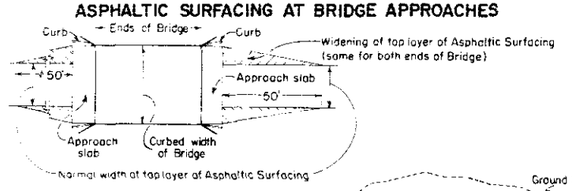
Case II

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.

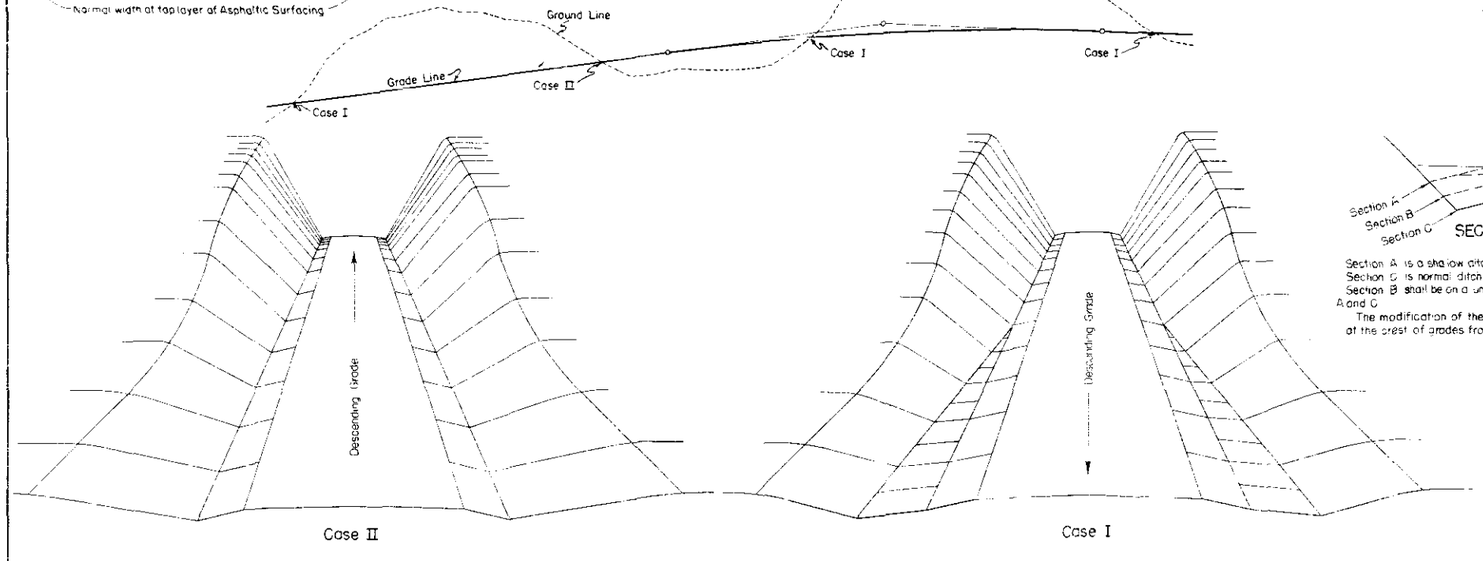
*CUT SLOPE TREATMENT IN EARTH CUTS: The intersection of cut slopes with the existing ground shall be rounded in earth cuts, beginning 5ft. outside the slope stake and extending 5 ft. down the cut slope. Where the cut slope is less than 5 ft. reduce each of the above widths of slope treatment to the actual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



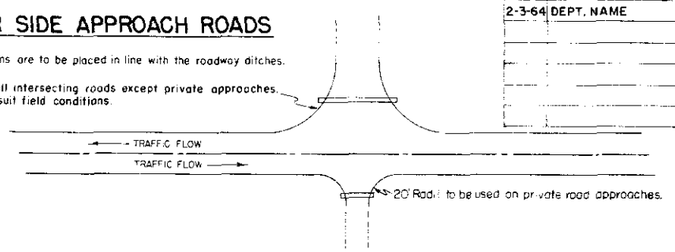
PLAN OF FLARING IN EARTH CUTS



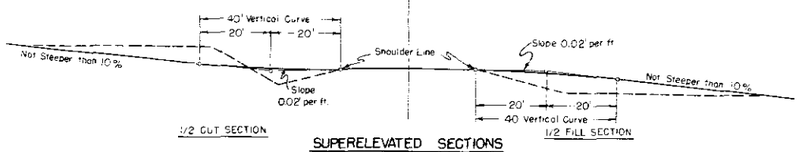
TYPICAL PLANS FOR SIDE APPROACH ROADS

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

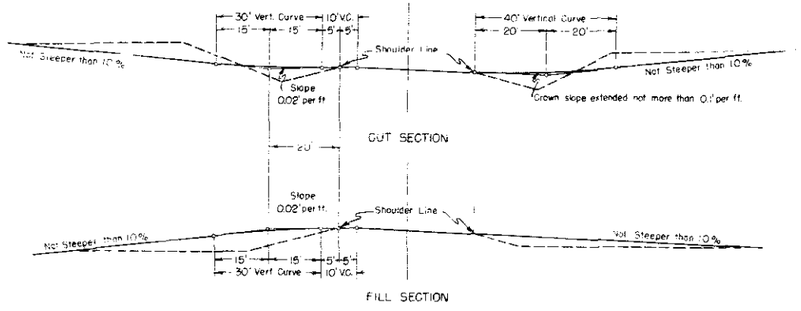
50' Radii to be used on all intersecting roads except private approaches. Radii may be varied to suit field conditions.



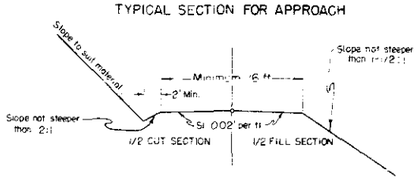
STANDARD CROWNED SECTION



SUPERELEVATED SECTIONS



TYPICAL SECTION FOR APPROACH

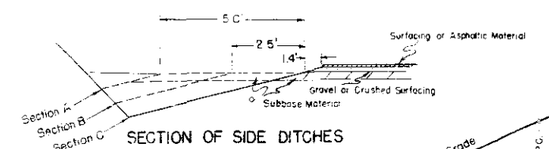


NOTE.

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

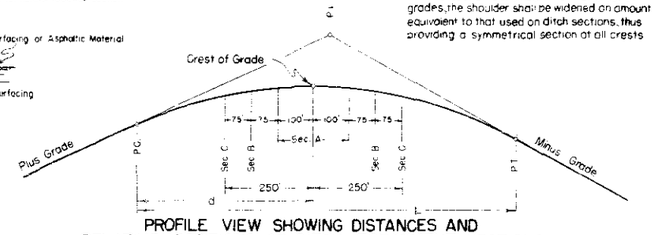
The modification of the ditch indicated shall be used only at the crest of grades from which drainage breaks both ways

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 "Grave 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. Zubian
Made by S.&M.&A.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 REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	[redacted]	[redacted]

1 2 3 4 5 6 7 8 9 0 .

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

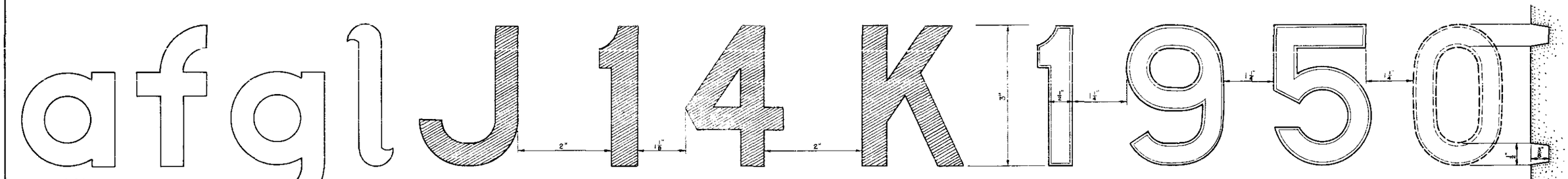
M N O P Q R S T U V W

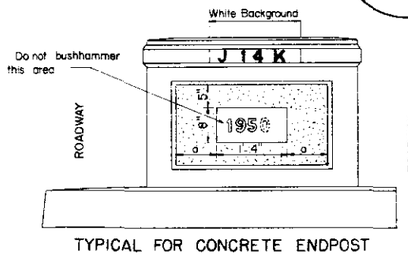
a f g l J 14 K 1950

abcdefghijklmnopqrstuvwxyz

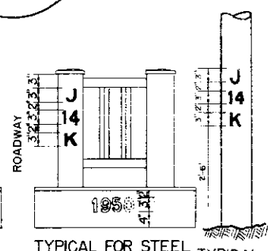
SAMPLE BRIDGE NUMBER

SAMPLE YEAR NUMBER

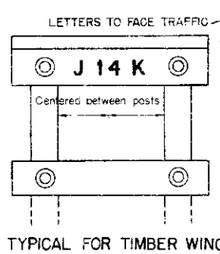




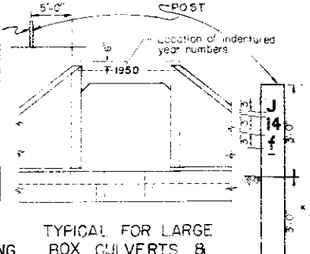
TYPICAL FOR CONCRETE ENDPOST



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 3/8" 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 39 "PAINTS AND PAINTING". THE BRACES 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 CONSIDERED ONE CLEAR SPAN MEASURED FROM INSIDE OF END WALLS.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

LETTERS AND FIGURES
FOR
STRUCTURE NUMBERS

Designed by	Approved by [signature]
Made by	Bridge Engineer
Checked by	Date: Feb 17, 1958

STRUCTURE NO. _____

STANDARD ROADWAY CONSTRUCTION TRAFFIC SIGNS

STANDARD M-6-B

(SHEET 1 OF 2 SHEETS)

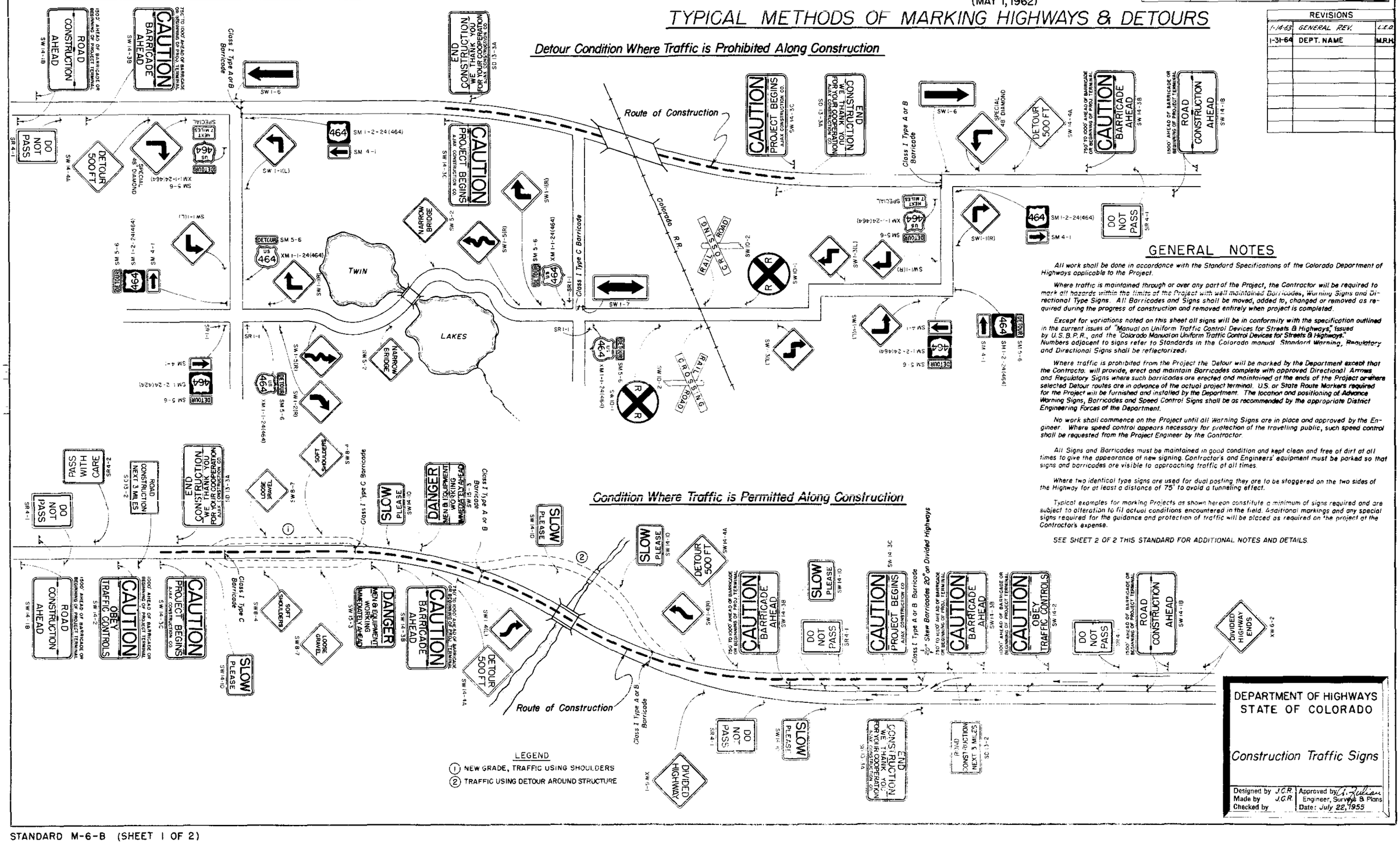
(MAY 1, 1962)

FED. ROAD R&B NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	[redacted]	[redacted]

REVISIONS		
1-14-63	GENERAL REV.	L.E.D.
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

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

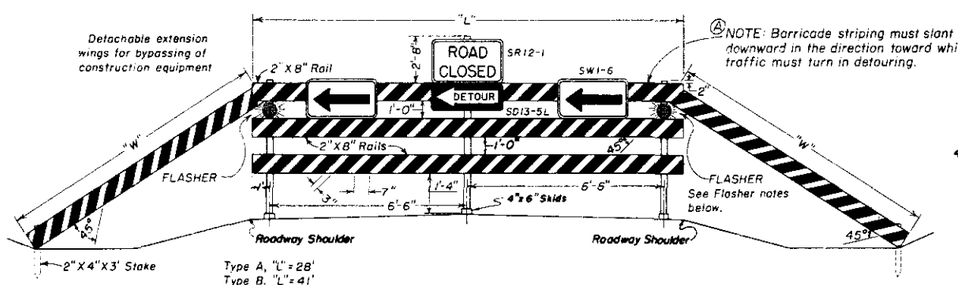
(SHEET 2 OF 2 SHEETS)
(MAY 1, 1962)

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

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.

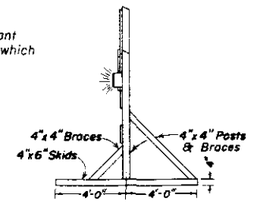
DETAILS OF BARRICADES

Class I
Type A or B
(Road Closed)



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

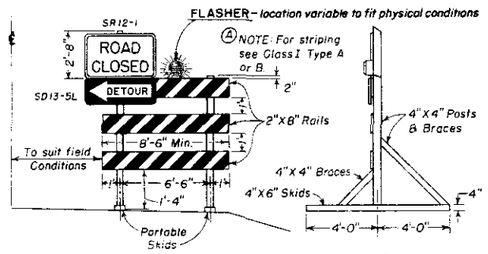
"W" Variable, length to be adequate to provide closing of borrow pit and shoulder.



End View

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.

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 before adding Reflective Strips.
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.

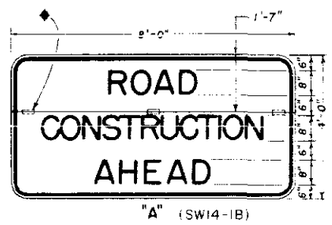
Planking	2"x6"	S4S
Posts (Barricades)	4"x4"	S4S
Posts (Signs)	4"x4" or 6"x6"	S4S

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

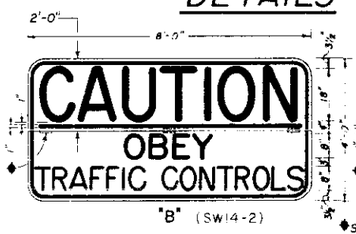
All skids, braces and posts to be painted yellow and nailed together with No. 20d nails.

Bases to be weighted where necessary to provide stability.

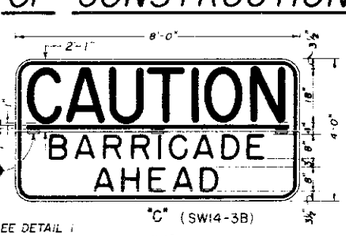
DETAILS OF CONSTRUCTION SIGNS



"A" (SW14-1B)

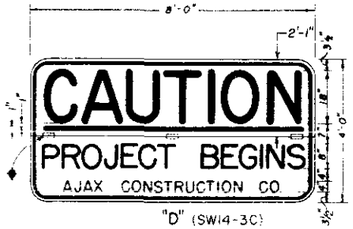


"B" (SW14-2)



"C" (SW14-3B)

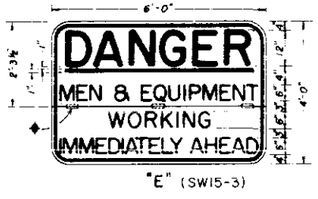
MARGIN AND BORDER COLOR
Signs "A" through "F"
Upper Portion – Margin – Same as Background; Border – Same as Legend
Lower Portion – Margin – Same as Background; Border – Same as Legend
Signs "G" and "I"
Margin – Reflectorized "Smooth Surface Yellow"
Border – Painted Black
Signs "J" and "K"
Margin – Reflectorized White
Border – Painted Black



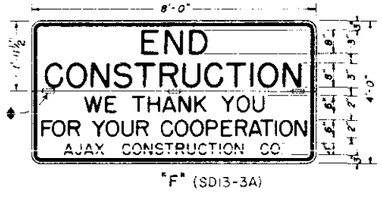
"D" (SW14-3C)

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.

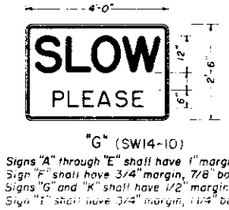
✤ 90° Countersunk Steel or Aluminum Lock Bolt Fasteners with Collars suitable for use on wood may be used in lieu of stove bolts



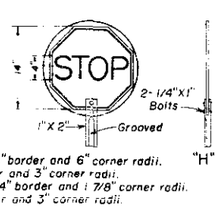
"E" (SW15-3)



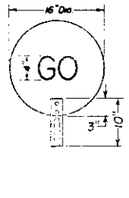
"F" (SD13-3A)

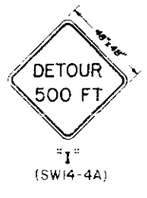


"G" (SW14-1O)



"H"



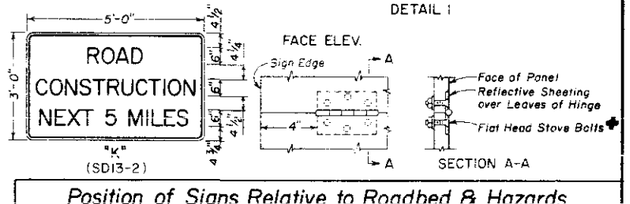


"I" (SW14-4A)

"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.

DETAIL 1



"K" (SD13-2)

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 and shall have no less than a 4" diameter lens. The illuminating element in a flashing yellow beacon or signal shall be flashed continuously at a rate between 50 to 70 flashes per minute with the "on" time being at least 25% of the cycle and which will be clearly distinguishable to traffic. The duration in which Flashers will be left in operation will be governed by field conditions and subject to approval by the Engineer.

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:

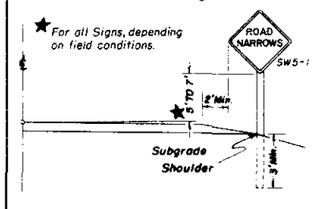
1	"ROAD CONSTRUCTION AHEAD"	Minimum 4
2.	"CAUTION OBEY TRAFFIC CONTROLS"	Minimum 2
3.	"CAUTION BARRICADE AHEAD"	As Required
4.	Standard Warning, Guide & Directional Signs	As Required
5.	"ROAD CONSTRUCTION NEXT 5 MILES"	As Required

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

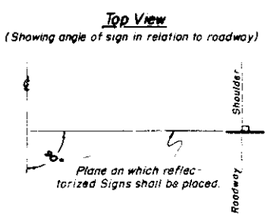
1	All Barricades	As Required
2	"CAUTION PROJECT BEGINS"	Minimum 2
3	"DANGER MEN & EQUIPMENT WORKING IMMEDIATELY AHEAD"	As Required
4	"END CONSTRUCTION WE THANK YOU FOR YOUR COOPERATION"	Minimum 2
5	"SLOW PLEASE"	As Required
6.	Standard Warning & Directional Signs	As Required
7	Approved Directional Arrows & 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

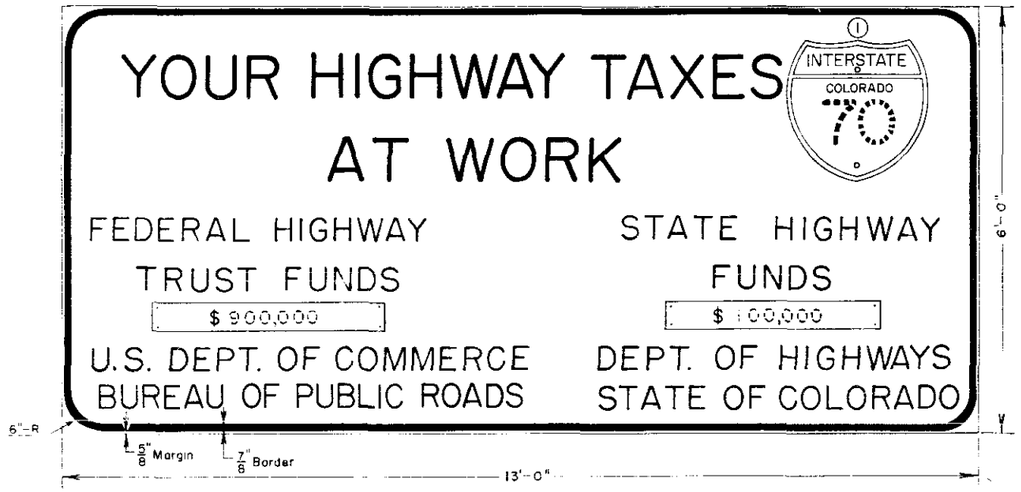
STANDARD M-6-CA

(JAN. 31, 1964)

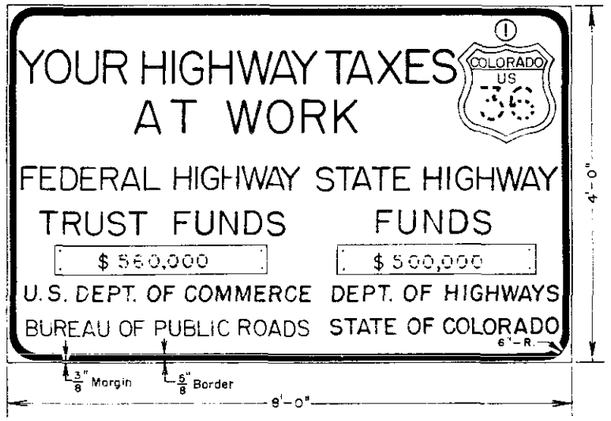
FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO	SHEET NO.	TOTAL SHEETS
9	COLORADO			

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

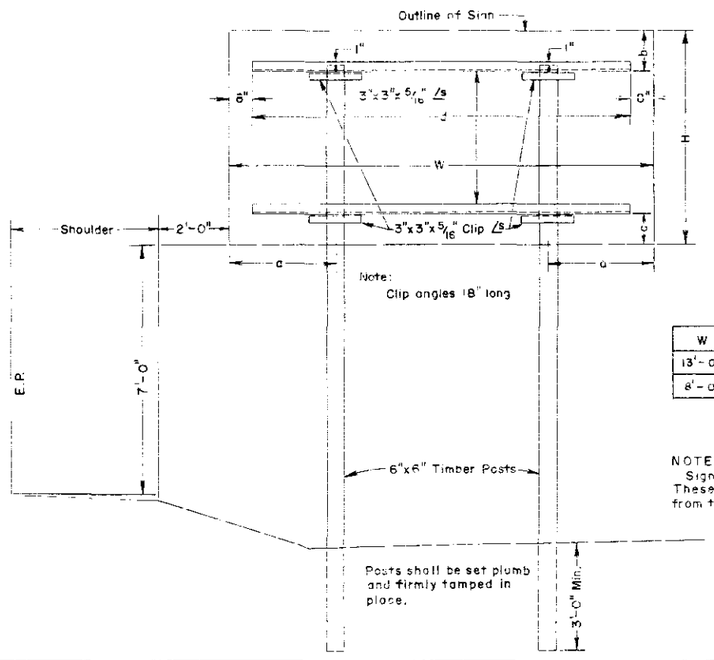
INTERSTATE SYSTEM



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"	5'-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.

① Applicable Interstate, U.S. Shield or State Route Shield.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

IDENTIFICATION SIGNS

Designed by B.F.R.	Approved by [illegible]
Made by D.J.B.	Staff Design Engr.
Checked by M.R.H.	Date: 2-5-64

STANDARD TYPES of DITCHES and CONSTRUCTION METHODS

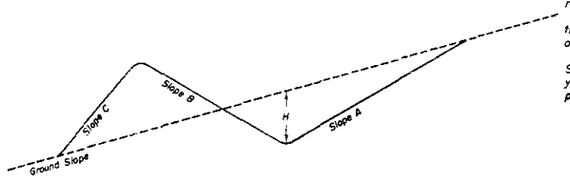
STANDARD M-13-A

(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



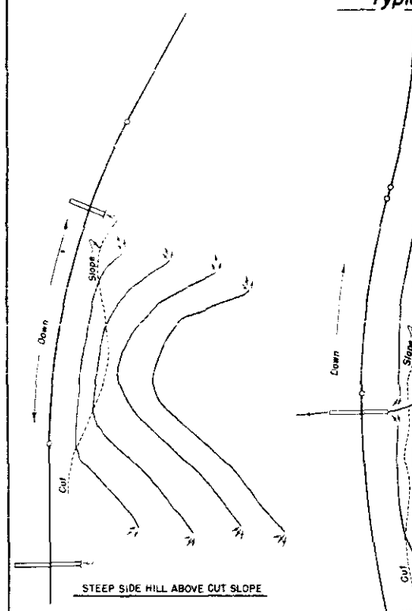
PURPOSE & USE OF THE TABLE

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.

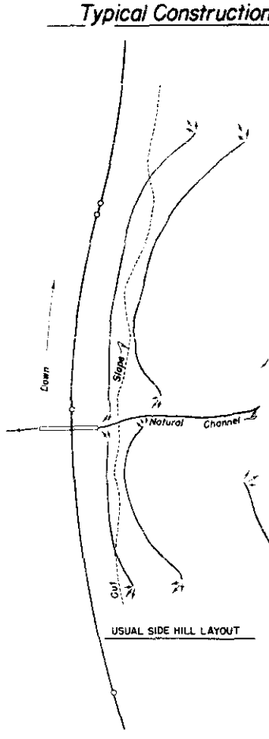
Foremost consideration in constructing these ditches is given first to the natural ground line slope confronted in construction, thence to the other values shown on the Typical Section.

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.

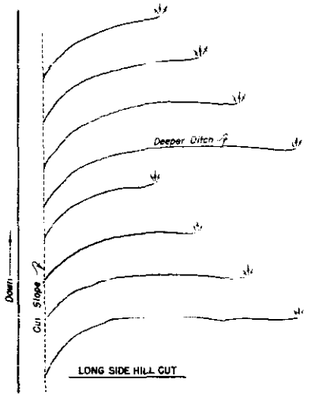
Typical Construction Layouts



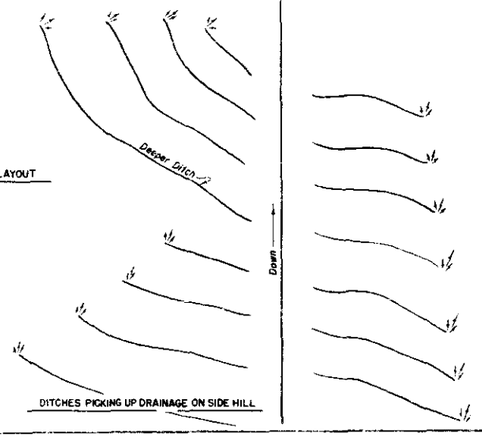
STEEP SIDE HILL ABOVE CUT SLOPE



USUAL SIDE HILL LAYOUT



LONG SIDE HILL CUT



DITCHES PICKING UP DRAINAGE ON SIDE HILL

Scale of Sketches in Feet

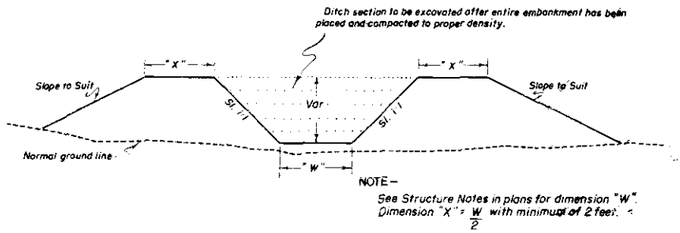
100 0 100 200 300 400

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.*

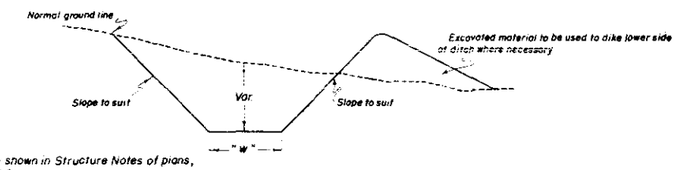
TYPICAL SECTIONS for DRAINAGE, IRRIGATION DITCHES and CHANNEL CHANGES



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

For Embankment Sections

(Generally for use in Irrigation Ditches & Channel Changes)



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.	Approved by: C. Fisher
Made by C.G.M.	Engineer of Surveys & Plans
Checked by	Date: Apr. 13, 1962

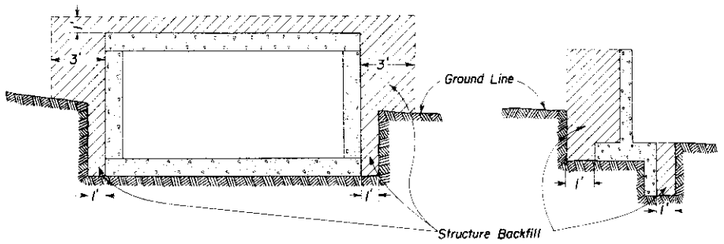
STANDARD M-16-A

(MAY 1, 1962)

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

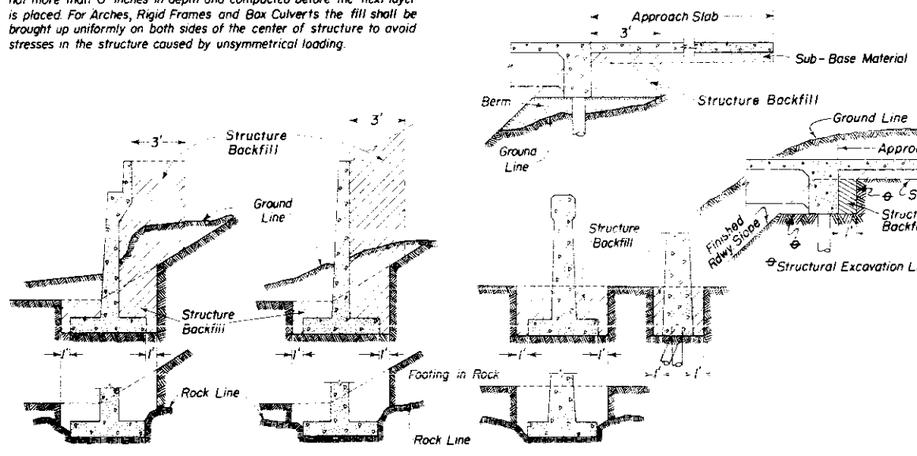
REVISION		
5-2-63	Rev. Backfill	L.E.O.
1-31-64	DEPT. NAME	M.R.H.

CONCRETE BOX CULVERTS & WINGWALLS

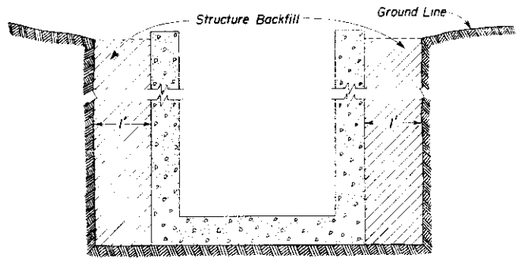


PIERS, ABUTMENTS, RETAINING WALLS ETC.

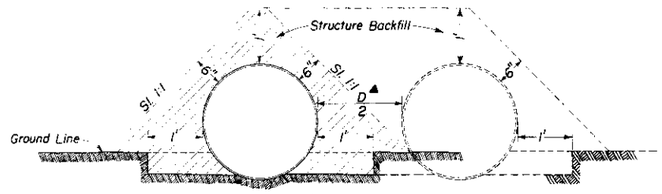
All material that is to be compacted shall be placed in horizontal layers not more than 6" inches in depth and compacted before the next layer is placed. For Arches, Rigid Frames and Box Culverts the fill shall be brought up uniformly on both sides of the center of structure to avoid stresses in the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



DROP INLETS, DIVISION BOXES, INTERCEPTING HEADWALLS ETC.



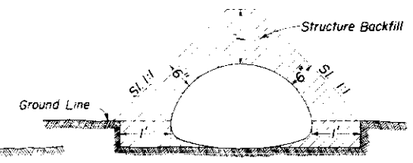
♦CIRCULAR CONDUIT



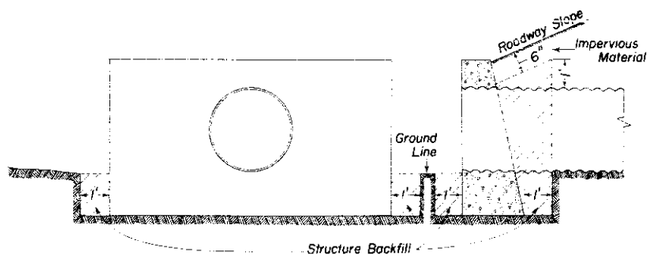
♦When two or more conduits are layed side by side, the distance between conduits shall be 1/2 the conduit diameter but not less than 1'-0".

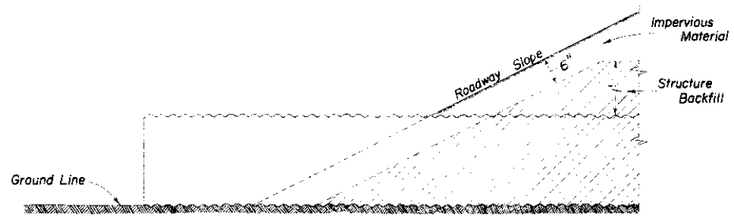
♦See Design Aid No. 16, 16a or 16b for computation of quantities.

♦ELLIPTICAL OR ARCH CONDUIT

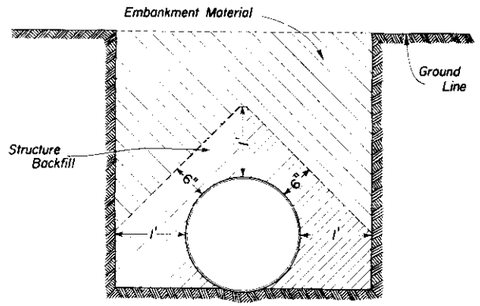


HEADWALLS AND END OF CULVERTS

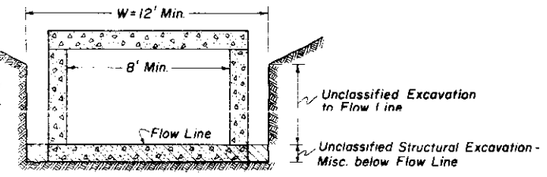




♦SIPHONS OR CONDUIT IN TRENCH



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 C.D. Kenworthy
Made by D.M.E.	Bridge Engineer
Checked by L.E.O.	Date: May 2, 1958

STANDARD M-45-A

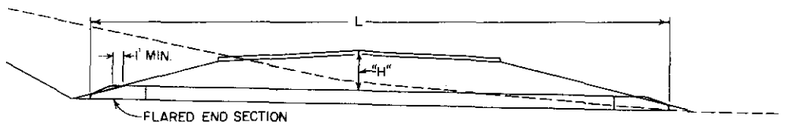
(DEC. 1, 1963)

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

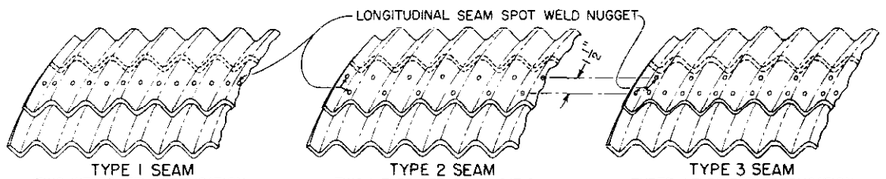


CULVERT WITHOUT END SECTIONS

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



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	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 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	16	14	14	14	12	12
21	16	16	16	16	16	14	14	14	12	12	10	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	10	10	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	8	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
① 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	12	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	
② 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										
③ 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 R. Julian
Made by T.E.F	Engineer, Surveys & Plans
Checked by	Date: Dec. 6, 1963

STANDARD M-46-B

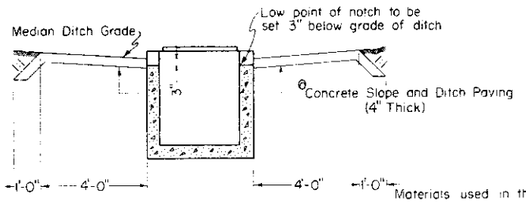
(MAY 1, 1962)

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

REVISIONS	
4-18-63 Rev. Steps	L.E.O.
7-2-63 Rev. Step Dimension	L.E.O.
2-3-64 DEPT. NAME	M.R.H.

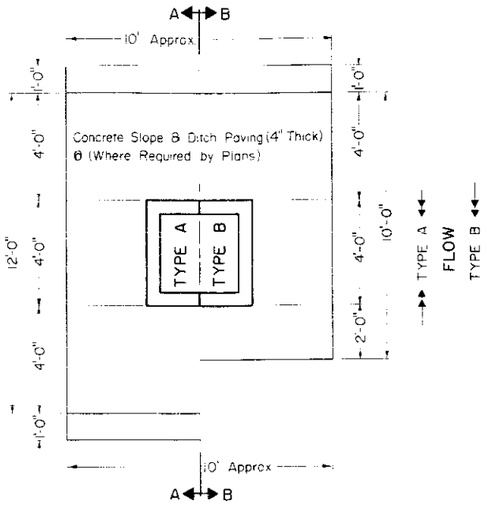
TYPE A

FOR USE AT BOTTOM OF VERTICAL CURVE



SECT. "A-A"

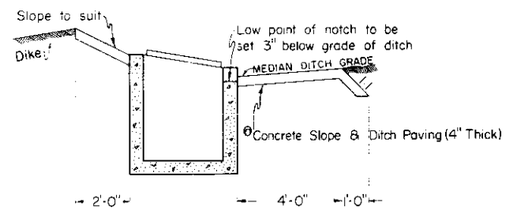
Materials used in the construction of Inlet Gratings shall meet the requirements of Item 48, Structural Steel, in the Standard Specifications.



LAYOUT OF INLET IN MEDIAN DITCH

TYPE B

FLOW FROM ONE DIRECTION



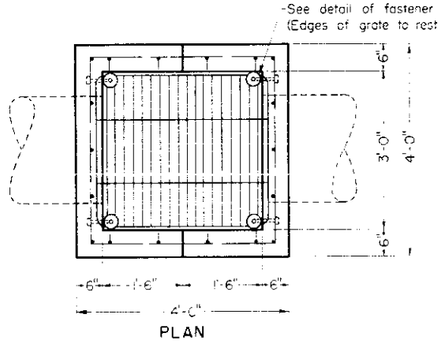
SECT. "B-B"

QUANTITIES FOR ONE INLET

H	CLASS "A" CONCRETE CU. YDS.		REINFORCING STEEL 0 LBS.	
	TYPE A	TYPE B	TYPE A	TYPE B
3'-0"	0.91	1.00	83	93
3'-6"	1.04	1.13	89	100
4'-0"	1.17	1.26	105	116
4'-6"	1.30	1.39	115	126
5'-0"	1.43	1.52	136	146
5'-6"	1.56	1.65	142	153
6'-0"	1.69	1.78	158	169
6'-6"	1.82	1.91	168	179
7'-0"	1.95	2.04	185	195
7'-6"	2.08	2.17	191	202
8'-0"	2.21	2.30	211	222
8'-6"	2.34	2.43	217	228
9'-0"	2.47	2.56	234	244
9'-6"	2.60	2.69	244	255
10'-0"	2.73	2.82	260	271
10'-6"	2.86	2.95	266	277
11'-0"	2.99	3.08	287	297
11'-6"	3.12	3.21	293	304
12'-0"	3.25	3.34	309	320

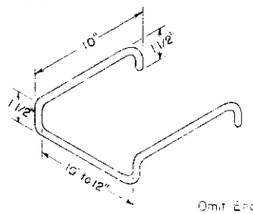
0 Includes 1% for overrun

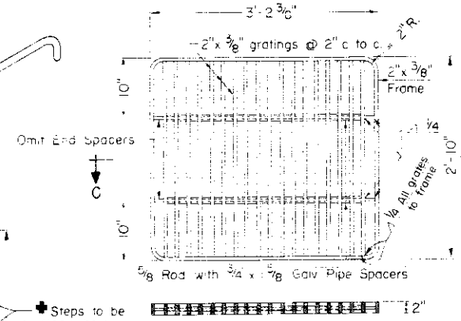
Volume occupied by pipes not to be deducted from quantities.

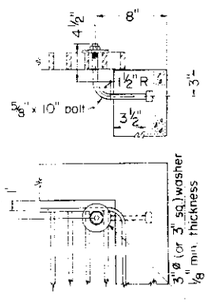


PLAN

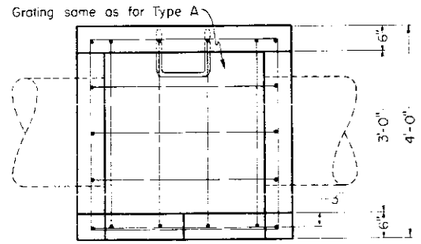
DETAIL OF INLET STEP✚







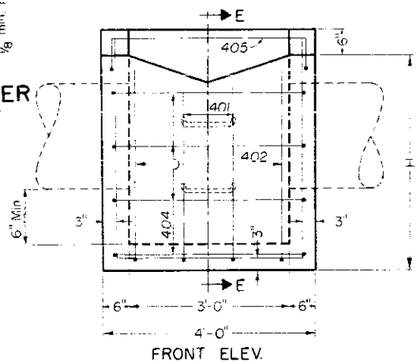
SECT. "C-C"



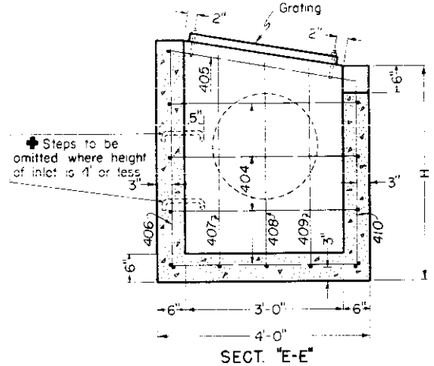
PLAN

DETAIL OF FASTENER

4 REQ'D FOR EACH INLET

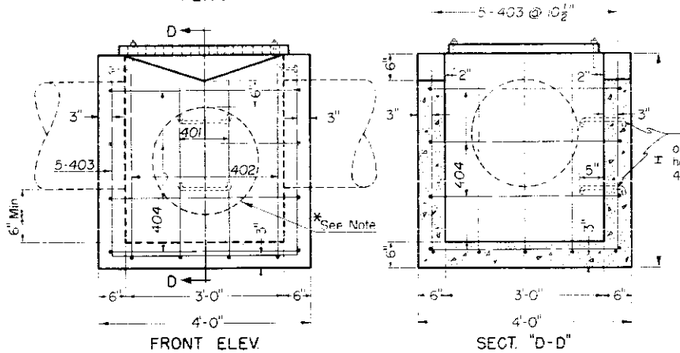


FRONT ELEV.



✚Steps to be omitted where height of inlet is 4' or less.

SECT. "E-E"



FRONT ELEV.

SECT. "D-D"

✚Steps to be omitted where height of inlet is 4' or less.

*Note for Longitudinal Pipe: 6" minimum between bottom of Inlet Opening and top of Longitudinal Pipe

✚DETAIL OF GRATING

MATERIAL LIST FOR GRATING AND FASTENERS

Strap Iron Frame	1 pc.	2"x 3/8" x 11'-9 5/16"	@ 2.55 lb. per ft. = 30.0 lb.
Strap Iron Gratings	18 pcs	2"x 3/8" x 2'-9 1/4"	@ 2.55 lb. per ft. = 127.2 lb.
Galv. Iron Pipe Spacers	34 pcs	3/4" x 1 9/16"	@ 1.13 lb. per ft. = 5.2 lb.
Tie Rods	2 pcs	5/8" x 3'-1 5/16"	@ 1.04 lb. per ft. = 6.5 lb.
Bolts	4 pcs	5/8" x 10"	@ 1.03 lb. ea. = 4.1 lb.
Washers	4 pcs		@ 0.23 lb. ea. = 0.9 lb.

✚NOTE: Acceptable equivalent Gratings may be substituted after approval by the Engineer.

BAR LIST FOR H=4'-0"

MARK	NO. REQ'D	KIND	TYPE A DIMENSIONS M	N	O	LENGTH	TYPE B DIMENSIONS M	N	O	LENGTH
401	2	I	3'-6"	3'-3"✚	3'-3"✚	10'-0"	3'-6"	3'-3"✚	4'-1"✚	10'-10"
402	2	I	3'-6"	3'-6"✚	3'-6"✚	10'-6"	3'-6"	3'-6"✚	4'-1"✚	11'-1"
403	5	I	3'-6"	3'-7"✚	3'-7"✚	10'-8"				
404	4△	II	3'-7"	3'-7"		15'-4"	3'-7"	3'-7"		15'-4"
405	1	I					3'-7"	3'-7"	3'-7"	10'-9"
406	1	I					3'-6"	4'-1"✚	4'-1"✚	11'-8"
407	1	I					3'-6"	4'-0"✚	4'-0"✚	11'-6"
408	1	I					3'-6"	3'-10"✚	3'-10"✚	11'-2"
409	1	I					3'-6"	3'-8"✚	3'-8"✚	10'-10"
410	1	I					3'-6"	3'-7"✚	3'-7"✚	10'-8"

All reinforcing bars to be ½" ø.

▲BENDING DIAGRAMS (SAME FOR TYPES A & B)

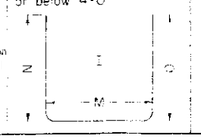
All dimensions out to out of bars

✚Steps required as follows:

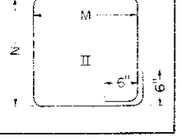
H=4'-6" . . . 1 step
H=5'-0", 5'-6" & 6'-0" . . . 2 steps
H=6'-6", 7'-0" & 7'-6" . . . 3 steps
H=8'-0", 8'-6" & 9'-0" . . . 4 steps
H=9'-6", 10'-0" & 10'-6" . . . 5 steps
H=11'-0", 11'-6" & 12'-0" . . . 6 steps

✚All Steps shall be 3/4" ø A-7 Steel Bars and shall be galvanized per ASTM Designation A123-59. Steps for Inlets shall be included for payment under "Reinforcing Steel"

✚ Increase or decrease dimensions N & O 6" for each 6" increase or decrease of H above or below 4'-0"



△Note for 404 bar: Subtract one bar for H less than 4'. Add one bar for each foot increase in H



▲NOTE: Cut or bend bars to fit around pipes as required

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 walls shall have forms on both sides. Bevel all exposed corners to a 1" face.

All reinforcing bars shall be deformed, of intermediate grade, and shall be tagged with the station number and bar designation.

All edge distances not marked clear are to the ℄ of the bar.

Inlet grating to be painted as per specifications for structural steel. One shop coat of Zinc Chromate primer and two field coats of Aluminum.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

CONCRETE MEDIAN INLETS

Designed by	Approved by
Made by ARH	Bridge Engineer
Checked by D.L.V.	Date: May 17 1962

STANDARD M-46-B

STANDARD M-46-C

(MAY 1, 1962)

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

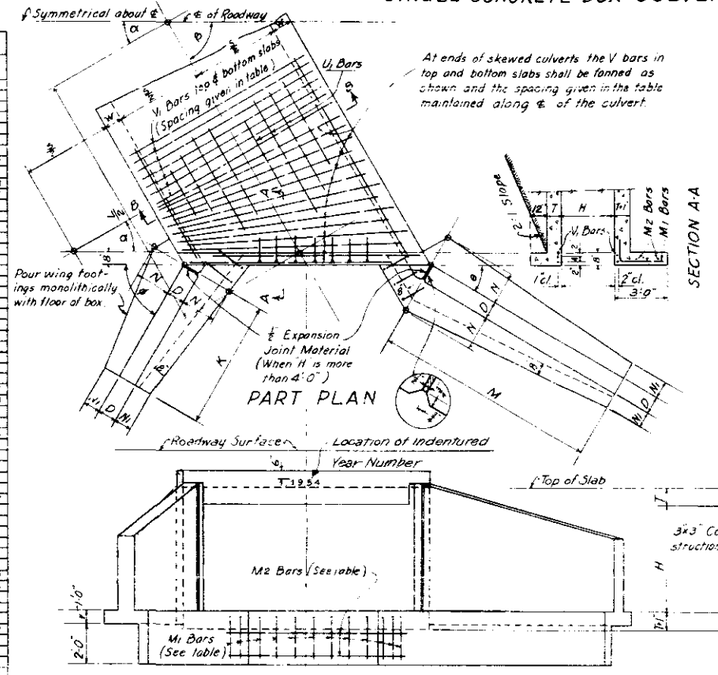
Dimensions & Quantities (see Wingwall Standard for Wings)

Height of Fill Allowed	Type	Span S	Height H	Slab T	Wall W	Bar size & spacing V1 Size	V1 Spa	W1 Size	W1 Spa	No. bars required U1	M1	Quantities For One Lin Ft of Box Concrete Cu Yds	Steel Lbs	Quantities for Two Headwalls Concrete Cu Yds	Steel Lbs
35'-0"	2A	3'-0"	2'-0"	6"	8"	1/2"	12"	1/2"	12"	8	8	0.252	15.6	1.30	81
30'-0"	3A	3'-0"	2'-0"	7"	8"	7/8"	12"	3/4"	12"	10	Cos α	0.299	26.3	1.50	115
			3'-0"							12		0.349	29.0	1.65	123
20'-0"	4A	4'-0"	3'-0"	7 1/2"	8"	7/8"	12"	1/2"	12"	14	10	0.362	31.8	1.75	150
			4'-0"							16	Cos α	0.412	34.6	1.90	154
			5'-0"							16	12	0.461	37.3	2.10	158
16'-0"	5A	5'-0"	4'-0"	8"	8"	3/4"	8"	1/2"	8"	18	12	0.481	45.4	2.20	153
			5'-0"							20	Cos α	0.539	48.71	2.40	157
			6'-0"							22		0.579	52.0	2.60	161
20'-0"	5B	5'-0"	3'-0"	8 1/2"	8"	3/4"	8"	5/8"	8"	16	12	0.500	45.6	2.20	153
			4'-0"							18	Cos α	0.549	48.8	2.40	157
			5'-0"							20		0.598	52.2	2.60	161
			6'-0"							22		0.625	54.71	2.65	180
14'-0"	6A	6'-0"	3'-0"	8 1/2"	8"	3/4"	8"	5/8"	8"	22	14	0.654	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	77.4	2.70	223
20'-0"	6B	6'-0"	5'-0"	10"	8"	7/8"	8"	5/8"	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	3.03	208
12'-0"	7A	7'-0"	5'-0"	9	9"	3/4"	7"	1/2"	7"	24	16	0.776	71.9	3.25	212
			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"	7/8"	8"	5/8"	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	91.1	3.10	257
20'-0"	7C	7'-0"	5'-0"	11"	9"	7/8"	7"	5/8"	7"	24	16	0.881	96.0	3.30	263
			6'-0"							26	Cos α	0.937	101.0	3.50	269
			7'-0"							28		0.992	106.0	3.75	274
			4'-0"							24		0.844	75.8	3.40	235
			5'-0"							26	18	0.905	79.5	3.60	239
10'-0"	8A	8'-0"	6'-0"	9 1/2"	10"	3/4"	7"	1/2"	7"	28	Cos α	0.966	83.2	3.80	243
			7'-0"							30		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"	11 1/2"	10"	7/8"	7"	5/8"	7"	28	Cos α	1.086	110.8	3.90	303
			7'-0"							30		1.148	115.8	4.20	308
			8'-0"							32		1.210	120.6	4.45	314
			4'-0"							28		1.023	115.8	3.55	292
			5'-0"							26	18	1.084	121.4	3.75	296
20'-0"	8C	8'-0"	6'-0"	12 1/2"	10"	7/8"	6"	5/8"	6"	28	Cos α	1.146	126.9	3.95	304
			7'-0"							30		1.208	133.5	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	332
7'-0"	9A	9'-0"	7'-0"	10"	11"	7/8"	8"	5/8"	8"	32	Cos α	1.176	111.6	4.50	337
			8'-0"							34		1.244	116.1	4.80	342
			9'-0"							36		1.311	120.7	5.15	348
			5'-0"							28		1.174	137.9	4.10	327
			6'-0"							30	20	1.242	137.5	4.30	333
14'-0"	9B	9'-0"	7'-0"	12"	11"	7/8"	6	5/8"	6"	32	Cos α	1.310	143.1	4.60	338
			8'-0"							34		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	20	1.377	156.9	4.40	406
20'-0"	9C	9'-0"	7'-0"	14"	11"	1"	7"	3/4"	7"	32		1.444	163.4	4.70	416
			8'-0"							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	167.7	4.60	355
			7'-0"							34	22	1.334	177.0	4.90	358
5'-0"	10A	10'-0"	8'-0"	10 1/2"	12"	7/8"	8"	1/2"	8"	36	Cos α	1.408	186.2	5.20	363
			9'-0"							38		1.483	196.8	5.60	367
			10'-0"							40		1.558	206.7	5.95	371
			6'-0"							34		1.367	180.4	4.70	367
			7'-0"							36	22	1.445	190.4	5.00	372
10'-0"	10B	10'-0"	8'-0"	12"	12"	7/8"	7"	5/8"	8"	38	Cos α	1.517	200.4	5.30	378
			9'-0"							40		1.591	210.3	5.65	383
			10'-0"							42		1.665	220.1	6.05	388
			6'-0"							36		1.518	200.7	4.80	443
			7'-0"							38	22	1.593	211.6	5.10	448
16'-0"	10C	10'-0"	8'-0"	14"	12"	1"	8"	3/4"	8"	40	Cos α	1.666	222.5	5.40	454
			9'-0"							42		1.741	233.4	5.80	459
			10'-0"							44		1.815	244.3	6.15	478
			6'-0"							36		1.361	216.6	4.95	483
			7'-0"							38	24	1.441	232.2	5.25	387
5'-0"	11A	11'-0"	8'-0"	11"	12"	7/8"	7"	1/2"	7"	40	Cos α	1.515	235.1	5.55	391
			9'-0"							42		1.589	239.6	5.90	395
			10'-0"							44		1.664	243.1	6.25	399
			6'-0"							38		1.490	248.3	5.00	467
			7'-0"							40	24	1.564	262.8	5.30	472
9'-0"	11B	11'-0"	8'-0"	12 1/2"	12"	1"	8"	5/8"	8"	42	Cos α	1.638	267.3	5.65	476
			9'-0"							44		1.712	161.8	6.00	485
			10'-0"							46		1.783	166.4	6.35	489
			6'-0"							38		1.608	152.5	5.10	326
			7'-0"							40	24	1.682	165.1	5.40	401
13'-0"	11C	11'-0"	8'-0"	14"	12"	7/8"	6"	5/8"	6"	42	Cos α	1.756	170.1	5.70	407
			9'-0"							44		1.830	176.2	6.10	412
			10'-0"							46		1.904	181.8	6.45	418
			6'-0"							38		1.525	174.3	5.25	411
			7'-0"							40	26	1.599	182.0	5.60	415
5'-0"	12A	12'-0"	8'-0"	12"	12"	7/8"	7"	1/2"	7"	42	Cos α	1.673	189.7	5.90	419
			9'-0"							44		1.747	197.4	6.25	423
			10'-0"							46		1.821	205.0	6.60	427
			6'-0"							40		1.697	197.7	5.40	502
			7'-0"							42	26	1.772	207.7	5.70	508
10'-0"	12B	12'-0"	8'-0"	14"	12"	1"	7"	5/8"	7"	44	Cos α	1.846	217.7	6.00	513
			9'-0"							46		1.920	227.6	6.40	519
			10'-0"							48		1.994	237.6	6.70	524
			6'-0"							40		1.625	226.0	5.60	482
			7'-0"							42	28	1.725	239.7	5.90	488
4'-0"	13A	13'-0"	8'-0"	12 1/2"	12"	7/8"	7"	1/2"	7"	44	Cos α	1.794	253.3	6.20	450
			9'-0"							46		1.868	267.0	6.55	454
			10'-0"							48		1.942	280.7	6.95	458
			6'-0"							42		1.787	268.4	5.70	538
			7'-0"							44	28	1.861	283.3	6.00	543
8'-0"	13B	13'-0"	8'-0"	14"	12"	1"	7"	5/8"	7"	46	Cos α	1.935	298.3	6.30	549
			9'-0"							48		2.009	313.1	6.65	555
			10'-0"							50		2.083	328.2	7.05	560
			6'-0"							42		1.827	277.6	5.95	571
			7'-0"							44	30	1.901	291.7	6.25	577
4'-0"	14A	14'-0"	8'-0"	13 1/2"	12"	1"	8"	5/8"	8"	46	Cos α	1.975	306.2	6.55	582
			9'-0"							48		2.049	320.7	6.95	588
			10'-0"							50		2.123	335.2	7.30	593
			6'-0"							44		1.975	299.5	6.05	572
			7'-0"							46	30	2.049	314.5	6.40	578
8'-0"	14B	14'-0"	8'-0"	15"	12"	1"	7"	5/8"	7"	48	Cos α	2.123	329.4	6.70	583
			9'-0"							50		2.198	344.4	7.05	589
			10'-0"							52		2.270	359.4	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.

SINGLE CONCRETE BOX CULVERT



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

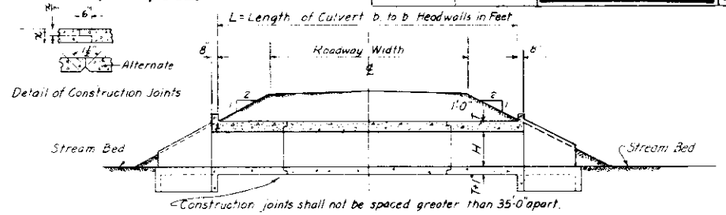
Bar List for Culvert & Headwalls (See Wingwall Standard for Wings)

Mark	Size	No. Req'd.	Type	Length
V1	See table 10+	2aL/Spa	I	S+2W-6
W1	See table 6+	2aL/Spa	I	H+2T-5
U1	1/2"	See table	I	L+1'-0"
M1	1/2"	See table	II	3'-6"
M2	1/2"	4	I	(S+2W-6)/Cos α
			Straight	Type I
			2'-6" / 1'-0"	Type II

(Bar dimensions are out to out of bar)

Possible Combinations (Span & Height)

2'x2'	5'x5'	9'x5'	10'x7'	11'x8'	11'x10'
3'x2'	7'x4'	8'x6'	9'x8'	10'x9'	14'x8'
4'x2'	6'x5'	7'x7'	12'x6'	13'x7'	13'x9'
3'x3'	8'x4'	9'x6'	11'x7'	12'x8'	12'x10'
4'x3'	7'x5'	8'x7'	13'x6'	14'x7'	14'x9'
5'x3'	6'x6'	10'x6'	10'x8'	11'x9'	13'x10'
4'x4'	8'x5'	9'x7'	9'x9'	10'x10'	14'x10'
5'x4'	6'x7'	8'x8'	12'x7'	13'x8'	
6'x4'	7'x6'	11'x6'	14'x6'	12'x9'	



TYPICAL SECTION THROUGH CULVERT

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

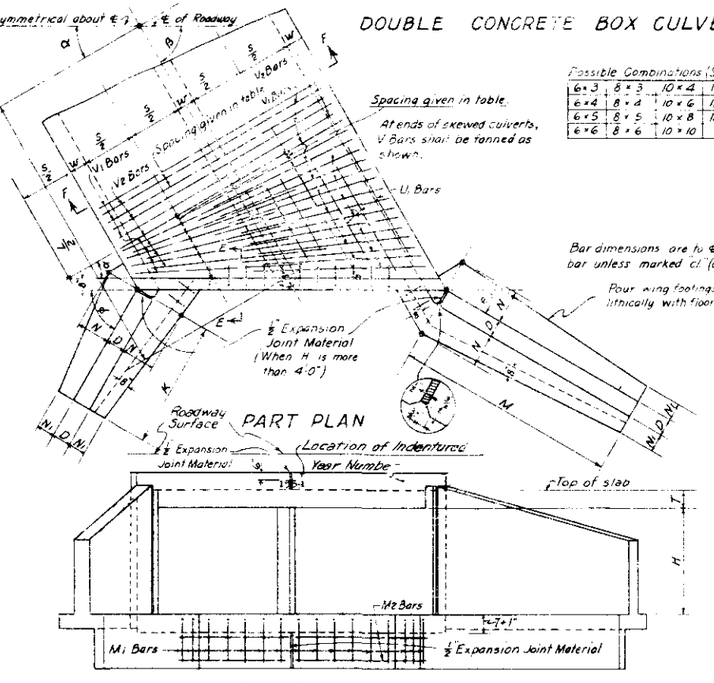
Note: K, M, N, N1 and D are dimensioned on Wingwall Standard for the various heights of culverts.

DOUBLE CONCRETE BOX CULVERT

Dimensions & Quantities (see Wingwall Standard for Wings)

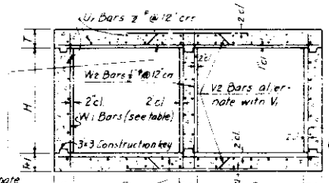
Height of Fill Allowed	Type	Span S	Height H	Slab T	Wall W	Bar Size & Spacing V1 Size	V1 Spac	V2 Size	V2 Spac	No. Bars Required U1	M1	Quantities for One Lin Ft of Box Concrete Cu Yds	Steel Lbs	Quantities for Two Headwalls Concrete Cu Yds	Steel Lbs
10'-0"	6-6-A	6'-0"	3'-0"	8 1/2"	8"	5/8"	12"	5/8"	12"	48	32	2.00	112.3	3.35	32
			4'-0"			5/8" Spa		1/2"	12"	52	Cos α	1.073	117.9	4.60	336
			5'-0"						12"	56		1.148	123.7	4.85	343
			6'-0"						12"	60		1.222	128.5	5.05	351
15'-0"	6-6-B	6'-0"	4'-0"	9 1/2"	8"	7/8"	12"	5/8"	12"	48	32	1.061	125.3	4.45	323
			5'-0"			5" Spa		1/2"	12"	52	Cos α	1.161	131.1	4.65	337
			6'-0"						12"	56		1.235	137.1	4.90	346
			8'-0"						8"	66		1.309	141.4	5.10	353
20'-0"	6-6-C	6'-0"	4'-0"	10 1/2"	8"	7/8"	8"	5/8"	12"	48	32	1.171	139.0	4.50	331
			5'-0"			4 1/2" Spa		1/2"	12"	52	Cos α	1.247	145.1	4.75	339
			6'-0"						12"	56		1.321	142.5	4.95	347
			7'-0"						8"	66		1.395	152.4	5.15	355
10'-0"	8-8-A	8'-0"	3'-0"	8"	10"	5/8"	12"	5/8"	12"	60	40	1.477	174.4	5.80	506
			4'-0"			6" Spa		1/2"	12"	64	Cos α	1.569	179.8	6.05	514
			5'-0"						12"	68		1.662	185.2	6.30	522
			6'-0"						8"	72		1.755	190.6	6.55	531
15'-0"	8-8-B	8'-0"	4'-0"	11"	10"	5/8"	7"	5/8"	12"	60	40	1.684	192.0	6.15	516
			5'-0"			5" Spa		1/2"	12"	68	Cos α	1.777	197.4	6.40	524
			6'-0"						8"	72		1.869	207.9	6.65	533
20'-0"	8-8-C	8'-0"	3'-0"	12 1/2"	10"	5/8"	7"	5/8"	12"	60	40	1.763	202.0	6.00	513
			4'-0"			5" Spa		1/2"	12"	64	Cos α	1.856	207.4	6.30	521
			5'-0"						10"	68		1.948	214.6	6.55	529
			6'-0"						7"	72		2.041	225.7	6.75	537
5'-0"	10-10-A	10'-0"	4'-0"	10"	12"	5/8"	8"	7/8"	12"	60	48	1.935	228.3	7.40	714
			5'-0"			7" Spa		5/8"	12"	66	Cos α	2.157	239.8	7.95	733
			6'-0"						12"	94		2.380	265.6	8.70	752
			10'-0"						9"	102		2.602	275.5	9.55	771
10'-0"	10-10-B	10'-0"	4'-0"	12"	12"	5/8"	7"	5/8"	15"	78	48	2.220	231.0	7.65	721
			6'-0"			7" Spa		5/8"	12"	94	Cos α	2.442	242.5	8.20	740
			10'-0"						8"	102		2.664	258.0	8.90	759
15'-0"	10-10-C	10'-0"	4'-0"	14"	12"	5/8"	7"	5/8"	15"	78	48	2.686	282.6	9.75	778
			6'-0"			6" Spa		5/8"	12"	94	Cos α	2.503	260.8	7.86	722
			8'-0"						9"	94		2.725	275.6	8.40	746
			10'-0"						6"	102		2.947	295.0	9.15	765
5'-0"	12-12-A	12'-0"	6'-0"	12"	12"	5/8"	7"	5/8"	15"	78	56	3.170	325.5	10.00	784
			7'-0"			7" Spa		5/8"	12"	104	Cos α	2.751	278.2	9.35	867
			10'-0"						9"	114		2.973	294.5	10.05	872
10'-0"	12-12-B	12'-0"	6'-0"	14"	12"	5/8"	7"	5/8"	15"	98	56	3.195	315.0	10.90	895
			8'-0"			6" Spa		5/8"	12"	104	Cos α	3.083	313.5	9.60	864
			10'-0"						8"	114		3.305	329.8	10.30	883
15'-0"	12-12-C	12'-0"	6'-0"	16"	12"	5/8"	7"	5/8"	12"	98	56	3.528	354.1	11.15	902
			8'-0"			5" Spa		5/8"	12"	106	Cos α	3.416	365.1	9.85	870
			10'-0"						6"	114		3.638	384.7	10.55	889
5'-0"	14-14-A	14'-0"	6'-0"	15"	12"	5/8"	7"	5/8"	15"	110	64	3.860	415.7	11.40	908
			8'-0"			6" Spa		5/8"	12"	118	Cos α	3.633	356.2	10.25	904
			10'-0"						9"	126		3.855	372.0	11.60	1003
10'-0"	14-14-B	14'-0"	6'-0"	16"	12"	5/8"	7"	5/8"	15"	110	64	4.077	392.9	12.50	1023
			8'-0"			5" Spa		5/8"	12"	118	Cos α	3.824	402.4	11.75	988
			10'-0"						8"	126		4.046	425.2	11.75	1007
												4.269	459.2	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'x3'	8'x3'	10'x4'	12'x6'	14'x6'
6'x4'	8'x4'	10'x6'	12'x8'	14'x8'
6'x5'	8'x5'	10'x8'	12'x10'	14'x10'
6'x6'	8'x6'	10'x10'		



V1 Bars alternate with V2. See Table for Spacing.

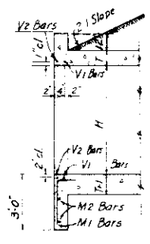
Bar List for Culvert and Two Headwalls (See Wingwall Std. for Wings)

Mark	Size	Number Required	Type	L	Total Length
V1	See Table	24(L+2)/Spacing	I	S+1.5W+4"	L
V2			II	0.785+4"	2E+m
W1			I	H+2T-4"	L
W2		2(L+2)	I	H+2T-4"	L
U1	1/2"	See Table	I	L+12"	L
M1	1/2"	See Table	III		3'-6"
M2	1/2"	8	I	S+1.5W/Cos α + 4"	L

Type I; Type II; Type III

(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	WWD	Approved by	[signature]
Made by	WWD	Bridge Engineer	
Checked by	T.J.M.	Date	Aug. 30, 1954

STANDARD M-46-C

STANDARD M-46-E

(MAY 1, 1962)

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

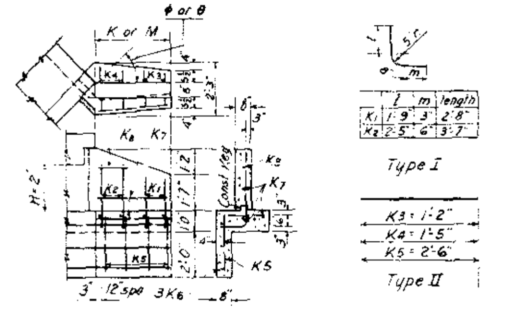
2-11-64 Rev Dept. Name M.R.H.

TABLE SHOWING VALUES OF K AND M WHEN "β" 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"	4'-9"	3'-10"	6'-7"	5'-2"	8'-10"	6'-3"	10'-10"	7'-3"	12'-7"	8'-3"	14'-5"	9'-3"	16'-0"	10'-3"	17'-9"	11'-3"	19'-6"
75°	15°	52°30'	37°30'	3'-0"	3'-11"	4'-2"	5'-5"	5'-7"	7'-3"	6'-10"	8'-11"	7'-11"	10'-4"	9'-0"	11'-9"	10'-1"	13'-2"	11'-2"	14'-7"	12'-3"	16'-0"
90°	0°	45°	45°	3'-4"	3'-4"	4'-8"	4'-8"	6'-3"	6'-3"	7'-8"	7'-8"	8'-11"	8'-11"	10'-2"	10'-2"	11'-4"	11'-4"	12'-7"	12'-7"	13'-9"	13'-9"
105°	15°	37°30'	52°30'	3'-11"	3'-0"	5'-5"	4'-2"	7'-3"	5'-7"	8'-11"	6'-10"	10'-4"	7'-11"	11'-9"	9'-0"	13'-2"	10'-1"	14'-7"	11'-2"	16'-0"	12'-3"
120°	30°	30°	60°	4'-9"	2'-9"	6'-7"	3'-10"	8'-10"	5'-2"	10'-10"	6'-3"	12'-7"	7'-3"	14'-5"	8'-3"	16'-0"	9'-3"	17'-9"	10'-3"	19'-6"	11'-3"
135°	45°	22°30'	67°30'	6'-2"	2'-4"	8'-7"	3'-7"	11'-7"	4'-10"	14'-2"	5'-11"	16'-5"	6'-10"	18'-8"	7'-9"	20'-10"	8'-8"	23'-2"	9'-8"	25'-5"	10'-7"

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.

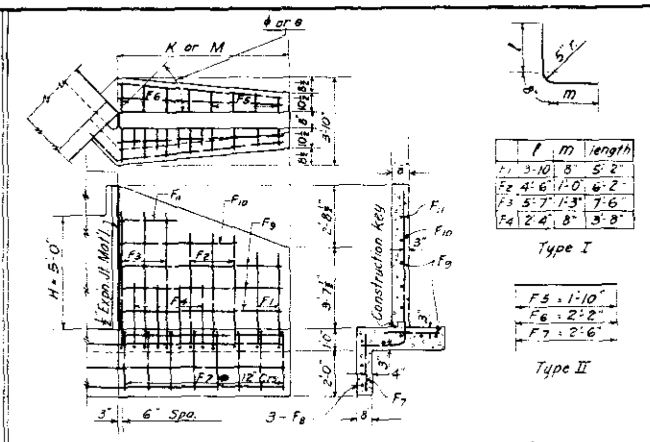


BAR LIST & QUANTITIES FOR ONE WING WHEN H = 2'-0"

When φ or θ equals	K1 ½"φ Type I	K2 ½"φ Type I	K3 ½"φ Type II	K4 ½"φ Type II	K5 ½"φ Type II	3-K6 ½"φ Type II	3-K7 ½"φ Type II	1-K8 ½"φ Type II	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

Number of bars required: K1–K5; Length of Bars: 3-K6, 3-K7, 1-K8; Quantities for One Wing: Concrete, Steel.

WING DETAIL WHEN H = 2'-0"

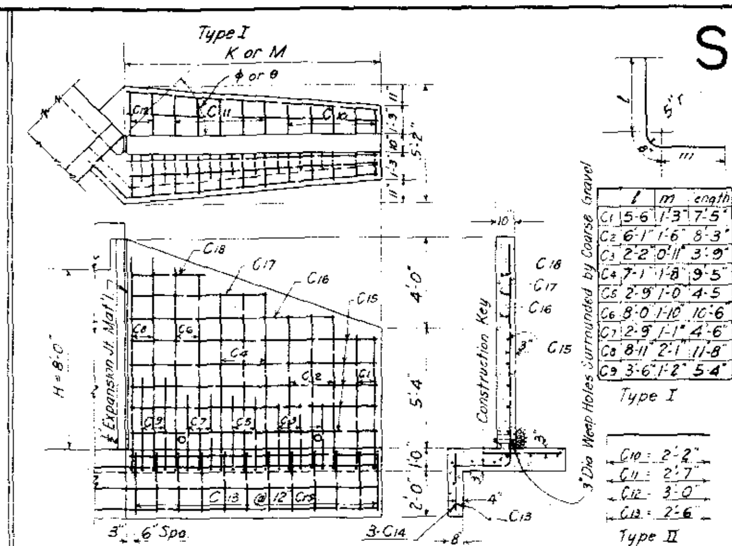


BAR LIST & QUANTITIES FOR ONE WING WHEN H = 5'-0"

When φ or θ equals	F1 ½"φ Type I	F2 ½"φ Type I	F3 ½"φ Type I	F4 ½"φ Type I	F5 ½"φ Type II	F6 ½"φ Type II	F7 ½"φ Type II	3-F8 ½"φ Type II	7-F9 ½"φ Type II	1-F10 ½"φ Type II	1-F11 ½"φ Type II	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"	1.96	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

Number of bars required: F1–F7; Length of Bars: 3-F8, 7-F9, 1-F10, 1-F11; Quantities - One Wing: Concrete, Steel.

WING DETAIL WHEN H = 5'-0"

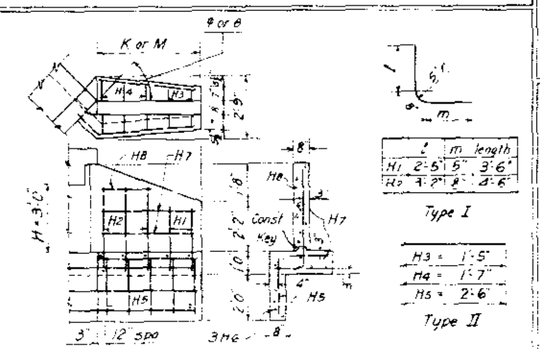


BAR LIST & QUANTITIES FOR ONE WING WHEN H = 8'-0"

When φ or θ equals	C1 ½"φ Type I	C2 ½"φ Type I	C3 ½"φ Type I	C4 ½"φ Type I	C5 ½"φ Type I	C6 ⅝"φ Type I	C7 ⅝"φ Type I	C8 ⅝"φ Type I	C9 ⅝"φ Type I	C10 ½"φ Type II	C11 ½"φ Type II	C12 ⅝"φ Type II	C13 ½"φ Type II	3-C14 ½"φ Type II	10-C15 ½"φ Type II	1-C16 ½"φ Type II	1-C17 ½"φ Type II	1-C18 ½"φ Type II	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'-2"	8'-4"	6'-9"	4'-2"	2'-4"	3.74	228

Number of bars required: C1–C13; Length of Bars: 3-C14, 10-C15, 1-C16, 1-C17, 1-C18; Quantities for One Wing: Concrete, Steel.

WING DETAIL WHEN H = 8'-0"

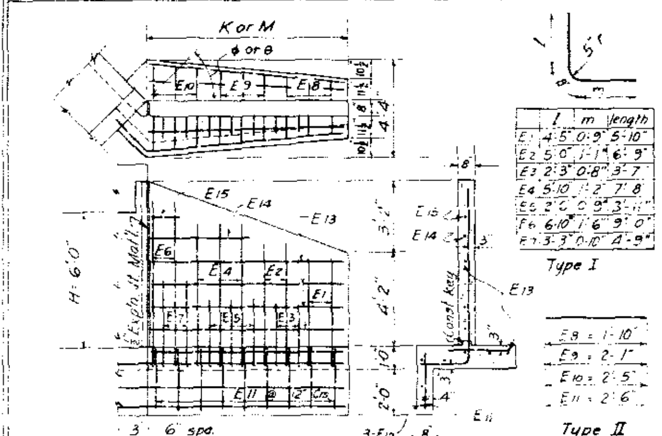


BAR LIST & QUANTITIES FOR ONE WING WHEN H = 3'-0"

When φ or θ equals	H1 ½"φ Type I	H2 ½"φ Type I	H3 ½"φ Type II	H4 ½"φ Type II	H5 ½"φ Type II	3-H6 ½"φ Type II	4-H7 ½"φ Type I	1-H8 ½"φ Type I	Concrete Cu Yds.	Steel lbs
22°30'	4	5	4	5	11	11'-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	[illegible]	6'-8"	5'-[illegible]	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

Number of Bars Required: H1–H5; Length of Bars: 3-H6, 4-H7, 1-H8; Quantities for One Wing: Concrete, Steel.

WING DETAIL WHEN H = 3'-0"



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

When φ or θ equals	E1 ½"φ Type I	E2 ½"φ Type I	E3 ½"φ Type I	E4 ½"φ Type I	E5 ½"φ Type I	E6 ½"φ Type I	E7 ⅝"φ Type I	E8 ½"φ Type II	E9 ½"φ Type II	E10 ½"φ Type II	E11 ½"φ Type II	3-E12 ½"φ Type II	8-E13 ½"φ Type II	1-E14 ½"φ Type II	1-E15 ½"φ Type II	Concrete Cu Yds	Steel Lbs
22°30'	4	4	4	5	4	4	4	5	6	6	20	19'-9"	16'-1"	8'-2"	3'-2"	5.21	317
30°	3	3	3	4	4	3	3	5	4	4	15	15'-0"	12'-3"	6'-2"	2'-2"	3.99	243
37°30'	2	3	3	3	3	3	2	3	4	4	13	12'-6"	10'-0"	5'-2"	2'-2"	3.28	203
45°	2	2	2	3	3	2	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	2	3	3	10	9'-8"	7'-7"	4'-2"	1'-2"	2.51	156
60°	2	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	2	3	2	8	8'-3"	6'-6"	3'-2"	1'-2"	2.17	134

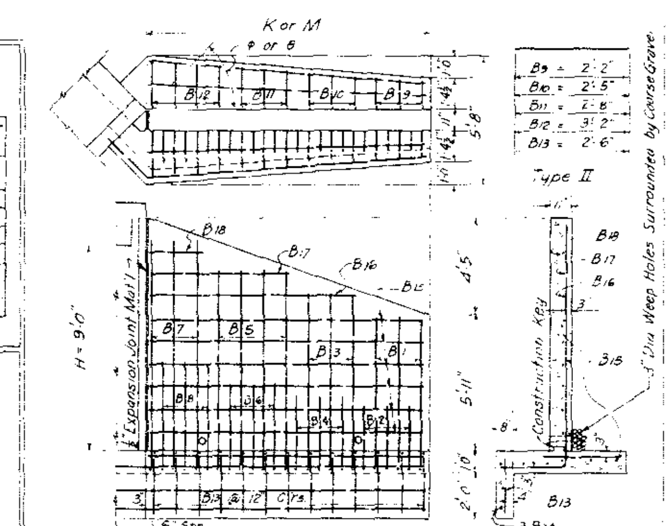
Number of Bars Required: E1–E11; Length of Bars: 3-E12, 8-E13, 1-E14, 1-E15; Quantities for One Wing: Concrete, Steel.

WING DETAIL WHEN H = 6'-0"

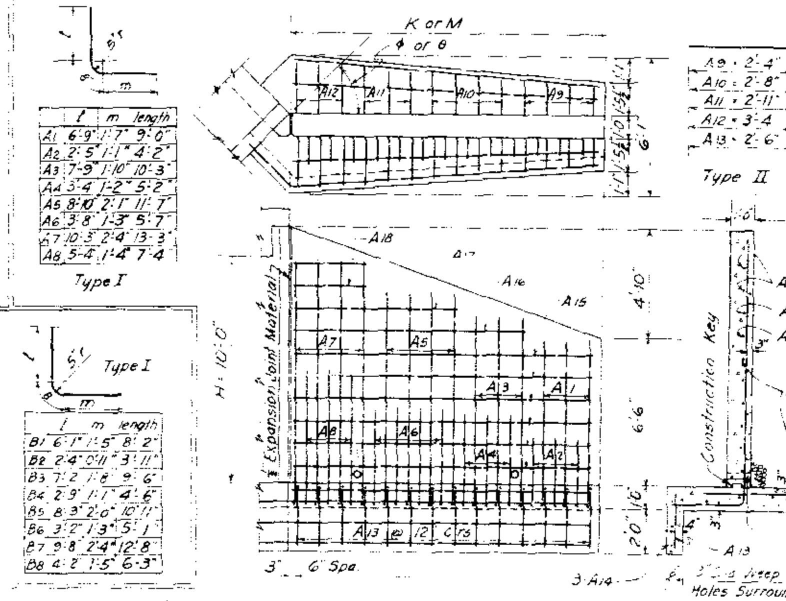
BAR LIST & QUANTITIES FOR ONE WING WHEN H = 9'-0"

When φ or θ equals	B1 ½"φ Type I	B2 ½"φ Type I	B3 ½"φ Type I	B4 ½"φ Type I	B5 ⅝"φ Type I	B6 ⅝"φ Type I	B7 ⅝"φ Type I	B8 ¾"φ Type I	B9 ½"φ Type II	B10 ½"φ Type II	B11 ½"φ Type II	B12 ⅝"φ Type II	B13 ½"φ Type II	3-B14 ½"φ Type II	11-B15 ½"φ Type II	1-B16 ½"φ Type II	1-B17 ½"φ Type II	1-B18 ½"φ Type II	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

Number of Bars Required: B1–B13; Length of Bars: 3-B14, 11-B15, 1-B16, 1-B17, 1-B18; Quantities for One Wing: Concrete, Steel.



WING DETAIL WHEN H = 9'-0"

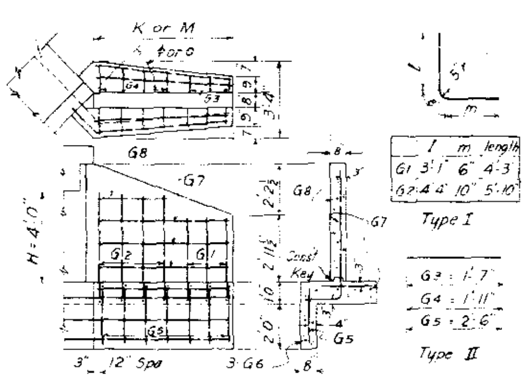


BAR LIST & QUANTITIES FOR ONE WING WHEN H = 10'-0"

When φ or θ equals	A1 ½"φ Type I	A2 ½"φ Type I	A3 ½"φ Type I	A4 ½"φ Type I	A5 ⅝"φ Type I	A6 ⅝"φ Type I	A7 ⅝"φ Type I	A8 ⅞"φ Type I	A9 ½"φ Type II	A10 ½"φ Type II	A11 ⅝"φ Type II	A12 ⅝"φ Type II	A13 ½"φ Type II	3-A14 ½"φ Type II	11-A15 ½"φ Type II	1-A16 ½"φ Type II	1-A17 ½"φ Type II	2-A18 ½"φ Type II	Concrete Cu Yds.	Steel Lbs.
22°30'	6	6	5	5	8	8	7	6	6	7	5	6	30	30'-0"	25'-11"	19'-2"	14'-2"	6'-2"	14.35	830
30°	5	4	4	4	5	6	6	5	6	6	4	4	23	23'-0"	19'-2"	14'-2"	10'-2"	5'-2"	11.01	636
37°30'	3	4	4	3	4	5	5	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	4	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'-11"	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

Number of bars required: A1–A13; Length of Bars: 3-A14, 11-A15, 1-A16, 1-A17, 2-A18; Quantities for One Wing: Concrete, Steel.

WING DETAIL WHEN H = 10'-0"

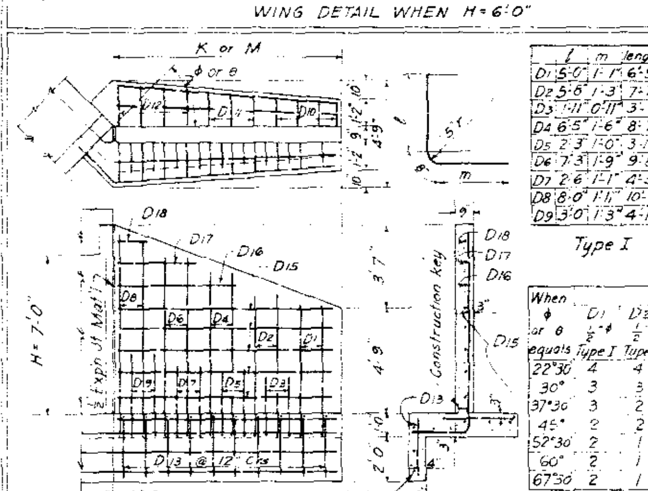


BAR LIST & QUANTITIES FOR ONE WING WHEN H = 4'-0"

When φ or θ equals	G1 ½"φ Type I	G2 ½"φ Type I	G3 ½"φ Type II	G4 ½"φ Type II	G5 ½"φ Type II	3-G6 ½"φ Type II	7-G7 ½"φ Type II	1-G8 ½"φ Type II	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

Number of Bars Required: G1–G5; Length of Bars: 3-G6, 7-G7, 1-G8; Quantities for One Wing: Concrete, Steel.

WING DETAIL WHEN H = 4'-0"



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

When φ or θ equals	D1 ½"φ Type I	D2 ½"φ Type I	D3 ½"φ Type I	D4 ½"φ Type I	D5 ½"φ Type I	D6 ⅝"φ Type I	D7 ⅝"φ Type I	D8 ⅝"φ Type I	D9 ⅝"φ Type I	D10 ½"φ Type II	D11 ½"φ Type II	D12 ½"φ Type II	D13 ½"φ Type II	3-D14 ½"φ Type II	10-D15 ½"φ Type II	1-D16 ½"φ Type II	1-D17 ½"φ Type II	1-D18 ½"φ Type II	Concrete Cu Yd	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'-2"	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	2	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

Number of Bars Required: D1–D13; Length of Bars: 3-D14, 10-D15, 1-D16, 1-D17, 1-D18; Quantities for One Wing: Concrete, Steel.

WING DETAIL WHEN H = 7'-0"

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. [illegible]

ALL CONSTRUCTION KEYS SHOWN BETWEEN FOOTINGS AND WALLS ARE 3"X3".

STEEL WEIGHTS INCLUDE 1½% 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 II.

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 [illegible] POUNDS PER CUBIC FOOT.

DESIGNING DATA

A.A.S.H.O. [illegible] 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. Made by W.W.D. Checked by T.J.M. Approved by [illegible] Bridge Engineer Date Aug 30, 1954

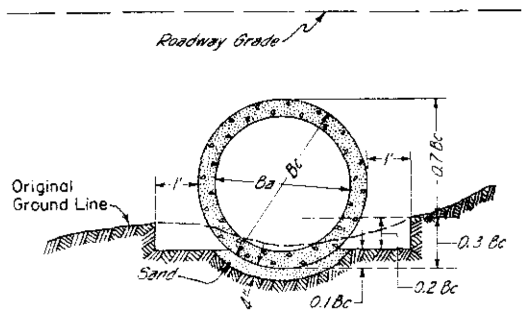
STANDARD M-46-E

STANDARD M-52-A

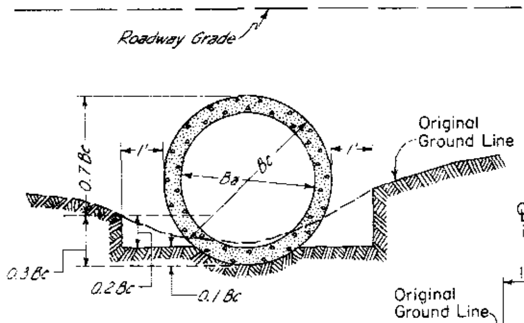
(MAY 1, 1962)

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

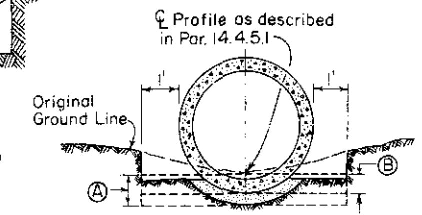
REVISIONS		
2-3-64	DEPT NAME	M.R.H.



0.7 PROJECTION RATIO
'B' BEDDING

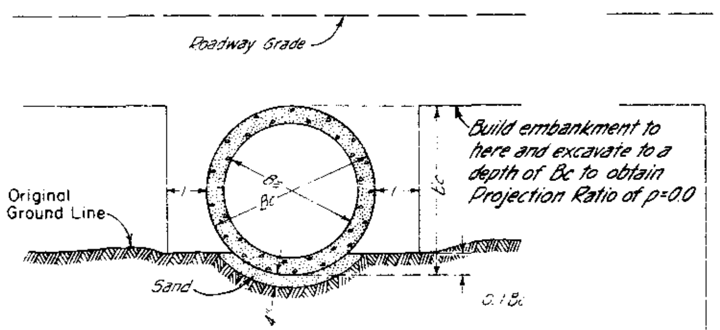


0.7 PROJECTION RATIO
'C' BEDDING



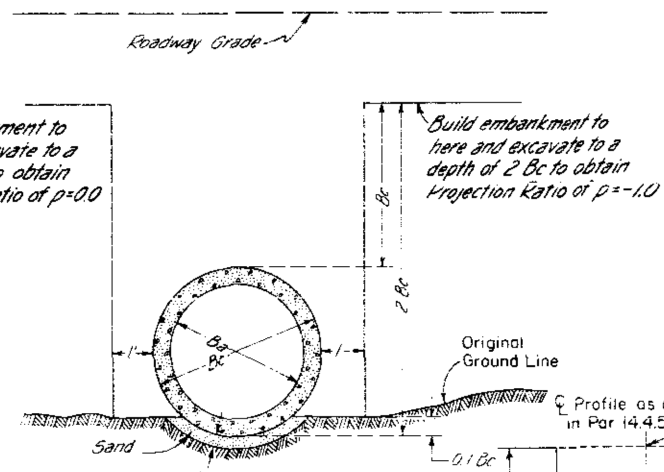
Ⓐ Limits of measurement for Structural Excavation for Class "B" Bedding.

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

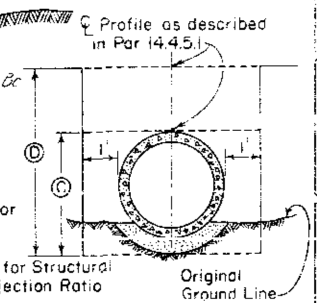


0.0 PROJECTION RATIO
'B' BEDDING

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

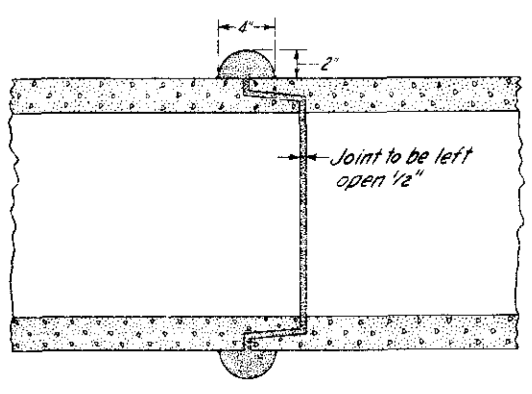


-1.0 PROJECTION RATIO
'B' BEDDING



Ⓒ 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		① 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'-47'	-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'-51'	-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'-6[illegible]'	-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		① 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

① 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.E.F. | Approved by [signature]
Made by D.M.E. | Bridge Engineer
Checked by L.E.O. | Date: May 16, 1960

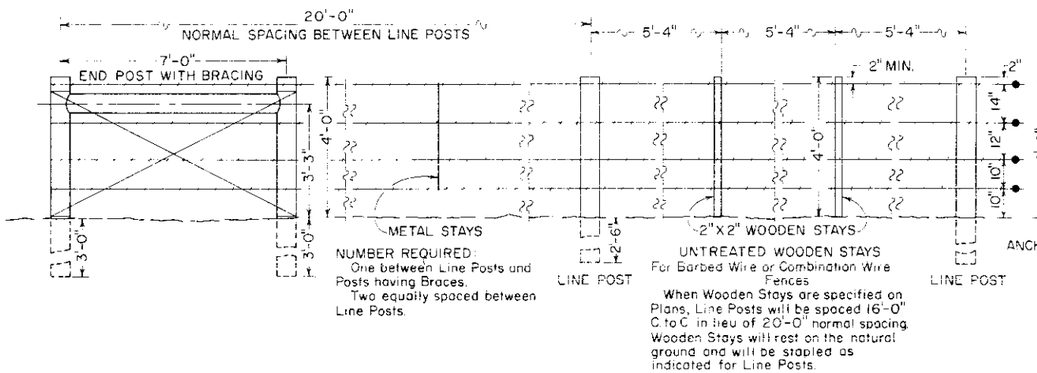
STANDARD M-76-A

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

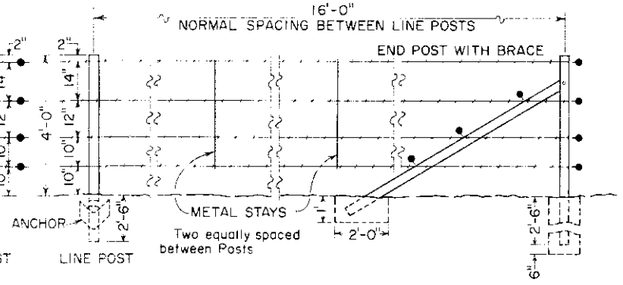
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		

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.

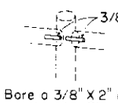
BARBED WIRE FENCE WITH WOODEN POSTS



BARBED WIRE FENCE WITH METAL POSTS

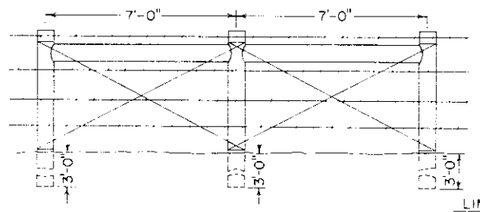


CROSS BRACE DOWELING DETAIL



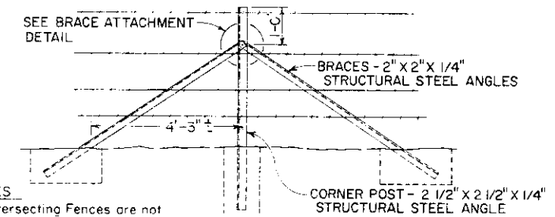
Bore a 3/8" X 2" Hole in each Post and Brace to receive the Pins. Wrap the ends of the Braces tightly with several turns of 12 1/2 ga. smooth Galv. Wire to prevent splitting or Notch Post and Nail with 40 d Common Nails.

LINE BRACES

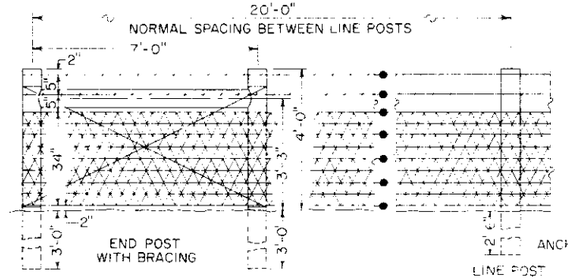


LINE BRACES

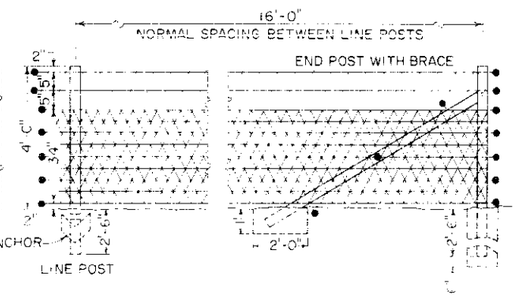
When Gates, Angles, Corners or Intersecting Fences are not specified therein, Line Braces shall be spaced as follows:
Metal Posts - 800' Intervals
Wooden Posts - 1,400' Intervals



COMBINATION WIRE FENCE WITH WOODEN POSTS

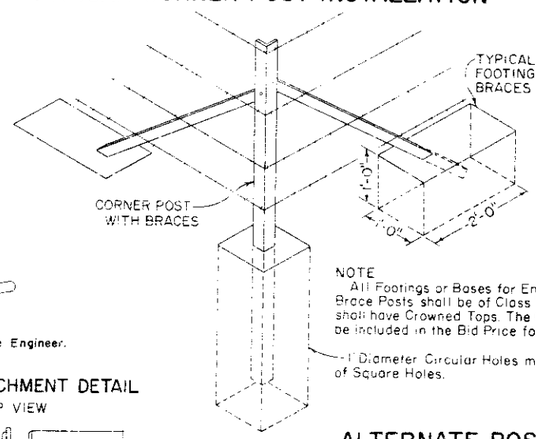


COMBINATION WIRE FENCE WITH METAL POSTS



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

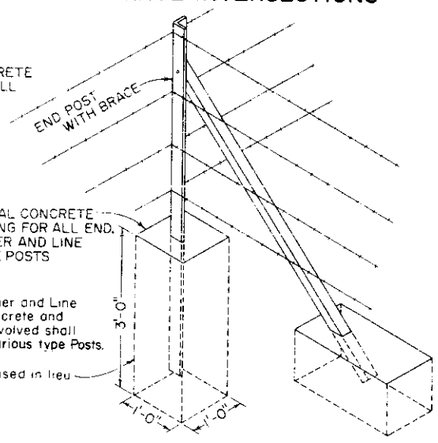
TYPICAL CORNER POST INSTALLATION



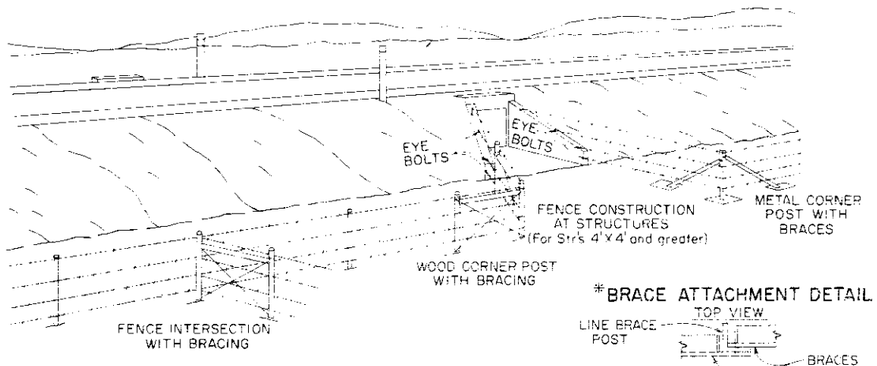
NOTE
All Footings or Bases for End, Corner and Line Brace Posts shall be of Class "A" Concrete and shall have Crowned Tops. The Cost involved shall be included in the Bid Price for the various type Posts.

1' Diameter Circular Holes may be used in lieu of Square Holes.

TYPICAL INSTALLATION AT FENCE INTERSECTIONS

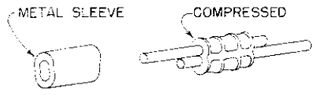


ILLUSTRATIVE SKETCH SHOWING TYPICAL EXAMPLES FOR CONSTRUCTING FENCES



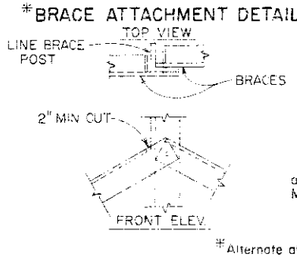
NOTE:
At all structures of 4'x4' and over, the fence shall be ended at eye-bolts in the wings of the structure. Where the type of structure prohibits the use of eye-bolts, an end post with brace shall be used.
Eye-bolts shall be made of 1/2" round bars with a minimum of six (6) inches of body length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

ACCEPTABLE WIRE SPLICE

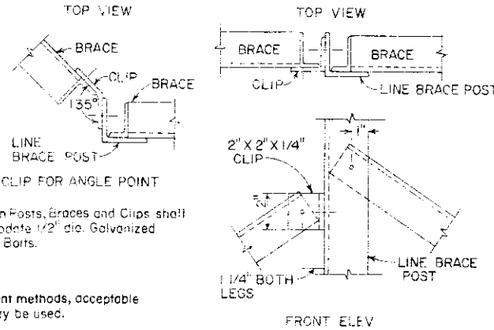


Splicing Sleeve shall be approved by the Engineer.

#BRACE ATTACHMENT DETAIL



#ALTERNATE BRACE ATTACHMENT DETAIL

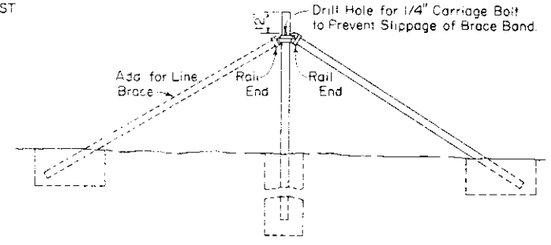


Holes in Posts, Braces and Clips shall accommodate 1/2" dia. Galvanized Machine Bolts.

#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. Julian
Made by	T.E.F.	Engr. Surveys & Plans	
Checked by	E.E.O.	Date:	6-12-1961

STANDARD M-76-A

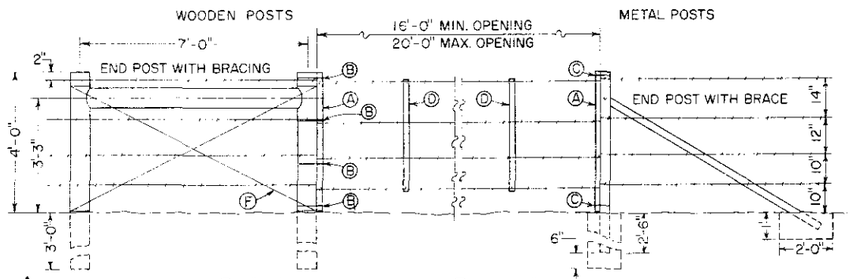
(SHEET 2 OF 2 SHEETS)

(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.

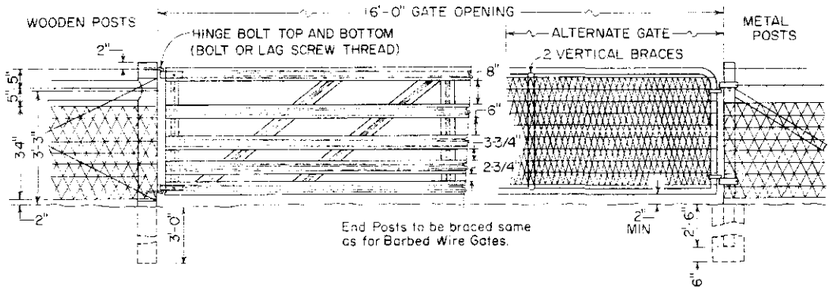
Ⓑ 4 - No. 12 1/2 Ga. Wire Loops to act as Hinges.

Ⓒ No. 12 1/2 Ga. Wire Loops.

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

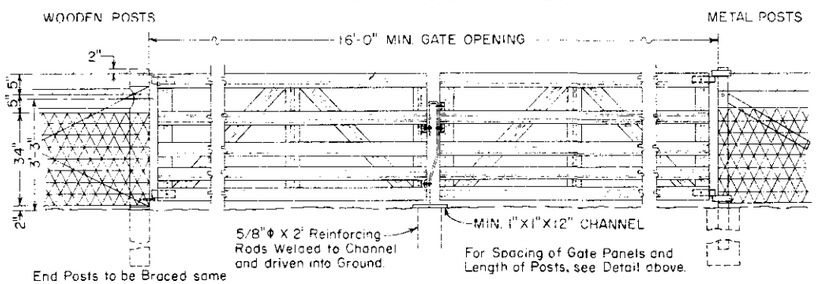
Ⓕ No. 12 1/2 Ga. Brace Wire.

DRIVEWAY GATES



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

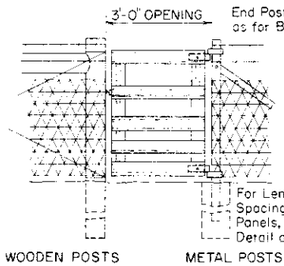
TWIN DRIVEWAY GATES



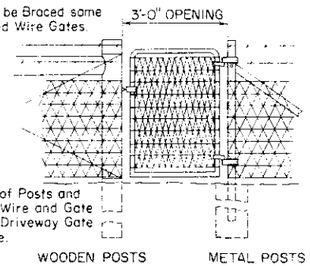
End Posts to be Braced same as for Barbed Wire Gates

For Spacing of Gate Panels and Length of Posts, see Detail above.

WALK GATE



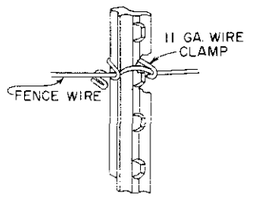
ALTERNATE WALK GATE



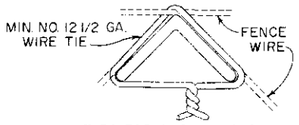
End Posts to be Braced same as for Barbed Wire Gates.

For Length of Posts and Spacing of Wire and Gate Panels, see Driveway Gate Detail above.

FENCE WIRE TIES



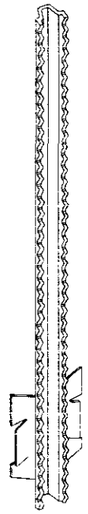
TIES FOR "STUDDED TEE" OR "U" POSTS



TIES FOR ANGLE POSTS

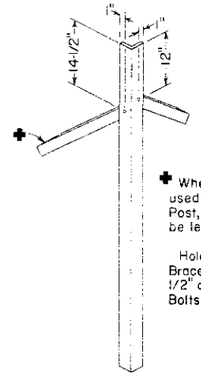
"STUDDED TEE" LINE POST

TYPICAL METAL POSTS



ALTERNATE LINE POST ("U" POST)

ANGLE POST (FOR END, CORNER AND LINE BRACE)

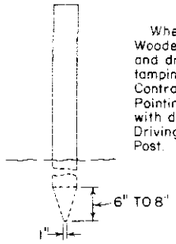


✚ When Post is to be used for an End Post, this Brace will be left off.

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 1.

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 1.

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 Engineers 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	[signature]
Made by	T.E.F.	Engr. Surveys & Plans	
Checked by	E.E.O.	Date:	6-12-19[illegible]

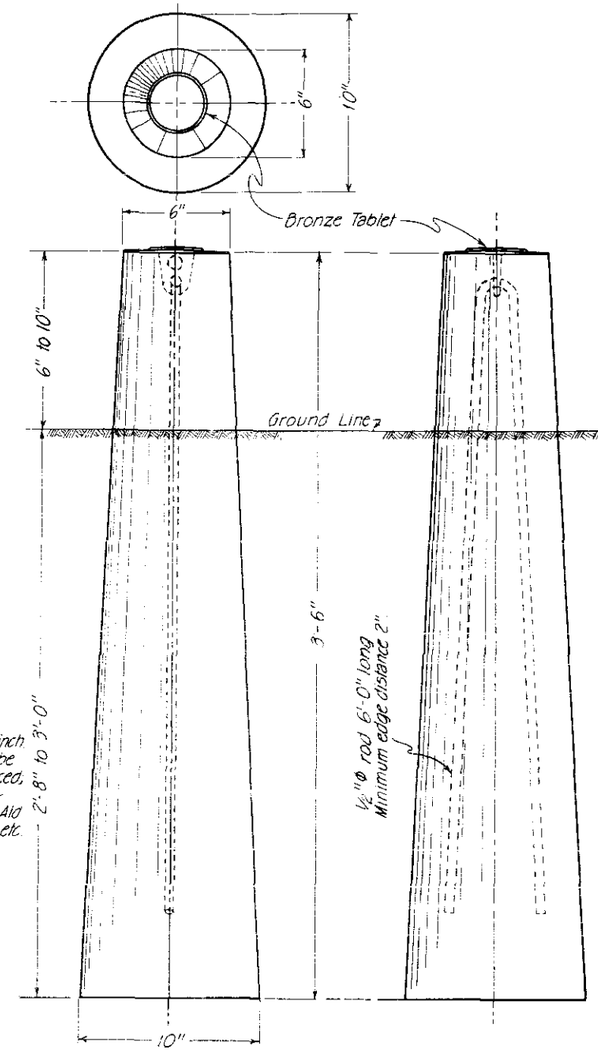
STANDARD M-81-A

(MAY 1, 1962)

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

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

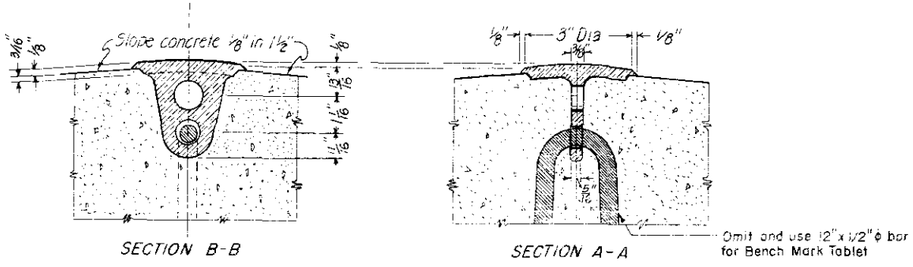
RIGHT OF WAY MARKER POST



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.)



BENCH MARK

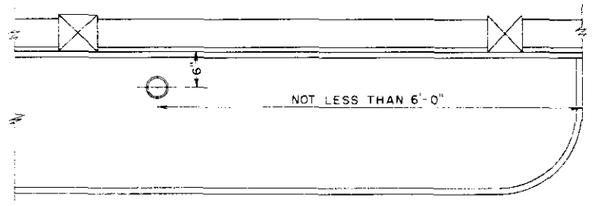
All work shall be done in accordance with Standard Specifications of the Colorado Department of Highways applicable to the project.

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).

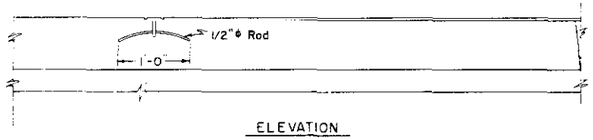
Bronze Bench Mark Tablets will be furnished by the Department at no expense to the Contractor.

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 center-line stationing directly opposite the marker.

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

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

MARKER POSTS AND BENCH MARKS

Designed by R.E.L.	Approved by: A. Julian
Ma'e by E.E.O.	
Ch ked by R.E.L.	Date: Nov. 12, 1953

STANDARD CURBS AND GUTTERS

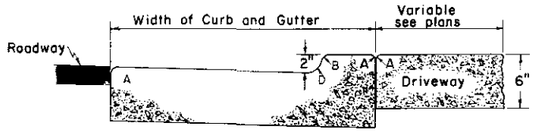
STANDARD M-84-A

(MAY 1, 1962)

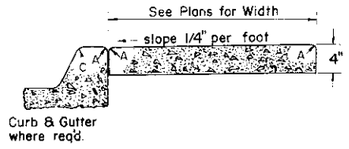
FED. ROAD REG. NO	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

REVISIONS		
3-25-63	Added Approach Slab Curbs.	C.R.S.
2-3-64	DEPT. NAME	M.R.H.

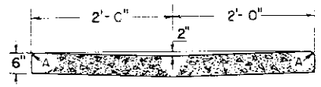
CONCRETE PAVEMENT (DRIVEWAYS)



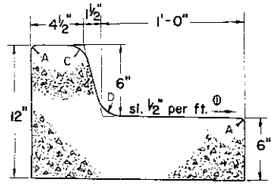
CONCRETE SIDEWALKS



CONCRETE GUTTER

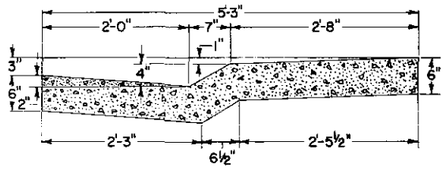


CONCRETE COMBINATION CURB AND GUTTER (6" Barrier-1' Gutter) (Type I)

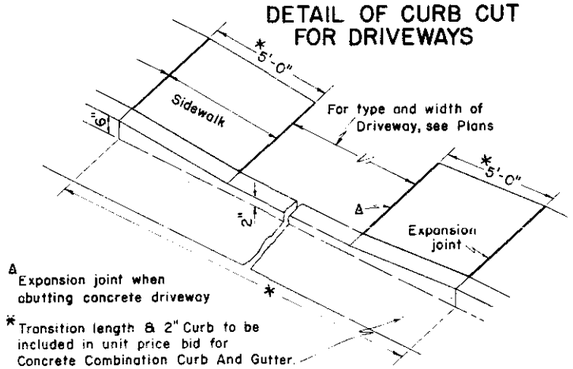


LEGEND FOR RADII
A = 1/8"
B = 1"
C = 1½"
D = 1½" to 2"

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

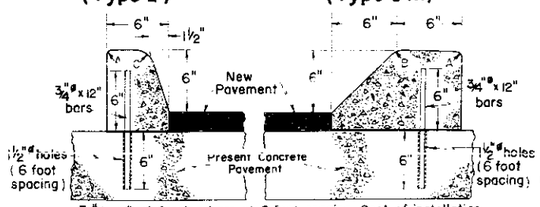


DETAIL OF CURB CUT FOR DRIVEWAYS



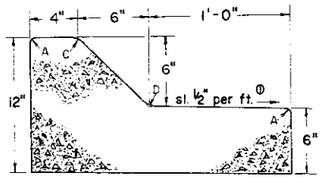
CONCRETE CURB (6" Barrier-Doweled) (Type I)

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



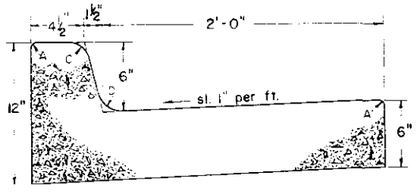
¾"ø x 12" reinforcing bars at 6 foot spacing. Cost of installation to be included in unit price bid for Curb. Bars to be grouted in 1½"ø holes in present concrete. Grout to consist of 2 parts clean sand and 1 part cement.

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



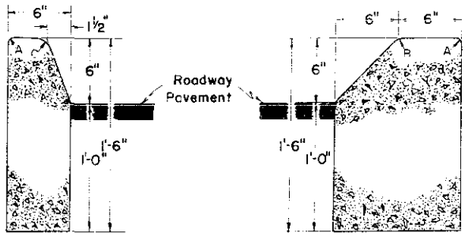
① Slope in opposite direction when required for curves or warped pavement sections.

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

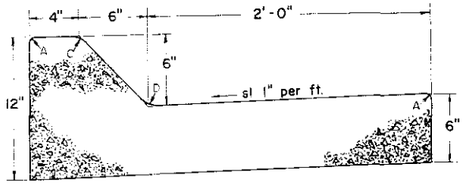


CONCRETE CURB (6" Barrier) (Type II)

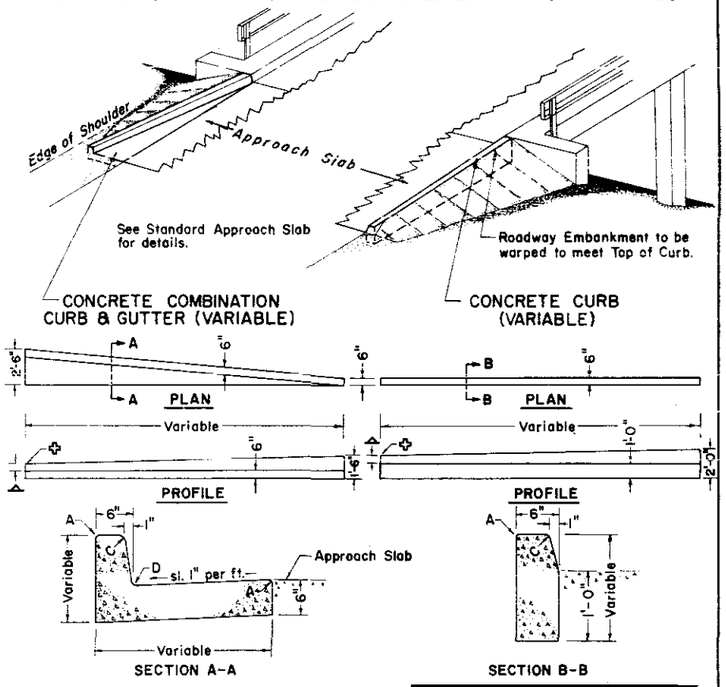
CONCRETE CURB (6" Mountable) (Type II-M)



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



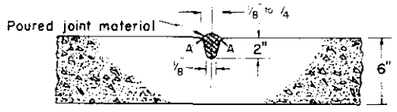
DETAILS OF CONCRETE COMBINATION CURB & GUTTER (VARIABLE) AND CONCRETE CURB (VARIABLE)



Δ {4" (To meet Asphaltic Shoulder Roll)
6" (To meet Concrete Combination Curb & Gutter)

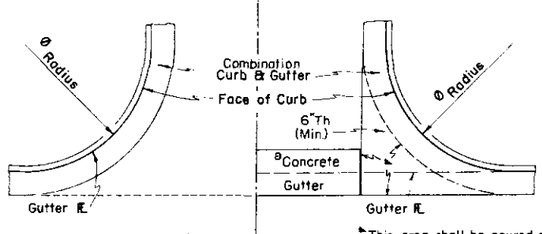
✣ Use 1½" R when no asphaltic or concrete curb is to be met. No radius required when meeting asphaltic or concrete curb.

TRANSVERSE WEAKENED PLANE JOINT FOR CONCRETE PAVEMENT (DRIVEWAYS)



This joint required where length of slab exceeds 15 feet.

CONSTRUCTION OF CONCRETE GUTTERS AT INTERSECTIONS



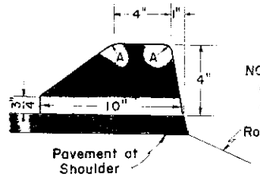
Ø Length of Radius as shown elsewhere on Plans.

* 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 Ø Concrete 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 1958

STANDARD M-95-A

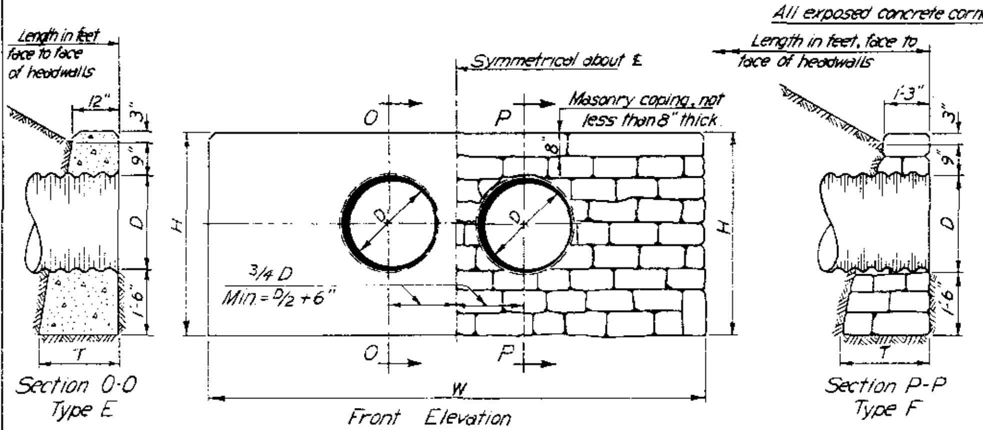
(MAY 1, 1962)

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

REVISIONS

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

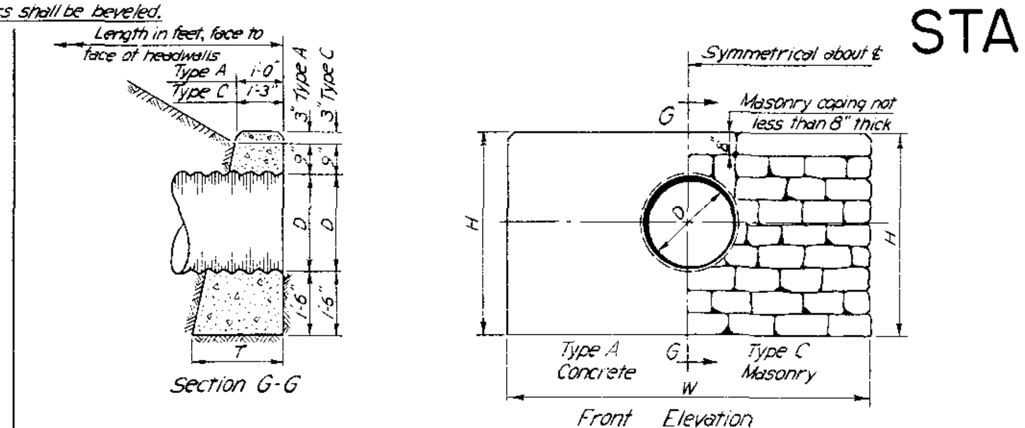
All exposed concrete corners shall be beveled.



STANDARD HEADWALLS FOR DOUBLE CORRUGATED METAL PIPE CULVERTS

Table of Dimensions and Quantities

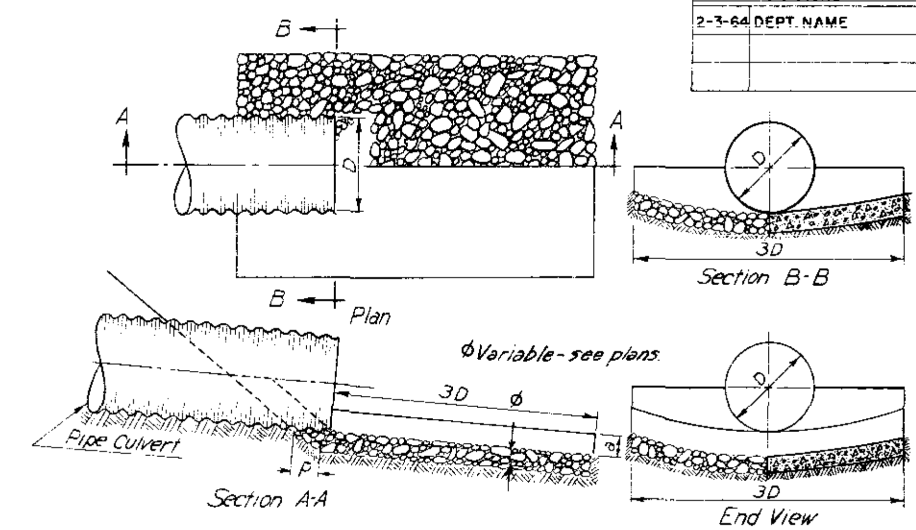
Type E			Both Types		Type F		
D Diam.	T	* Concrete in Two Headwalls	W	H	Cement Rubble Masonry in Two Headwalls	T	D Diam.
15"	1'-6"	2.4 Cu. Yds.	7'-6"	3'-9"	3.1 Cu. Yds.	2'-0"	15"
18"	1'-7"	3.0 DO	8'-6"	4'-0"	3.8 DO	2'-1"	18"
24"	1'-10"	4.4 DO	10'-6"	4'-6"	5.5 DO	2'-4"	24"
30"	2'-0"	6.1 DO	12'-9"	5'-0"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

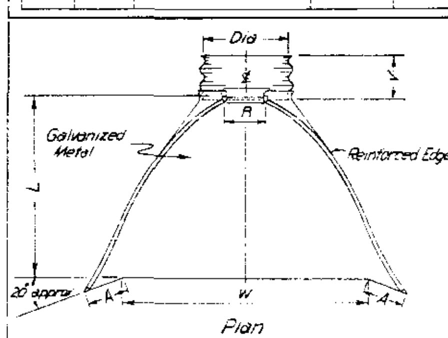
Type A			Both Types		Type C		
D Diam.	T	* Concrete in Two Headwalls	W	H	Cement Rubble Masonry in Two Headwalls	T	D Diam.
15"	1'-6"	1.8 Cu. Yds.	5'-3"	3'-9"	2.2 Cu. Yds.	2'-0"	15"
18"	1'-7"	2.2 DO	6'-0"	4'-0"	2.8 Do	2'-1"	18"
24"	1'-10"	3.3 DO	7'-6"	4'-6"	4.1 Do	2'-4"	24"
30"	2'-0"	4.5 DO	9'-0"	5'-0"	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"



CONCRETE OR GROUTED RUBBLE APRON FOR PIPE CULVERT

Square Yards of Slope and Ditch Paving

Fill Slope	D	15"	18"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"
	p \ φ	7½"	9"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"
1½:1	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



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

Type K

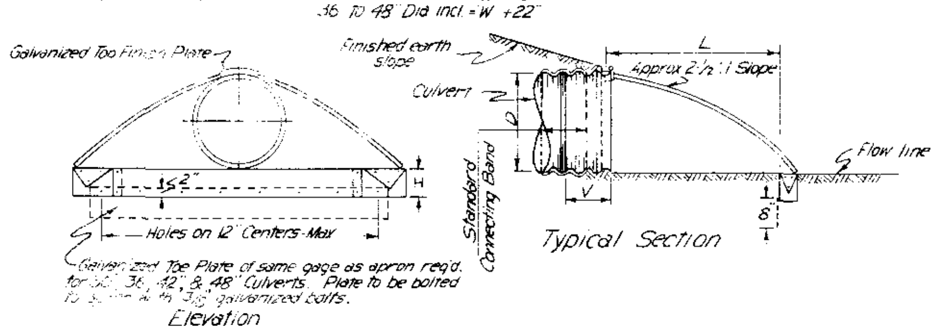
Culv Diam D▲	Dimensions A 1" Tol	B Max.	L 1½" Tol	W 2" Tol	H 1" Tol	Remarks
12"	4¾	6"	21"	24"	6"	One piece skirt
15"	6"	8"	26"	30"	6"	One piece skirt
18"	7	9"	31"	36"	6	One piece skirt
21"	8¼	11"	36"	42"	6"	One piece skirt
24"	9½	12"	42	48"	6"	One piece skirt
30"	12"	15"	52½	60"	7½	Two piece skirt ⊖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

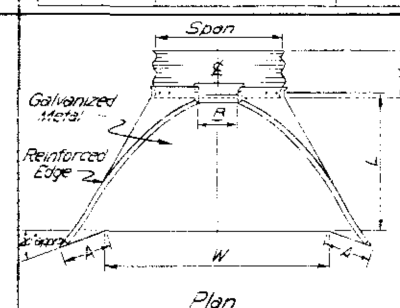
⊖ One splice on ℄ made by either riveting or bolting. Galvanized Connector Section, Corner Plate & Toe Plate to be same gage as skirt section.

▲ Culvert diameter is equal to dimension D of connector section.

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



V = 7" for 18" x 11" to 36" x 22" Pipe-Arches
V = 12" for 43" x 27" to 72" x 44" Pipe-Arches

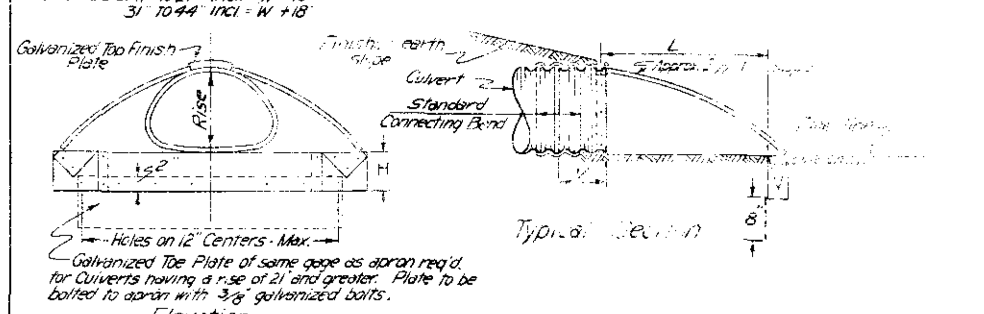
Type L

Equivalent Culvert Diam.	Arch Dimensions Span	Rise	Dimensions A 1" Tol	B Max.	L 1½" Tol	W 2" Tol	H 1" Tol	Remarks
15"	18"	11"	[illegible]	9"	19"	30"	6"	One piece skirt
18"	22"	13"	5¼	10"	25"	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"	25"	63"	96"	10⅞	Two piece skirt ▲
54"	65"	40"	[illegible]	23"	70"	112"	[illegible]	Three piece skirt ⊖
60"	72"	44	[illegible]	24	79	128	[illegible]	Three piece skirt ⊖

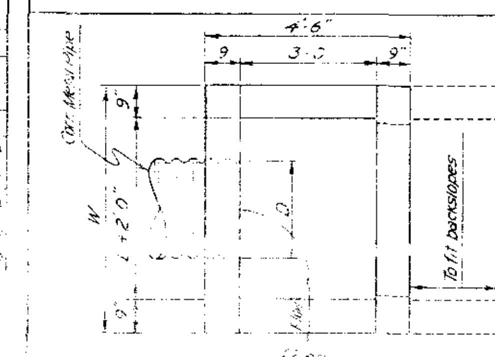
▲ Splices to be lap riveted or bolted on ℄

⊖ 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.

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



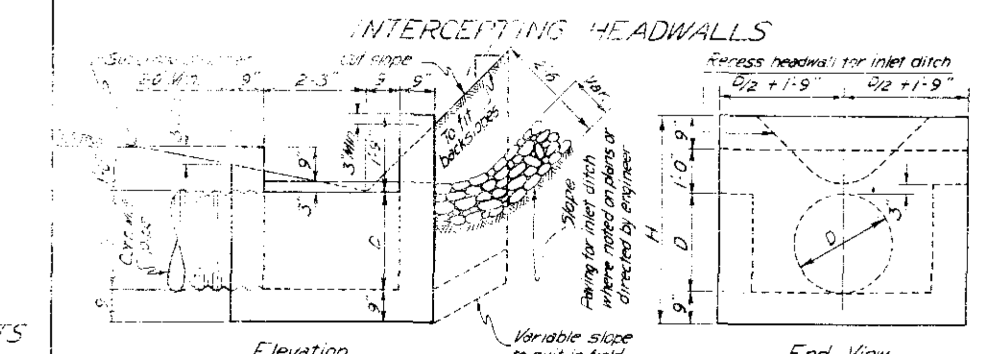
Quantities of *Concrete or Cement Rubble Masonry

Size of Pipe	Width of Wall	Height of Wall	Quantities in One Headwall
D	W	H	Cu. Yds.
15"	4'-9"	3'-9"	1.48
18"	5'-0"	4'-0"	1.64
24"	5'-6"	4'-6"	1.99
30"	6'-0"	5'-0"	2.34
36"	6'-6"	5'-6"	2.72

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.

INTERCEPTING HEADWALLS



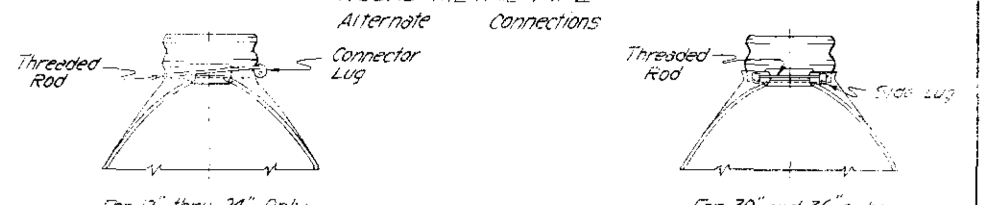
General Notes for All Structures

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

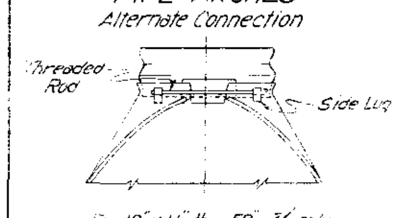
All construction joints shall be thoroughly cleaned before fresh concrete is poured.

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

ROUND METAL PIPE
Alternate Connections



PIPE ARCHES
Alternate Connection



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) Bridge Engineer
Made by H.G.P.	
Checked by M.W.M.	Date June 1, 1958

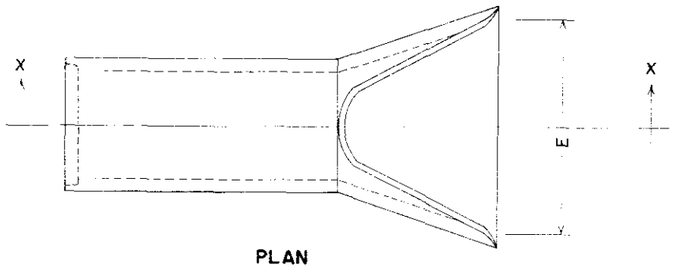
STANDARD M-152-A

(MAY 1, 1962)

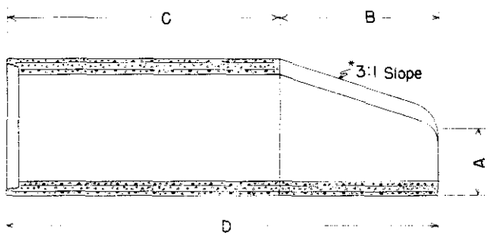
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	[redacted]	[redacted]

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

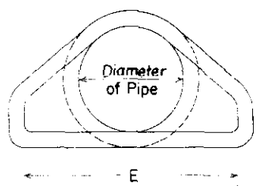
FLARED END SECTION FOR CONCRETE PIPE



PLAN

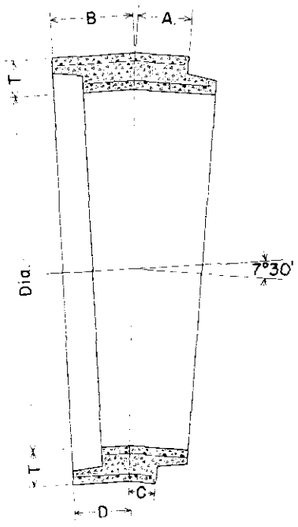


SECTION X-X



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'-0 7/8"	6'-0 7/8"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
24"	9 1/2"	3'-7 1/2"	4'-6"	8'-1 1/2"	4'-0"
30"	1'-0"	4'-6"	3'-7 3/4"	8'-1 3/4"	5'-0"
36"	1'-3"	5'-3"	2'-10 3/4"	8'-1 3/4"	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"	4 1/2"	4 1/2"	3 1/2"	3 1/2"	8"
15"	5 1/2"	5 1/8"	4 1/4"	3 7/8"	9 3/8"
18"	3 1/2"	6 1/2"	2"	5"	8 1/2"
24"	4"	6 1/2"	2"	4 9/16"	8 1/2"
30"	4 1/2"	7"	2"	4 1/2"	9"
36"	4 7/8"	8 7/16"	2"	5 9/16"	10 7/16"
42"	6"	9 1/2"	2 5/8"	6 1/8"	12 1/8"
48"	7"	11"	3 3/16"	7 3/16"	14 3/16"
54"	8 1/8"	12 1/8"	4"	8"	16 1/8"
60"	9 1/8"	14"	4 3/8"	9 1/4"	18 3/8"

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

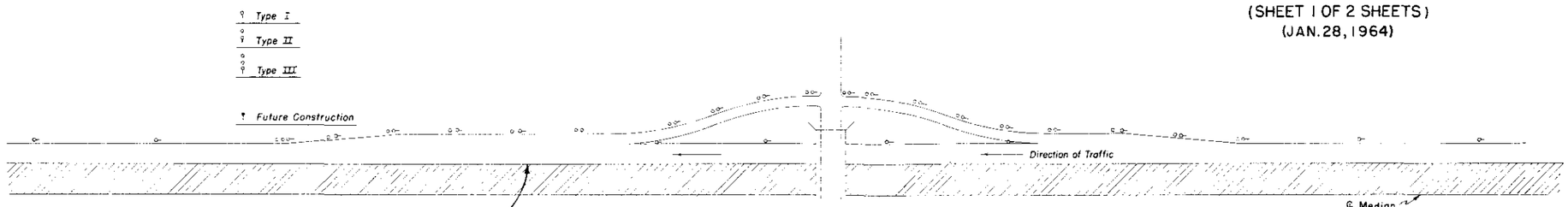
Designed by	R.S.M.	Approved by	[signature]
Made by	J.M.K.		
Checked by	R.S.M.	Date:	January 14, 1949

STANDARD M-192-AA

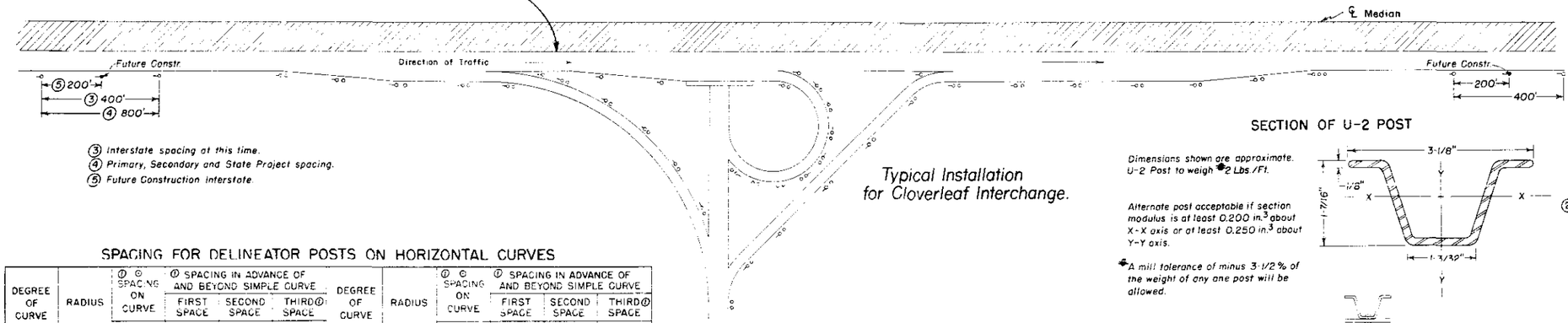
(SHEET 1 OF 2 SHEETS)
(JAN. 28, 1964)

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	① ⊙ SPACING ON CURVE	① SPACING IN ADVANCE OF AND BEYOND SIMPLE CURVE			DEGREE OF CURVE	RADIUS	① ⊙ SPACING ON CURVE	① SPACING IN ADVANCE OF AND BEYOND SIMPLE CURVE			
			FIRST SPACE	SECOND SPACE	THIRD① SPACE				FIRST SPACE	SECOND SPACE	THIRD① 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.

① 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

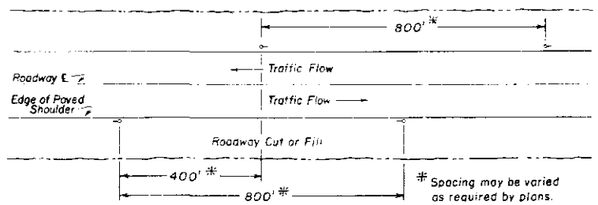
Dimensions shown are approximate. U-2 Post to weigh ◆2 Lbs./Ft.

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.

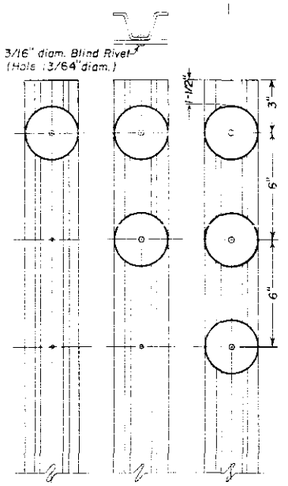
◆*A mill tolerance of minus 3-1/2% of the weight of any one post will be allowed.*

Spacing for Delineator Posts on Tangents

(Two Lane - Two Way Traffic)



* Spacing may be varied as required by plans.

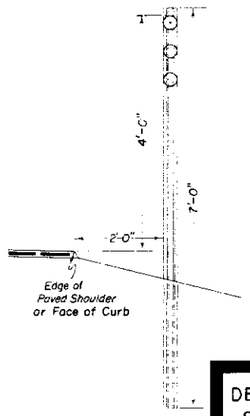


TYPE I — 1-3" diam. Crystal Reflector on U-2 Post

TYPE II — 2-3" diam. Yellow Reflectors on U-2 Post

TYPE III — 3-3" diam. Yellow Reflectors on U-2 Post

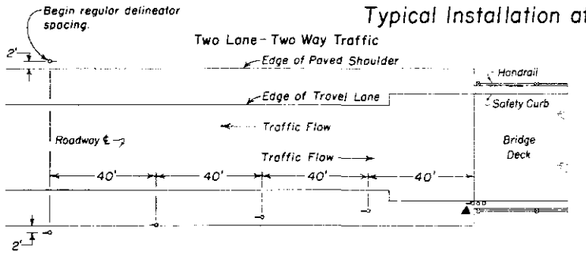
Min. 3 holes in all posts required as shown.



DETAIL
RIVETING REFLECTOR TO POST

Typical Installation at Bridge Approaches

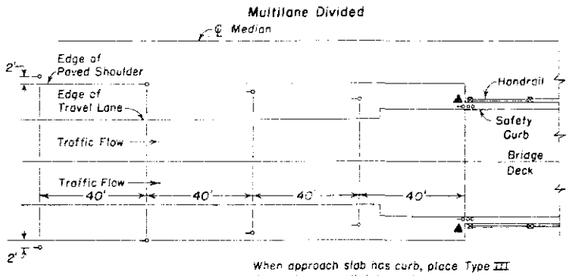
Two Lane - Two Way Traffic



▲*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.

Multilane Divided



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

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

DELINEATORS

D. signed by CKM	Approved by E. E. Wilson
Made by WNC	Engineer, Surveys & Plans
Checked by LEO	Date: October 19, 1962

STANDARD M-192-AA

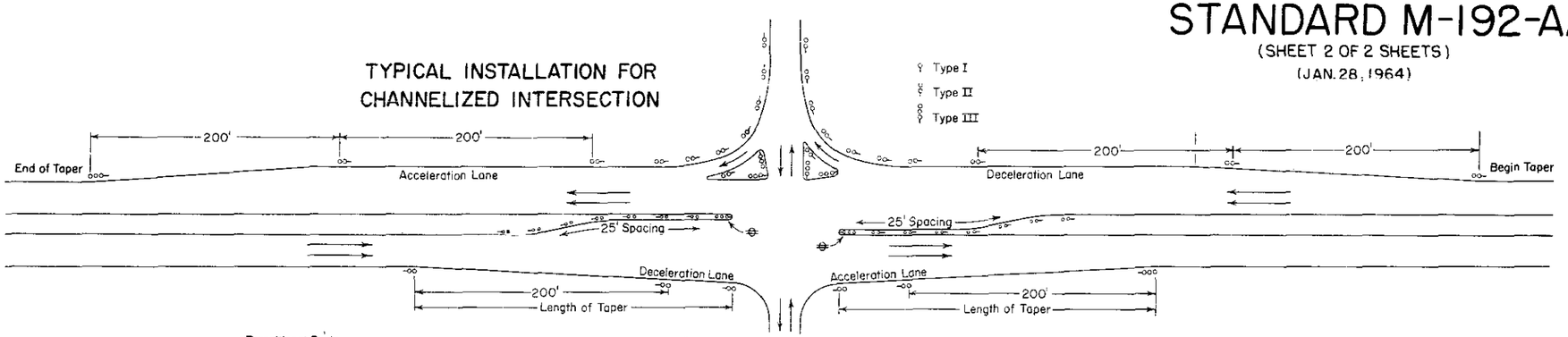
(SHEET 2 OF 2 SHEETS)

(JAN. 28, 1964)

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

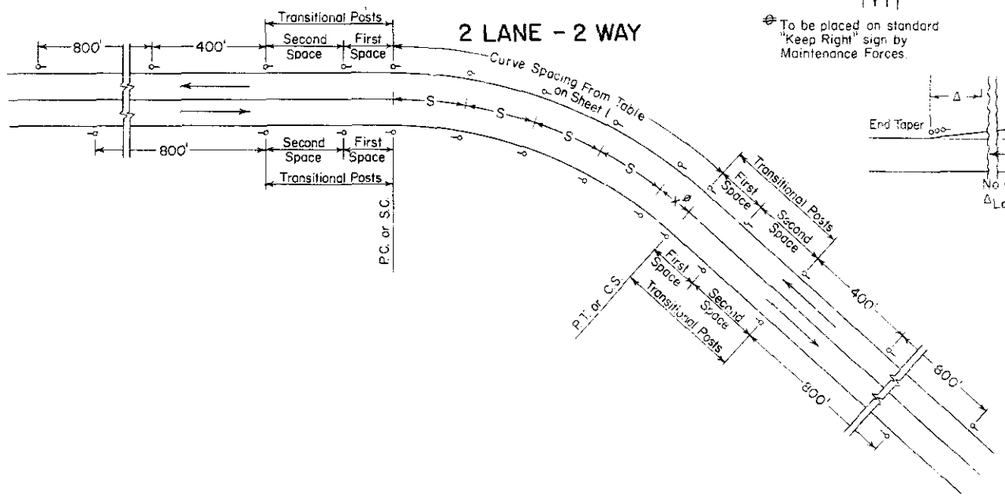
REVISIONS		

TYPICAL INSTALLATION FOR CHANNELIZED INTERSECTION

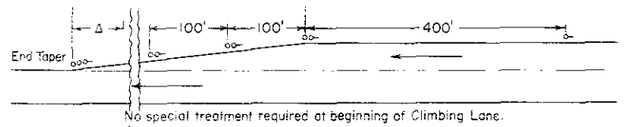


To be placed on standard "Keep Right" sign by Maintenance Forces.

2 LANE - 2 WAY



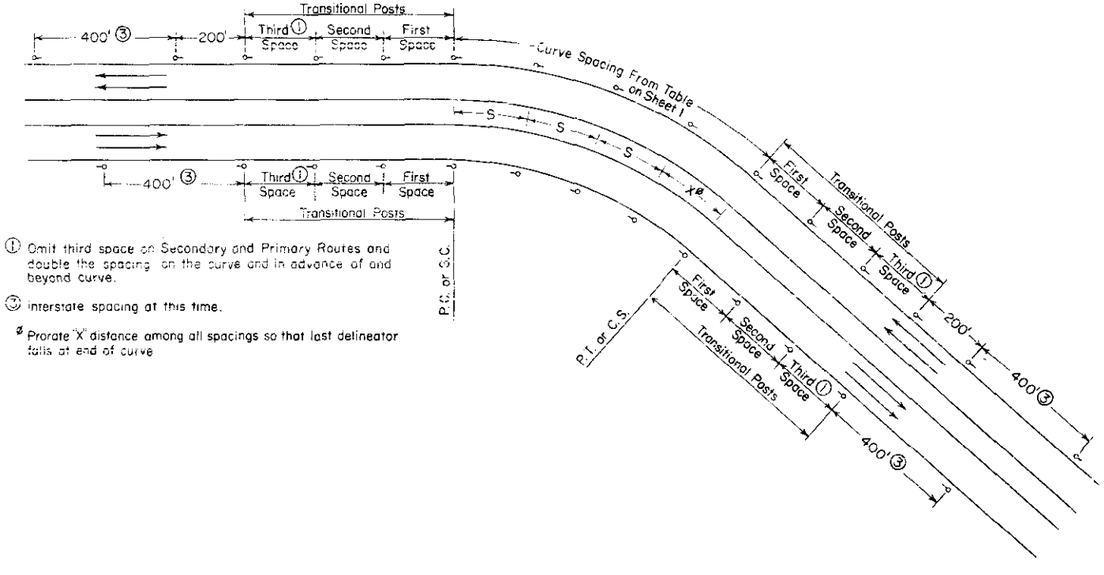
TYPICAL INSTALLATION FOR CLIMBING LANE TRANSITION



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.

* Prorate "X" distance among all spacings so that last delineator falls at end of curve

GENERAL NOTES

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

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

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

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

DELINEATORS

Designed by C.K.M.	Approved by
Made by T.E.F.	Engineer
Checked by L.E.O.	Date: