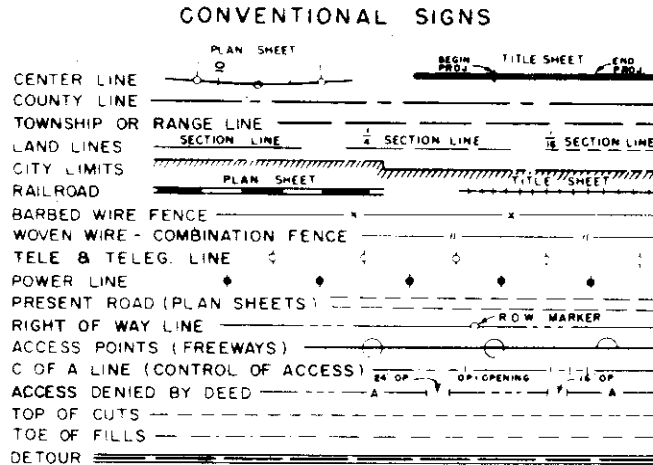


NOV 25 1968

INACTIVE

DEPARTMENT OF HIGHWAYS STATE OF COLORADO

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	S 0002 (27)	1



PLAN AND PROFILE OF PROPOSED COMPLETED FEDERAL AID PROJECT NO. S 0002 (27) STATE HIGHWAY NO. 100 BACA COUNTY

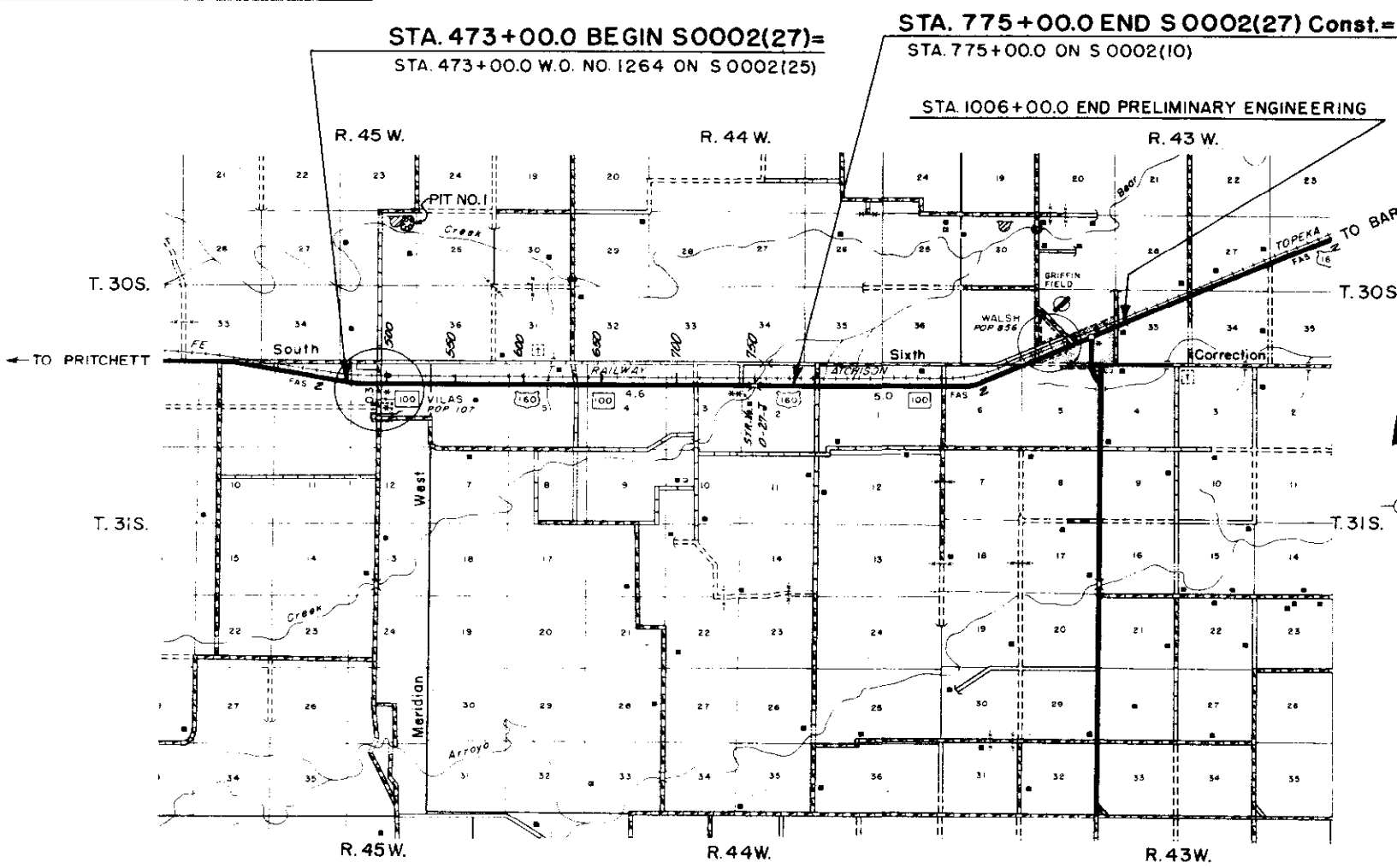
SCALES OF ORIGINAL DRAWINGS
ON PLAN, 1 IN. = 100 FT.
ON PROFILE, 1 IN. = 100 FT. HORIZONTAL
1 IN. = 10 FT. VERTICAL
GRADE LINE ON PROFILE IS SHOWN AS GRADE OF FINISHED ROAD
GROSS LENGTH OF PROJECT 30,099.8 FT. = 5.701 MI.
NET LENGTH OF PROJECT

INDEX OF SHEETS

1 CONSTRUCTED
REVISED DATE MAY 1968

SHEET NO

- 1 Sketch Map and Title Page
- 2 Typical Section, General Notes & Tabulation of Length & Design Data
- 3 Summary of Approximate Quantities
- 4 Structure Quantities
- 5 Sketch Map of Material Pit
- 6 Subbase Plan, Surfacing Plan, Tabulation of Delineators and Summary of Earthwork Quantities
- 7 Guard Rail to Bridge Rail Connection and Detail of Headwall Removal
- 8-18 Alignment Plan and Profile
- 19-38 Cross Sections (Includes Structures) Borrow STA. 611+~622+
- 20 BORROW STA. 762+
- 21 BORROW STA. 765+ TO 768+
- M-203-A Superelevation & Widening of Curves - Chained Highways 7-1-65
- M-203-B Approach Roads, Flaring, Cut Slope Treatment, Bridge & Crest Widening 7-1-65
- M-203-C Ditch Types 7-1-65
- M-206-A Excavation and Backfill for Structures (2 Shts.) 3-17-67
- M-601-A Single and Double Concrete Box Culverts 7-1-65
- M-601-C Wingwalls for Concrete Box Culverts 4:1 Side Slopes (2 Shts.) 7-1-65
- M-603-M Metal Culvert Pipe 3-20-67
- M-603-RC Reinforced Concrete Pipe 3-20-67
- M-606-AA Guard Rail, Type 3 (3 Shts.) 8-1-67
- M-612-C Delineators (2 Shts.) Sht No. 1-7-1-65 Sht No. 2-5-4-67
- M-614-A Timber Barricades 7-1-65
- M-614-IA Construction Identification Signs 6-19-67
- M-614-TB Traffic Signing for Highway Construction (3 Shts.) Sht No. 2-7-1-65 Sht No. 1 & No. 3 7-12-67



CONTRACTOR: FAST CONST. CO.
RES. ENGR. N.V. FRANCIS
DATE STARTED: OCTOBER 23, 1967
DATE COMPLETED: MAY 11, 1968

SEE SPECIAL PROVISIONS FOR
NOTICE TO BIDDERS

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

APPROVED: *Charles H. Schumacher* 9-14-67
CHIEF ENGINEER DATE

By *C. E. Julian*, Asst. Ch. Engr., Engrg.

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
BUREAU OF PUBLIC ROADS

APPROVED: _____ DATE _____

DIVISION ENGINEER

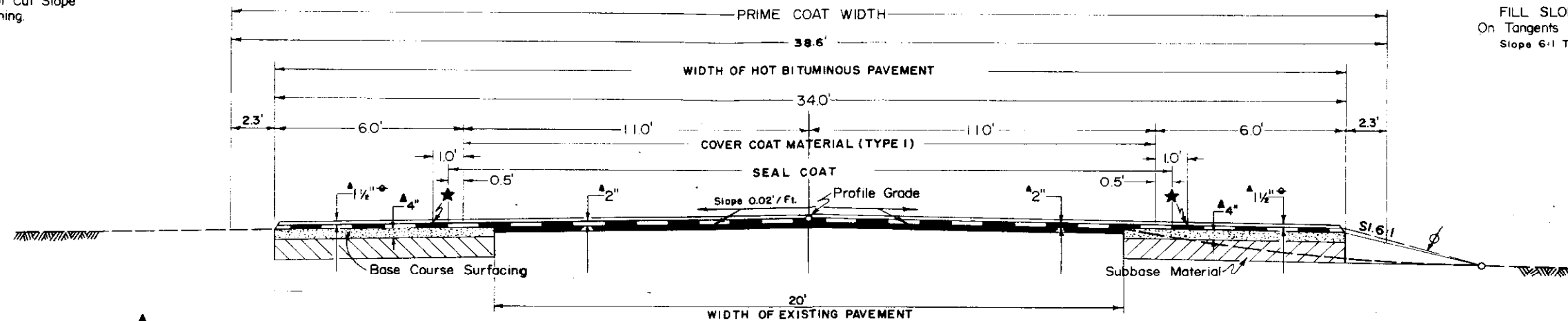
M.E.V.

TYPICAL SECTION

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	S 0002(27)	2	

See Standard for Details of Cut Slope
Treatment, Flaring and Widening.

FILL SLOPES:
On Tangents
Slope 6:1 Thru out Project.



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.

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

- ▲ Approximate Thickness
- Asphaltic Pavement Future Construction.
- ★ Location of solid white painted stripe.
- Ⓢ The contractor will be required to place additional suitable material to this line after completion of paving operation.

Material shall be placed in separate courses at the following rates per 100 lin. ft. of Roadway.

Bituminous Pavement	4.0	Tons
Base Course	3.1	Tons

GENERAL NOTES

For preliminary plan quantities of Bituminous Materials and Cover Coat Material, the following rates of application were used:

Prime Coat	@	0.40 Gals. per Sq. Yd.
Seal Coat	@	0.35 Gals. per Sq. Yd.
Cover Coat Material	@	25 Lbs. per Sq. Yd.

Rates of application shall be determined by the Engineer at the time of application.

The top 1 ft of the subgrade shall be constructed with moisture and density control (in stabilized areas)

Standard Compaction will be used for this project.

Road approaches which require bituminous pavement shall be primed and a 2" thickness of pavement placed as follows:

Public approaches and entrances to buildings or residences and dip approaches shall be paved 50 ft. out from edge of shoulder or to the Right of Way Line whichever is less. Field entrances shall be paved 4 ft. out from edge of shoulder.

Earth slopes shall be disced or roughened by other approved methods for mulching or erosion protection.

Guard posts and delineators will be removed by State Forces.

It is estimated that 1000 Hours of Flagging for controlling traffic will be required on this project.

It is estimated that 200 Hours of Blading will be required on this project.

TABULATION OF LENGTH & DESIGN DATA

STATION	ROADWAY		LOADING
	LIN. FT.		
473+00.0 BEGIN S0002(27) CONST. = 473+00.0 W.O. NO. 1264 ON S0002(25)	847.5		
481+47.5 BK (PROJ) EQUATION 481+47.7 AH (SURV)	4,452.3		
526+00.0 BK EQUATION 527+00.0 AH	22,302.0		
750+02.0 STR. NO. 0-27-J 750+41.3	39.3		H-20
775+00.0 END S0002(27) CONST. = 775+00.0 ON S0002(10)			
TOTAL	30,999.8		
SUMMARY		LIN. FT.	MILES
ROADWAY (NET AND GROSS LENGTH)		30,999.8	5.701
DESIGN DATA			
MAXIMUM DEGREE OF CURVE		2°00'	
MAXIMUM GRADE		2.00%	
MINIMUM SSD HORIZONTAL		730'	
MINIMUM SSD VERTICAL		665'	
MAXIMUM DESIGN SPEED		70 MPH	

SUMMARY OF ~~APPROXIMATE~~ ^{FINAL} QUANTITIES

(R-1) 9-27-67 MEV - Structure, Embankment & Borrow
(R-2) 10-3-67 MEV - Item No. 304

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	COLORADO	S0002 (27)	3	21

CONTRACT ITEM NO.	CONTRACT ITEM	UNIT	BOOK PAGE SHEET	TOTAL S0002(27)	FINAL	DIFF.	TOTAL S0004(5)	FINAL	DIFF.	COMBINED PROJECT TOTALS	FINAL	DIFF.
202	Removal of Portions of Present Structure (R-1)	Each	2 54	1	1	0				2	2	0
202	Removal of Headwall	Each	2 41	2	2	0				2	2	0
203	Unclassified Excavation (Haul)	Cu. Yd.	6	46,000	30,141	-15,859	32,000	17,112	-14,888	78,000	47,253	-30,747
203	Borrow (Haul)	Cu. Yd.	17 21	1,000	3,312	+2,312				1,000	3,312	+2,312
203	Blading	Hour		200	0	-200				200	0	-200
204	Haul	Ton-Mi.	6	238,200	308,238	+67,038	508,400	432,144	-76,256	746,600	737,382	-9,218
206	Structure Excavation (Haul)	Cu. Yd.	4	130	115	-15	140	142	+2	270	257	-13
206	Structure Backfill (Class 3) (Haul)	Cu. Yd.	4	150	42,154	+8	100	95	-5	250	237	-13
209	Wetting	M. Gal.		2,780	1,284	-1,496	2,750	2,813	+63	5,530	4,097	-1,433
210	Reset Mail Box Structure	Each		12	0	-12				12	0	-12
203	Embankment (Standard) (R-1)	Cu. Yd.	6	49,000	44,971	-4,029				49,000	44,971	-4,029
203	Borrow (Complete in Place) (R-1)	Cu. Yd.					6,000	3,585	-2,415	6,000	3,585	-2,415
210	Reset End Section (R-2)	Each	2 253 48 4	8	6	-2				8	6	-2
304	Aggregate Base Course (Class 2)	Ton		28,900	40,844.05	+11,944.05	56,300	48,010.85	-8,289.15	85,200	88,834.90	+3,634.90
304	Aggregate Base Course (Class 7) (Special)	Ton		9900	12,875.55	+2,975.55				9900	12,875.55	+2,975.55
304	Aggregate Base Course (Class 7)	Ton					13,600	13,669.60	+69.60	13,600	13,669.60	+69.60
306	Reconditioning	Mile					40	40	0	40	40	0
403	Hot Bituminous Pavement (Grading F) (Hydrated Lime)	Ton		12,300	12,367.25	+67.25	6,500	6,482.10	-17.90	18,800	18,849.35	+49.35
409	Cover Coat Material (Type I)	Ton		820	830.45	+10.45	590	556.55	-33.45	1,410	1,387.00	-23.00
411	Asphalt Cement (85-100 Pen)	Ton		880	804.57	-75.43	470	409.32	-60.68	1,350	1,243.89	-106.11
411	Emulsified Asphalt (SS-1)	Gal.		26,300	0	-26,300	28,900	0	-28,900	55,200	0	-55,200
411	Liquid Asphaltic Material (Mc-70)	Gal.	1 719	52,800	12,294	-40,506	29,300	23,305	-5,995	82,100	35,599	-46,501
411	Liquid Asphaltic Material (Rc-800)	Gal.	1 1213	19,400	19,056	-344	12,400	11,184	-1,216	31,800	30,240	-1,560
411	Emulsified Asphalt (SS-K)	Gal.		82,500	100,634	+18,134				82,500	100,634	+18,134
601	Concrete Class A	Cu. Yd.	2 46	88	73.54	-14.46				88	73.54	-14.46
603	30 inch Corr. Steel Pipe	Lin. Ft.					0	10	+10	0	10	+10
602	Reinforcing Steel	Lb.	2 42	7,000	5,570	-1,430				7,000	5,570	-1,430
606	Guard Rail Type 3	Lin. Ft.	2 34	700	700	0	780	700	-80	1,480	1,400	-80
603	30 inch Corrugated Steel Pipe	Lin. Ft.	4	18	0	-18				18	0	-18
603	36 inch Corrugated Steel Pipe	Lin. Ft.	4	24	24	0				24	24	0
603	48 inch Corrugated Steel Pipe	Lin. Ft.	4	16	16	0				16	16	0
612	Deliminator (Type I)	Each	2 59	64	58	-6	8	8	0	72	66	-6
612	Deliminator (Type III)	Each		4	4	0	2	2	0	6	6	0
614	Flagging	Hour	2 59	200	655	+455	1,000	38	-962	1,200	693	-507
617	18 inch Culvert Pipe	Lin. Ft.	4	76	76	0	172	172	0	248	248	0
617	24 inch Culvert Pipe	Lin. Ft.	4	68	68	0	165	165	0	233	233	0
617	36 inch Culvert Pipe	Lin. Ft.	4				56	66	+10	56	66	+10
620	Field Office	Each	1 14	1	1	0				1	1	0
620	Field Laboratory	Each	1 15	1	1	0	1	1	0	2	2	0
620	Sanitary Facility	Each	1 16	1	1	0	1	1	0	2	2	0
626	Mobilization	L.S.		(Prorated)			(Prorated)			•		
STATE FORCES												
	Furnish and Install Identification Signs	Each		2	2	0	2	2	0	4	4	0
NON-FEDERAL AID												
	Signing And Stripping Entire Project	L.S.		•			•			•		

FINAL STRUCTURE QUANTITIES

(R-1) Rev. 9-27-67 M.E.V. Structure Note
(R-2) 10-3-67 M.E.V. ABC (CL.2)

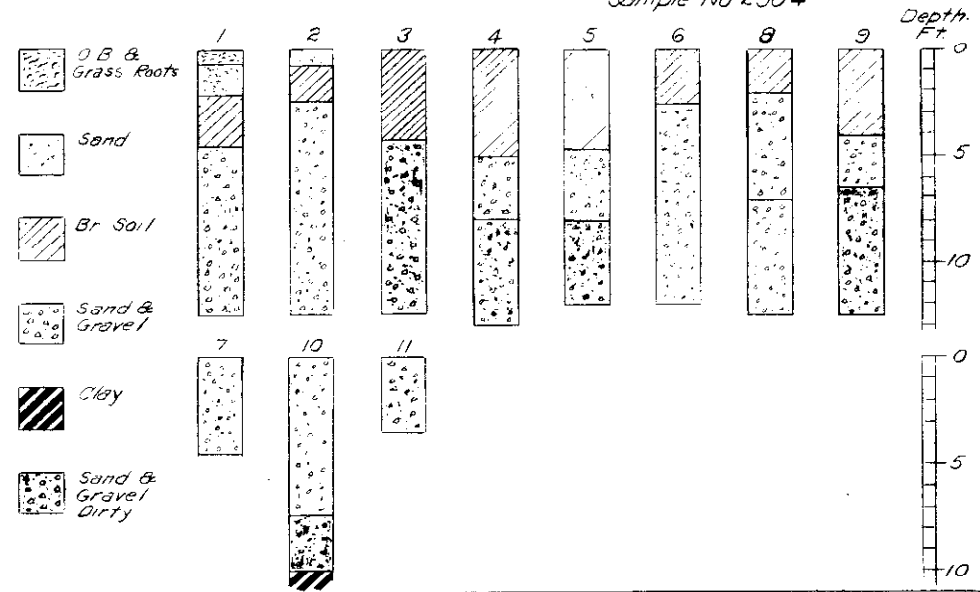
FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
8	COLORADO	S 0002 (27)	4

LOCATION	REMOVAL OF STRUCTURE	UNCLASSIFIED EXCAVATION CUBIC YARD			STRUCTURE EXCAVATION CUBIC YARD	STRUCTURE BACKFILL CUBIC YARD	AGGREGATE BASE COURSE		HOT BITUMINOUS PAVEMENT (GRADING F.)	CONCRETE CUBIC YARD	REINFORCING STEEL LB.	RESET END SECTION EACH	CORRUGATED STEEL PIPE LIN. FT.				CULVERT PIPE LIN. FT.		"H" OVER CULV. FT.	SLOPE AND DITCH PAVING CUBIC YARD	END SECTION		MISCELLANEOUS	
		EXCAV.	EMB.	DITCH			TON						30"	36"	48"	18"	24"	EACH			EACH			
							CL. 2	CL. 6														TON		TON
473+00							<	<	<											2	7			AS CONSTRUCTED REVISED DATE 7-1-68
476+ to 484+				56																2	9			
476+84			50					55	28											2	11			
480+72			50					55	28											2	13			
481+68			60		10	7		61	31							46			1	2	15			
483+91			15					16	3											2	17			
489+19				5	5	5						2		641 12 RL				68	2	2	19			
490+00				133	16	11		55	28										1	2	20			
491+96			20		4	5		15	8							30				2	21			
496+97				5	8	9						2		641 8 RL					2	2	22			
502+81							11		2										2	2	23			
517+83							15		8										2	2	24			
529+04								22	4										2	2	25			
544+12								14	2										2	2	26			
559+38								11	2										2	2	27			
569+72				5	7	8						2		641 8 RL					2	2	28			
581+74								28	4										2	2	29			
606+39		15			65	110				673	6,985								2	2	30			2 - Removal of Headwall
622+92								22	4										2	2	31			
699+68			16		5	3						2		641 4 RL					2	2	32			
702+76			50					55	28										2	2	33			
739+97								22	4										2	2	34			
750+																			2	2	35			(R-1) Guard Rail Type 3 700 Lin. Ft. Removal of Portions of Present Structure -1
764+78								11	2										2	2	36			
775+							<	<	<										2	2	37			
Project Totals		15	*245 20 0	*214 0	115 120	142 147		*481 0	*188 0		673	6,985	18 6	18 24	16 76	68								

< Included in Surfacing and Subbase Plans.

* INCLUDED IN ROADWAY QUANTITIES

• 4:1 Wingwalls



SUBBASE PLAN
(R-2)

STATION TO STATION	SOURCE	THICKNESS	AGGREGATE BASE COURSE CLASS 2 PLAN	AGGREGATE BASE COURSE CLASS 2 FINAL	HAUL TON MILE PLAN	HAUL TON MILE FINAL
*Approach to Project	PIT NO. 1 LEWIS ALFREY 2.3 miles to Sta 490+00 "R" 58	12"	47	—	124	—
473+00 to 481+475 BK		12"	797	1,258.80	2,026	3,825
481+477Ah to 490+00		12"	801	1,281.30	1,907	3,049
490+00 to 526+00 BK		12"	3,384	4,816.05	8,937	12,714
527+00Ah to 534+00		12"	658	2,131.95	2,006	6,545
534+00 to 595+00		14"	6,649	9,810.05	24,549	36,395
595+00 to 645+00		12"	4,700	7,458.55	22,293	35,931
645+00 to 695+00		14"	5,450	8,243.70	31,012	47,072
695+00 to 775+00		6"	3,760	5,506.65	26,024	38,216
*Approach to Project		6"	24	—	185	—
*Est for Correcting Irregularities			2,627	—	11,907	—
TOTALS			28,897	40,844.05	130,970	183,747

* Thickness based on Design Curve "C" (R-1)
* INCLUDED IN ROADWAY QUANTITIES

SURFACING PLAN

STATION TO STATION	SOURCE	QUANTITY TONS				HAUL - TON MILE			
		PLAN AGGREGATE BASE COURSE CLASS 7 (SPECIAL)	FINAL AGGREGATE BASE COURSE CLASS 7 (SPECIAL)	HOT BITUMINOUS PAVEMENT BOTTOM LAYER GRADING F PLAN	HOT BITUMINOUS PAVEMENT BOTTOM LAYER GRADING F FINAL	PLAN AGGREGATE BASE COURSE CLASS 7 (SPECIAL)	FINAL AGGREGATE BASE COURSE CLASS 7 (SPECIAL)	HOT BITUMINOUS PAVEMENT BOTTOM LAYER GRADING F PLAN	HOT BITUMINOUS PAVEMENT BOTTOM LAYER GRADING F FINAL
*Approach to Project	PIT NO. 1 LEWIS ALFREY 2.3 miles to Sta 490+00 "R" 67	16	—	20	—	42	—	53	—
473+00 to 481+475 BK		263	489.30	339	395.15	669	1,244	862	1,694
481+477Ah to 490+00		264	352.45	341	439.35	629	839	812	1,046
490+00 to 526+00 BK		1,116	1,846.60	1,440	1,311.25	2,947	4,815	3,803	3,620
527+00Ah to 775+00		7,688	10,186.70	9,920	10,121.50	40,979	54,419	52,877	54,304
*Approach to Project		16	—	20	—	123	—	154	—
*Structure Quantities		470	—	186	—	2,280	—	902	—
TOTALS		9,833	12,875.55	12,266	12,351.25	47,669	61,457	59,463	60,034
							107,132		

* INCLUDED IN ROADWAY QUANTITIES

(R-1) Rev. M.E.V. 9-27-67 Design Curve & Embankments
(R-2) 10-3-67 M.E.V. ABC (CL 2)

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
8	COLORADO	S0002 (27)	6	21

DELINEATORS

AS CONSTRUCTED
REVISED DATE MAY 1964

STATION TO STATION	SIDE	SPACING	PLAN	FINAL	PLAN	FINAL
			TYPE I	TYPE I	TYPE III	TYPE III
465+86.3 to 489+295	LI. & RI	2° Curve	18	16	2	2
496+92 to 497+02	" " "	Structure				
525+298 to 543+28.1	" " "	1° Curve	14	12		
578+75 to 606+14.7	" " "	1° Curve	12	18		
594+00 to 606+14.7	" " "	1° Curve	12			
750+10 to 750+20	" " "	Structure	8	8	2	2
100+00		STRUCTURE		2		
569+00		STRUCTURE		2		
TOTAL			64	58	4	4

See Book 2 Page 59

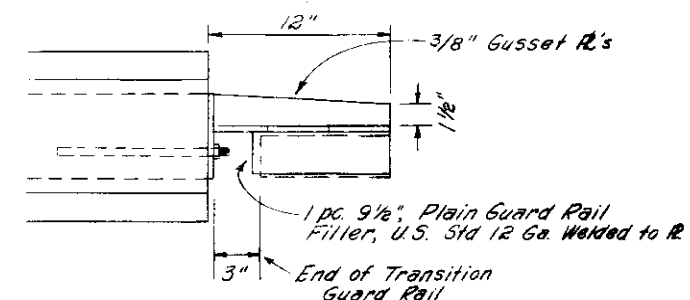
SUMMARY OF EARTHWORK QUANTITIES

UNCLASSIFIED EXCAVATION	PLAN	FINAL
	Cu Yd	Cu Yd
ROADWAY (FROM CROSS SECTIONS)	15,035	19,460
STRUCTURE QUANTITIES AS EMB	245	20
STRUCTURE QUANTITIES AS EXCAV	15	15
STRUCTURE QUANTITIES AS DITCH EXCAV	214	—
* STRIPPING (REMOVING OVERBURDEN)	15,000	5,323
* STRIPPING (REPLACING OVERBURDEN)	15,000	5,323
TOTAL FOR PAY QUANTITY	45,509	30,141
* BORROW FROM PITS	640	3,312
TOTAL FOR PAY QUANTITY	640	3,312
EMBANKMENTS (STANDARD) (R-1)		
(MOISTURE AND DENSITY CONTROL)		
EMBANKMENT (NET) - I.B.M. SHEETS	14,250	21,491
BASE OF CUTS AND FILLS	34,559	23,480
TOTAL FOR PAY QUANTITY	48,809	44,971
ROADWAY QUANTITIES BALANCE		
EXCAVATION		
UNCLASSIFIED	15,035	19,460
BORROW	640	3,312
TOTAL	15,675	22,772
EMBANKMENT (ROADWAY FROM CROSS SECTION)	14,250	21,491
TOTAL	14,250	21,491
EMBANKMENT X FACTOR	15,675	22,772
TOTAL	15,675	22,772

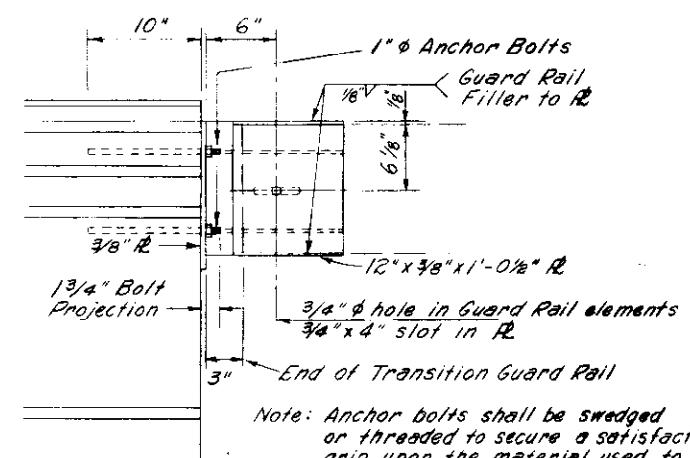
* See Book No. 3 - For Borrow Sheets 19, 20, 21
* FOR INFORMATION ONLY

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	S 0002 (27)	7	

DETAIL OF
— GUARD RAIL TO BRIDGE RAIL —
— CONNECTION —

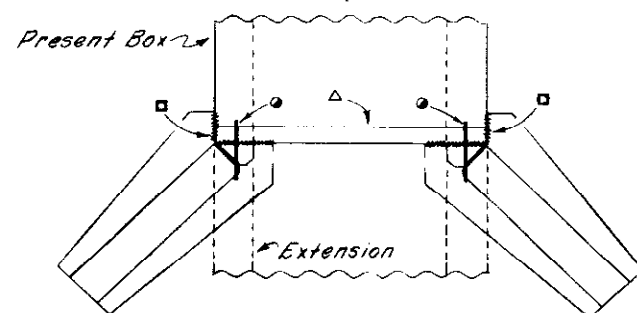


PLAN VIEW

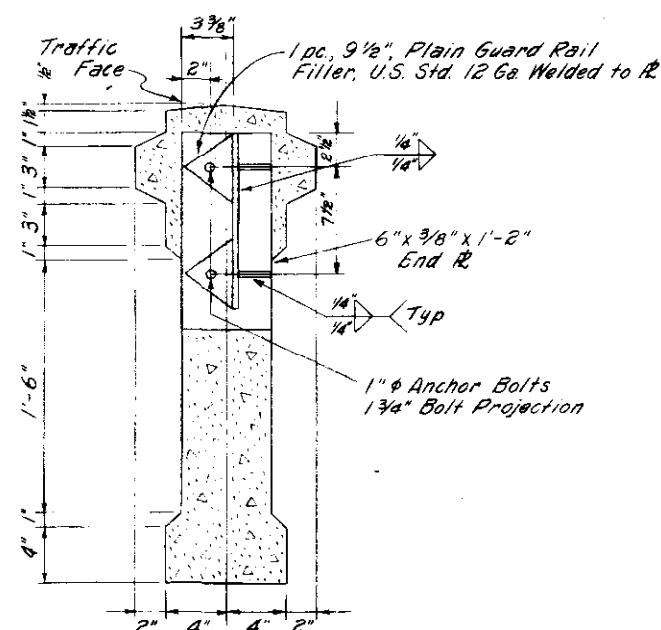


ELEVATION VIEW

DETAIL OF
— HEADWALL REMOVAL —



- Remove along these lines.
 - △ This headwall is to be removed when fill over headwall is less than 1 ft.
 - 2 ft. reinforcing bars to be placed at every longitudinal bar shown on the Standard. Size to be same as longitudinal bars.
- Tie bars are to be grouted in place by a cement grout composed of one part cement and two parts clean well graded sand.
- The cost of drilling holes and placing tie bars is to be included in payment for "Removal of Headwalls".



END VIEW

FED. ROAD DIST. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	50002 (27)	8

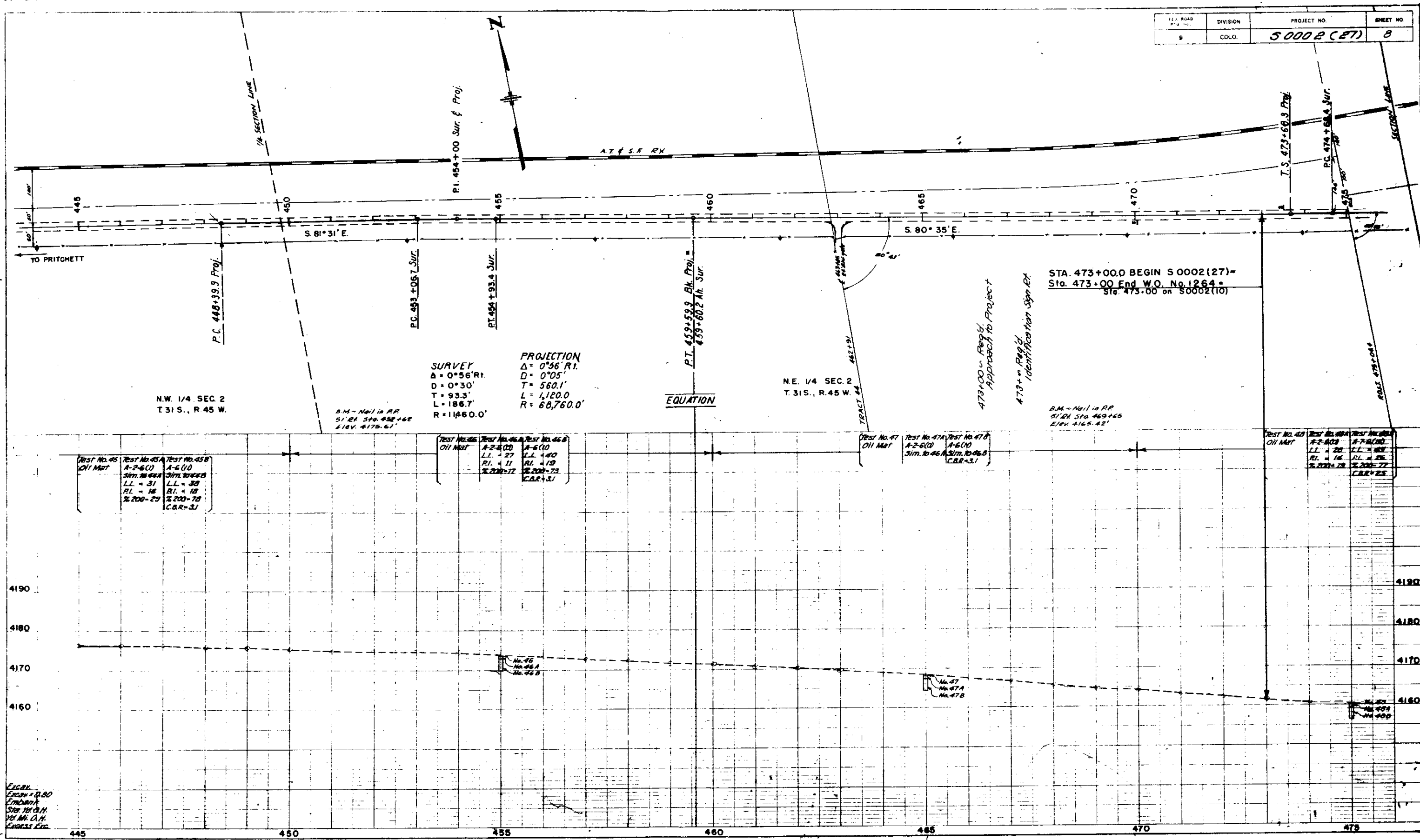


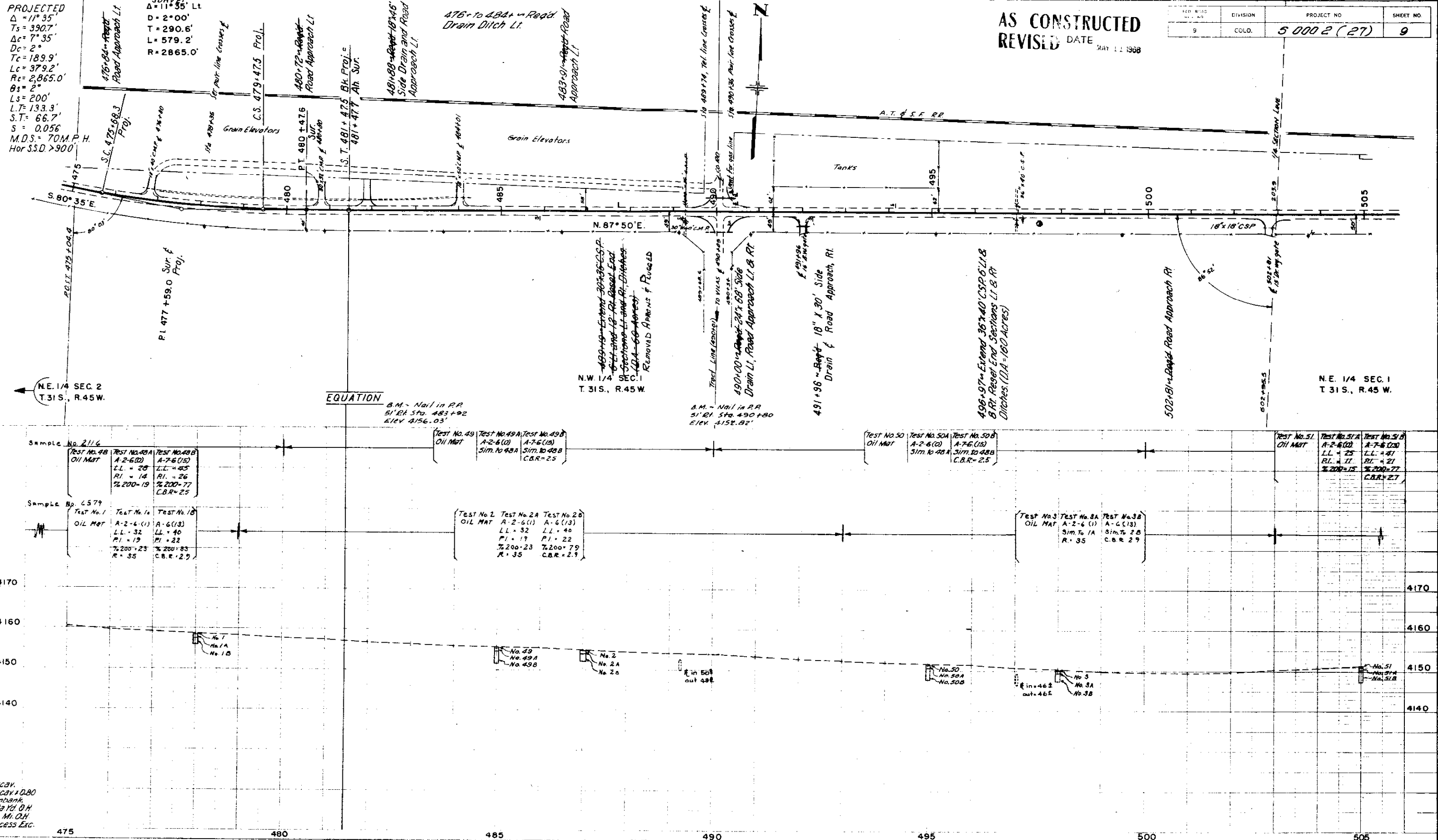
FIG. 1
 ELEV. 41.80
 ELEV. 41.80
 STA. 445.00
 STA. 445.00
 STA. 445.00

PROJECTED
 $\Delta = 11^\circ 35'$
 $T_s = 390.7'$
 $\Delta c = 7^\circ 35'$
 $D_c = 2'$
 $T_c = 189.9'$
 $L_c = 379.2'$
 $R_c = 2,865.0'$
 $\theta_s = 2^\circ$
 $L_s = 200'$
 $L.T. = 133.3'$
 $S.T. = 66.7'$
 $S = 0.056$
M.D.S. = 70 M.P.H.
Hor S.S.D. > 900'

SURVEY
 $\Delta = 11^\circ 35'$ Lt
 $D = 2^\circ 00'$
 $T = 290.6'$
 $L = 579.2'$
 $R = 2865.0'$

AS CONSTRUCTED
REVISED DATE MAY 11 1968

ED. ROAD	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.	5 000 2 (27)	9



EQUATION

B.M. - Nail in RR
51' RA Sta. 483+92
Elev. 4156.03'

B.M. - Nail in RR
51' RA Sta. 490+80
Elev. 4152.82'

Sample No. 2114

Test No. 48	Test No. 49A	Test No. 49B
OIL MAT	A-2-6(10)	A-7-6(15)
LL = 28	LL = 40	LL = 40
PI = 14	PI = 26	PI = 26
% 200 = 19	% 200 = 77	% 200 = 77
C.B.R. = 25		

Sample No. 6579

Test No. 1	Test No. 1a	Test No. 1b
OIL MAT	A-2-6(1)	A-6(13)
LL = 32	LL = 40	LL = 40
PI = 19	PI = 22	PI = 22
% 200 = 23	% 200 = 83	% 200 = 83
R = 35	C.B.R. = 29	

Test No. 49

OIL MAT	Test No. 49A	Test No. 49B
	A-2-6(10)	A-7-6(15)
	Sim. to 49A	Sim. to 49B
	C.B.R. = 25	

Test No. 2

OIL MAT	Test No. 2A	Test No. 2B
	A-2-6(1)	A-6(13)
	LL = 32	LL = 40
	PI = 19	PI = 22
	% 200 = 23	% 200 = 79
	R = 35	C.B.R. = 29

Test No. 50

OIL MAT	Test No. 50A	Test No. 50B
	A-2-6(10)	A-7-6(15)
	Sim. to 50A	Sim. to 50B
	C.B.R. = 25	

Test No. 3

OIL MAT	Test No. 3A	Test No. 3B
	A-2-6(1)	A-6(13)
	Sim. to 3A	Sim. to 3B
	R = 35	C.B.R. = 29

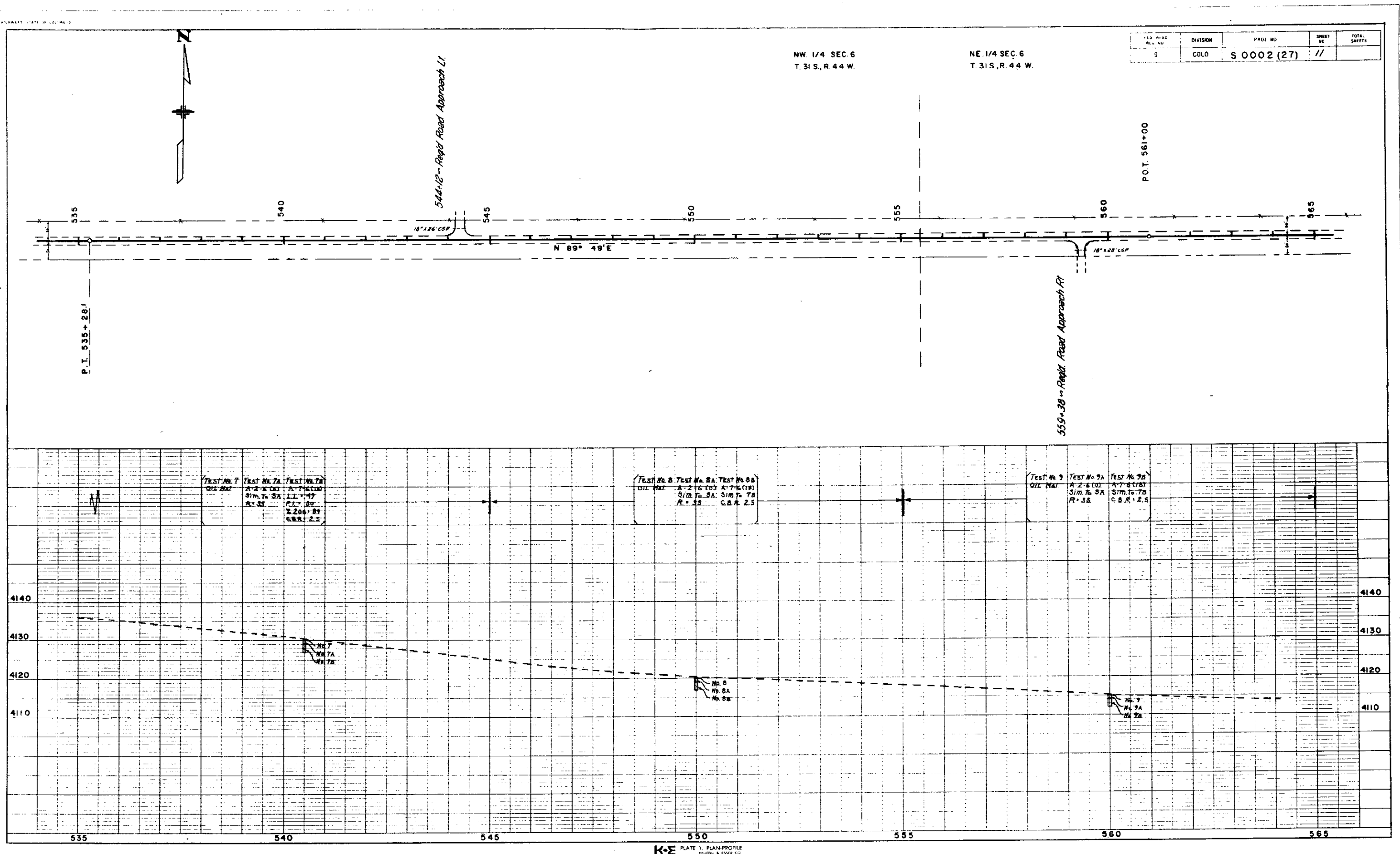
Test No. 51

OIL MAT	Test No. 51A	Test No. 51B
	A-2-6(10)	A-7-6(15)
	LL = 25	LL = 41
	PI = 11	PI = 21
	% 200 = 15	% 200 = 77
	C.B.R. = 27	

Excav.
Excav. 0.80
Embank.
Sta. 480.4
yd. M. O.H.
Excess Exc.

28769

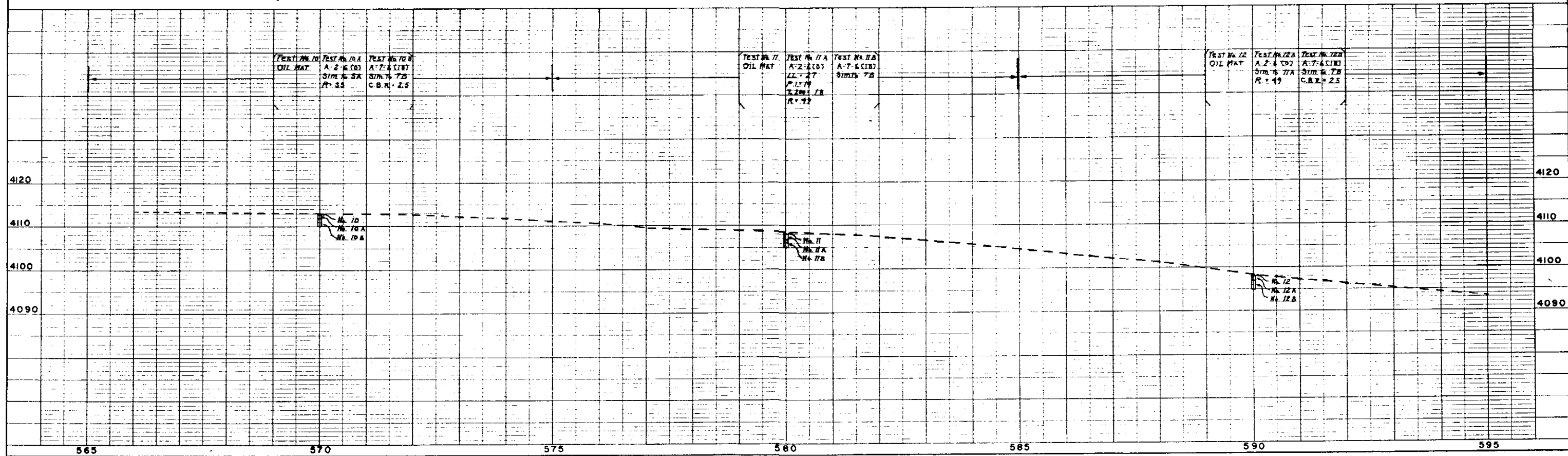
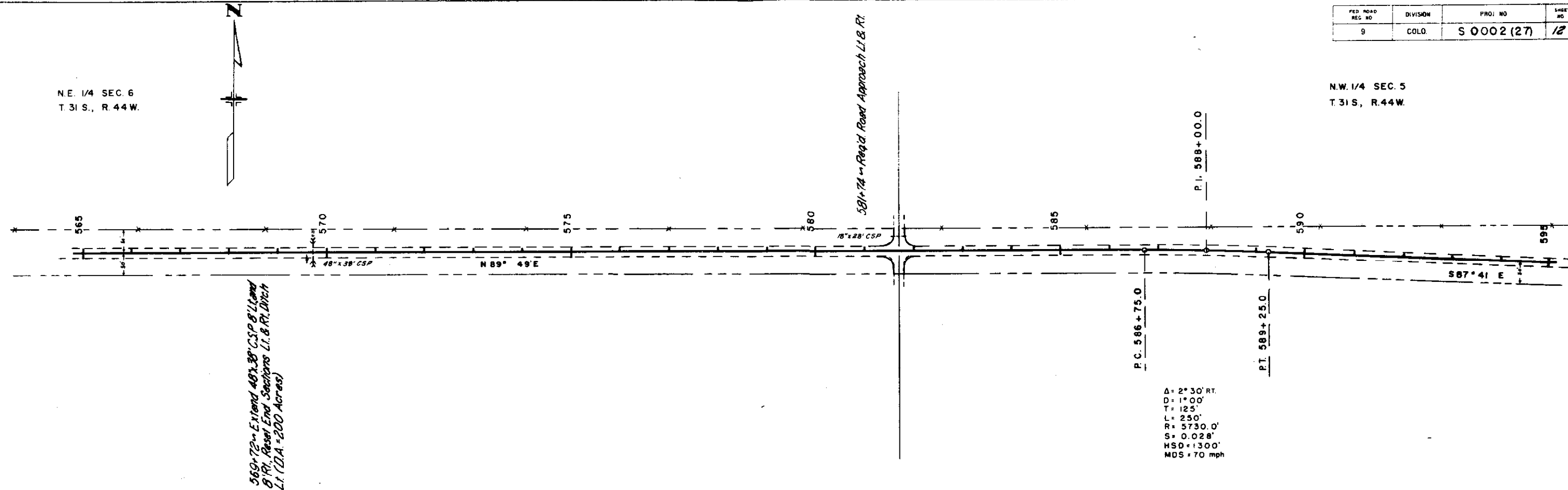
28769



FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0002 (27)	12	

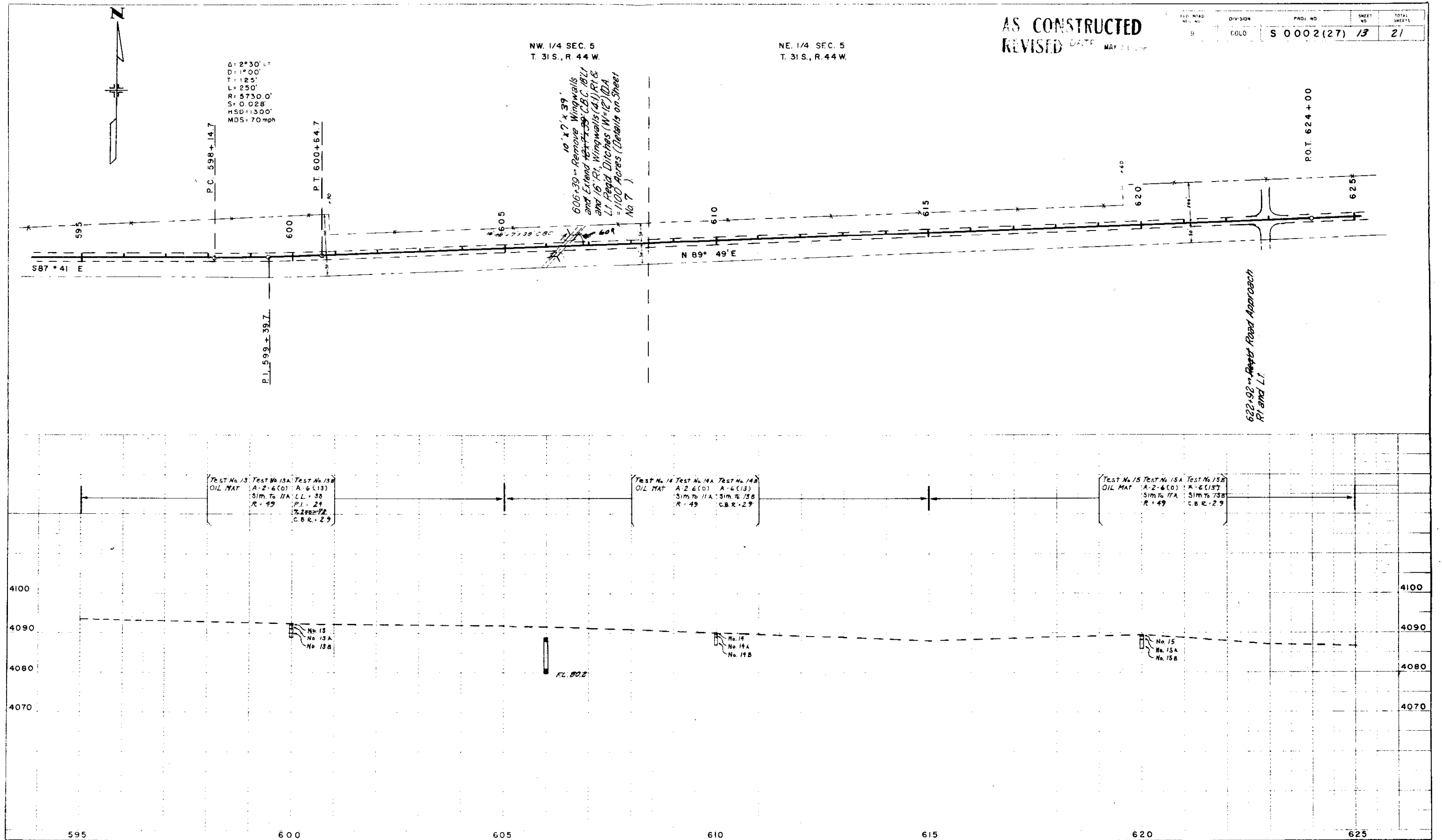
N.E. 1/4 SEC. 6
T.31S., R.44W.

N.W. 1/4 SEC. 5
T.31S., R.44W.



28748

DA 46 66



AS CONSTRUCTED
REVISED DATE MAY 21 1964

FED. ROAD DIST. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0002 (27)	13	21

PLAN
NOTE BOOK NO. 1000
NO. 18748

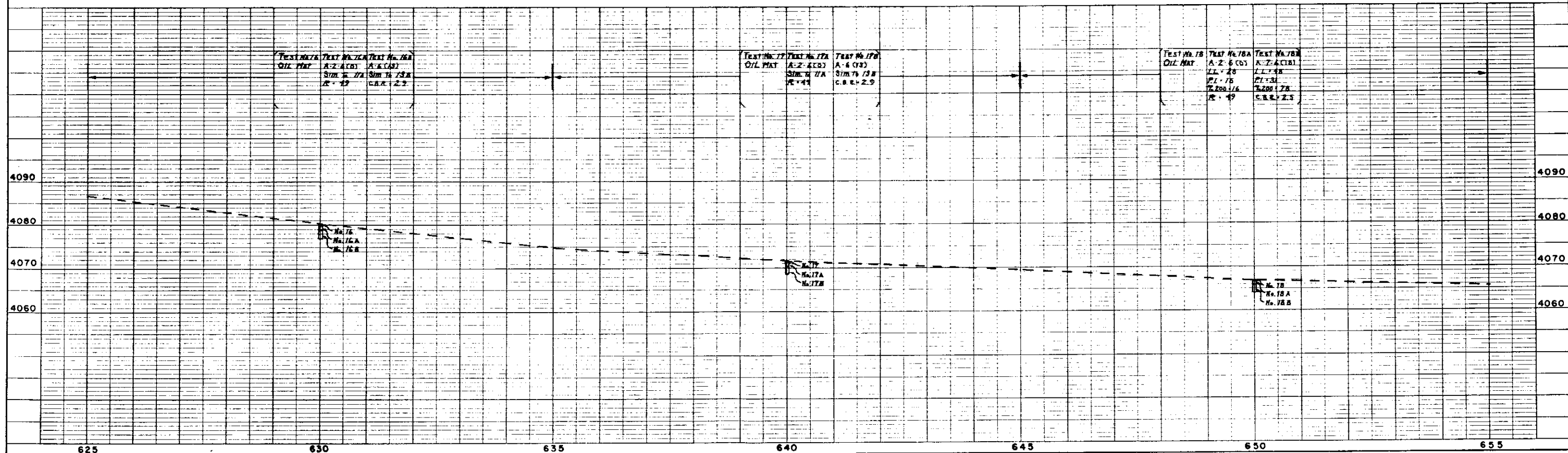
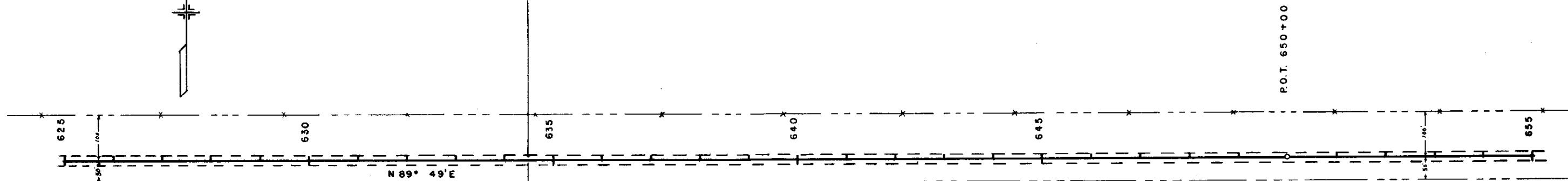
PROFILE
NOTE BOOK NO. 1000
NO. 18748



NE 1/4 SEC. 5
T 31 S, R. 44 W.

NW 1/4 SEC. 4
T 31 S, R. 44 W.

FED. ROAD REC. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0002(27)	14	



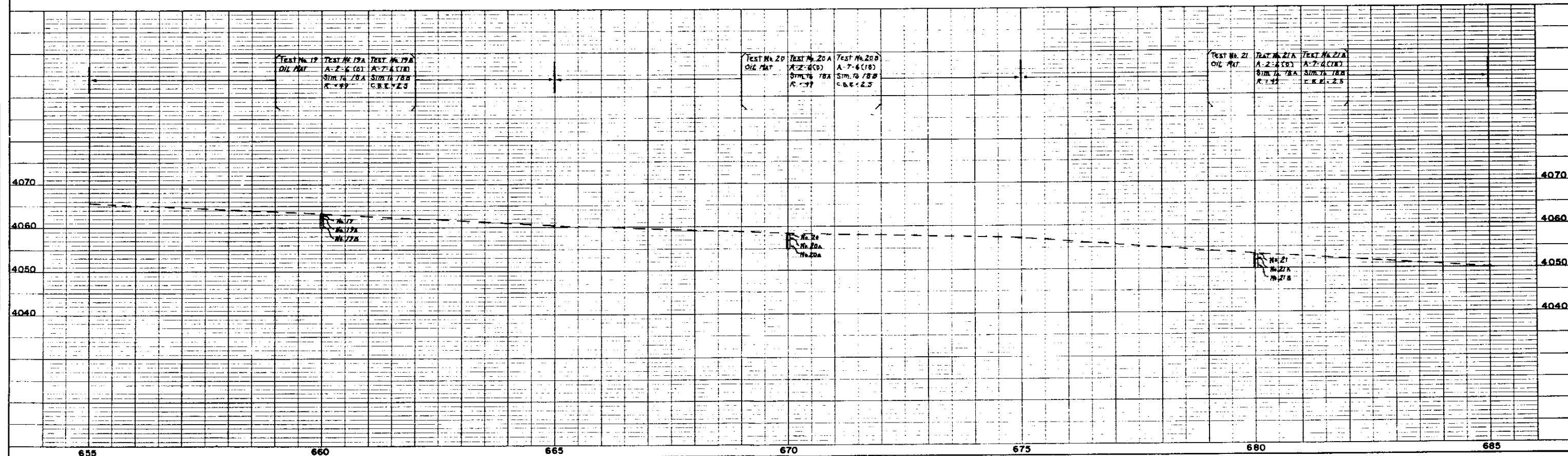
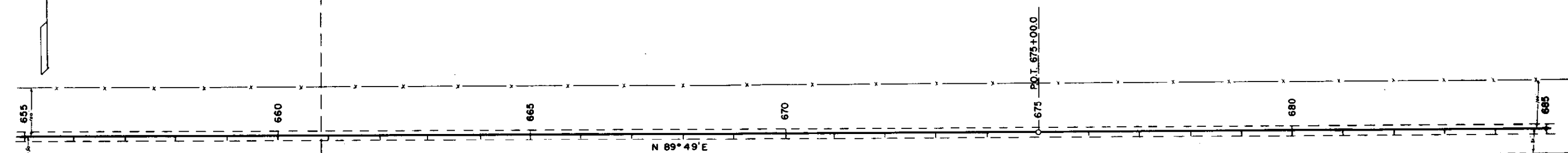
PLAN
NOTES
NO. 41748

PROF. 1
24 No. 68
STRUCTURAL MATERIAL

NW 1/4 SEC. 4
T. 31 S., R. 44 W.

NE 1/4 SEC. 4
T. 31 S., R. 44 W.

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0002 (27)	15	

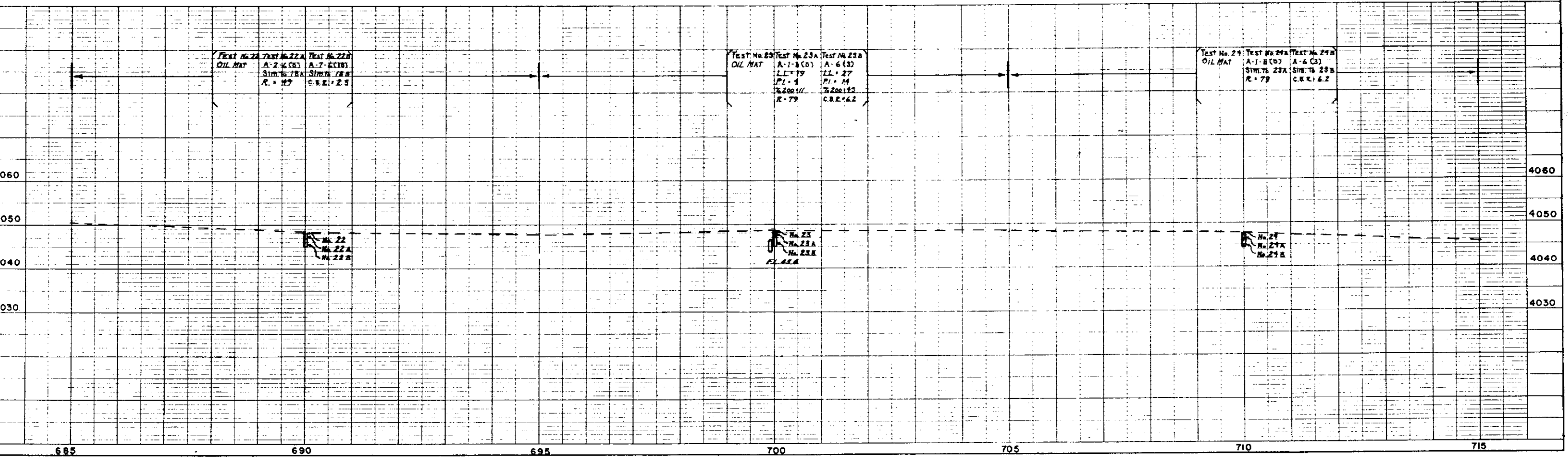
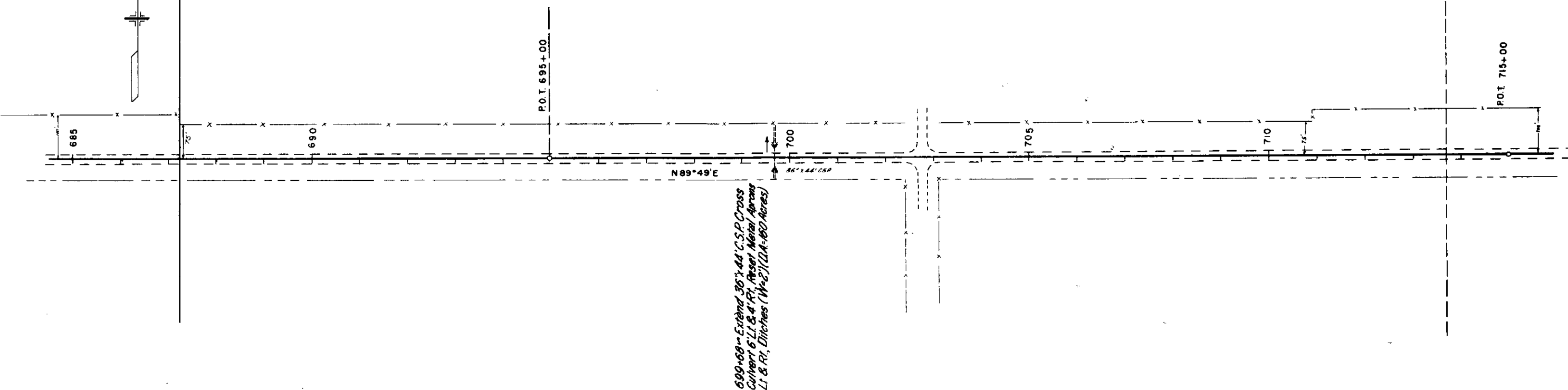


NE. 1/4 SEC. 4
T. 31 S., R. 44 W.

NW. 1/4 SEC. 3
T. 31 S., R. 44 W.

REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO	S 0002 (27)	16	

NE. 1/4 SEC. 3
T. 31 S., R. 44 W.



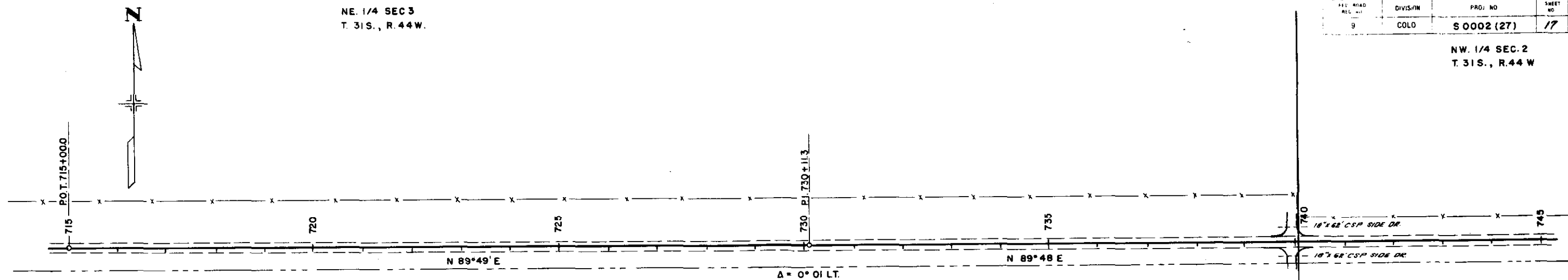
PLAN
NOTE BOOK ALUMINUM SHEET
NO. 28768

PROFILE
NOTE BOOK ALUMINUM SHEET
NO. 28768

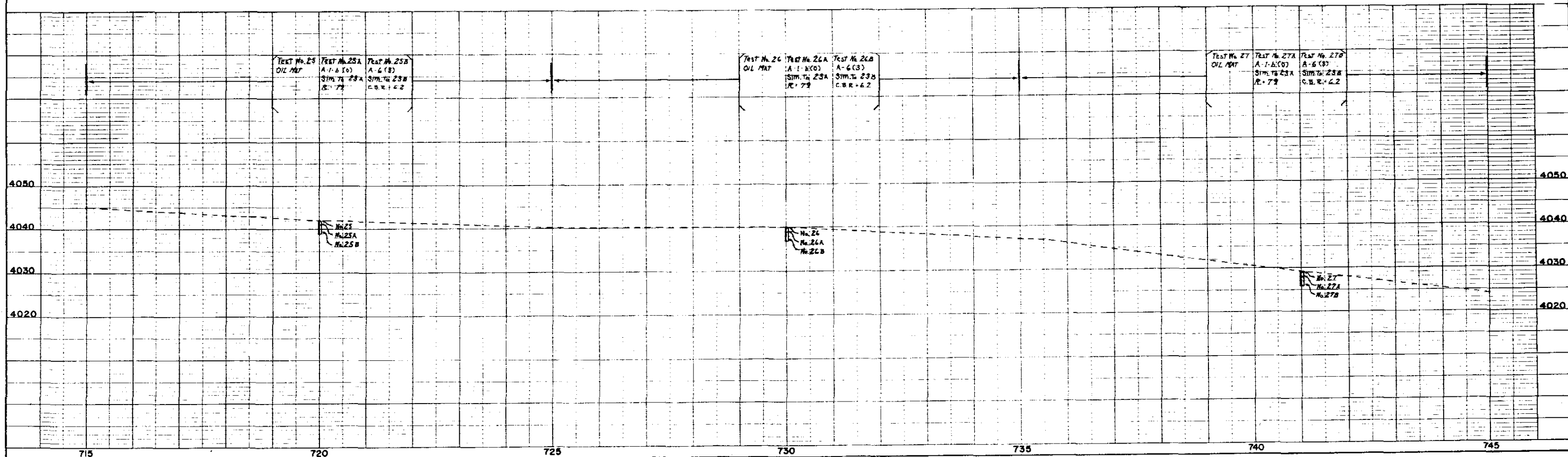
NE. 1/4 SEC. 3
T. 31 S., R. 44 W.

NW. 1/4 SEC. 2
T. 31 S., R. 44 W.

FILE NO.	DIVISION	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	COLO	S 0002 (27)	17	



739+97~ Road Road Approach
L1 & R1



NW 1/4 SEC. 2
T. 31 S., R. 44 W.



750+00 Req'd Guard Rail (Type 3)
For Guard Rail connection to bridge
(See Sheet 7)
(R-1) Remove Handrails
from wingwalls
as directed

P.O.T. 755+00.0

N. 89°48'E.

764+78 ~ Req'd Road Approach R1

ST

STA. 775+00.0 END S0002(27) Const. =
STA. 775+00.0 on S0002(10)

775+00 ~ Req'd Approach to Project

775+00 ~ Req'd Identification
Sign Lt.

P.O.T. 775+00.0

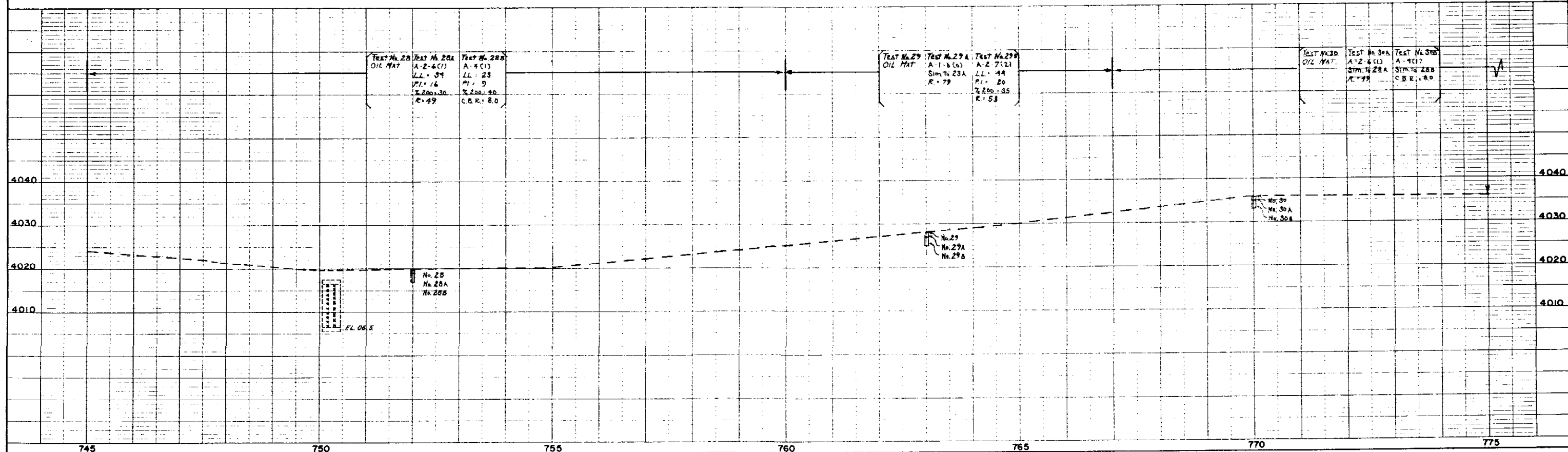
(R-1) Rev. 9-27-67 MEK ~ Structure Note

N.E. 1/4 SEC. 2
T. 31 S., R. 44 W.

PROJ. NO.	SHEET NO.	TOTAL SHEETS
S0002(27)	18	

PLAN
NOTE BOOK NO. 44
PROJECT NO. 44

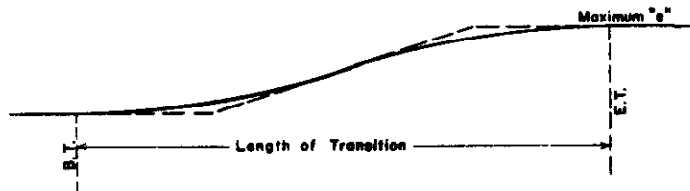
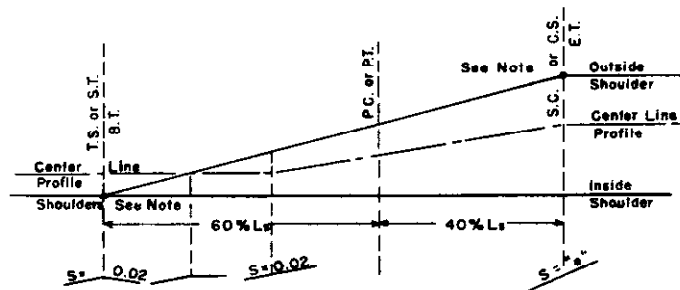
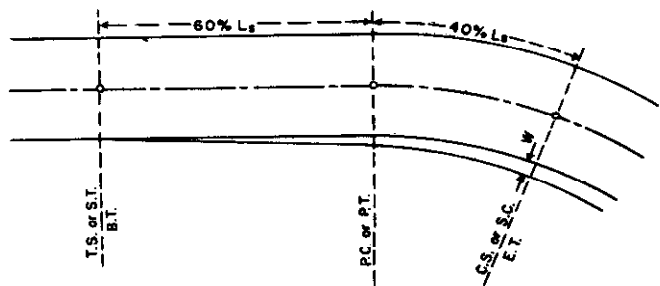
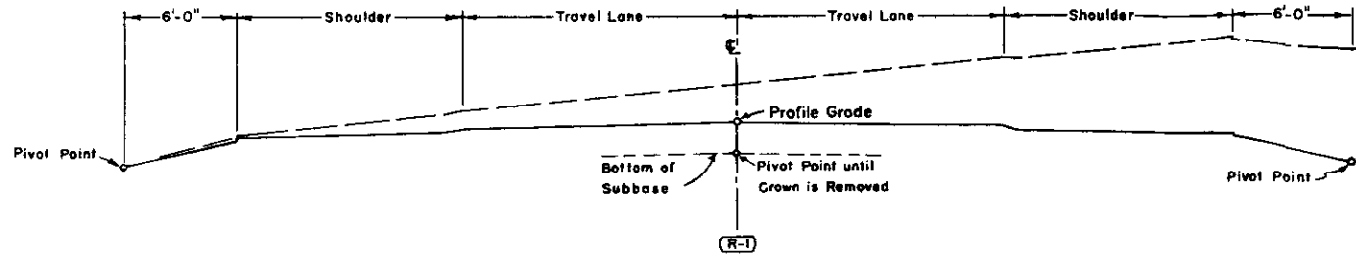
PROFILE
NOTE BOOK NO. 44
PROJECT NO. 44



K-2 DATE: 11/1/67

STANDARD M-203-A
(JULY 1, 1965)

FEDERAL ROAD REGION NO.	DISTRICT	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 super-elevation 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 super-elevation.

REVISIONS		
5-26-67	Superelev Template	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°	.080	30	150'	.100	30	200'
25°	.080	30	150'	.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
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 or Spiral	Minimum Length of Transition or Spiral	Required Superelevation Rate Ft./Ft.	Minimum Length of Transition or Spiral	Minimum Length of Transition or Spiral	Required Superelevation Rate Ft./Ft.	Minimum Length of Transition or Spiral	Minimum Length of Transition or Spiral	Required Superelevation Rate Ft./Ft.	Minimum Length of Transition or Spiral	Minimum Length of Transition or Spiral	Required Superelevation Rate Ft./Ft.	Minimum Length of Transition or Spiral	Minimum Length of Transition or Spiral	Required Superelevation Rate Ft./Ft.	Minimum Length of Transition or Spiral	Minimum Length of Transition or Spiral	Required Superelevation Rate Ft./Ft.	Minimum Length of Transition or Spiral	Minimum Length of Transition or Spiral	
0°15'	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	0°15'
0°30'	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	0°30'
0°45'	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	0°45'
1°00'	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	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	R C	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	.056	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	300'	.100	.100	300'	6°
7°	.045	.050	100'	.056	.063	150'	.066	.076	150'	.074	.088	200'	.079	.097	250'	.080	.100	250'				7°
8°	.050	.055	100'	.061	.069	150'	.071	.084	200'	.078	.094	200'	.080	.100	250'							8°
9°	.054	.061	100'	.065	.075	150'	.074	.089	200'	.080	.097	200'										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'																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°	.080	.100	200'																			
25°	.080	.100	200'																			

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.
Width of Crowned Highway to be figured for Superelevation—left pivot point to right pivot point.

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

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

SUPERELEVATION &
WIDENING OF CURVES
CROWNED HIGHWAYS

Designed by S.B.L. Approved by S.B.L.
Made by S.B.L. Staff Design Eng.
Checked by L.E.O. Date 10/1/1965

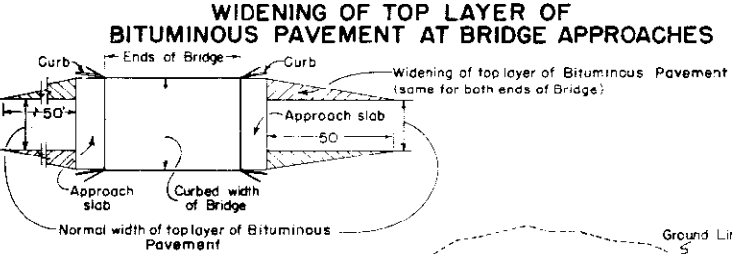
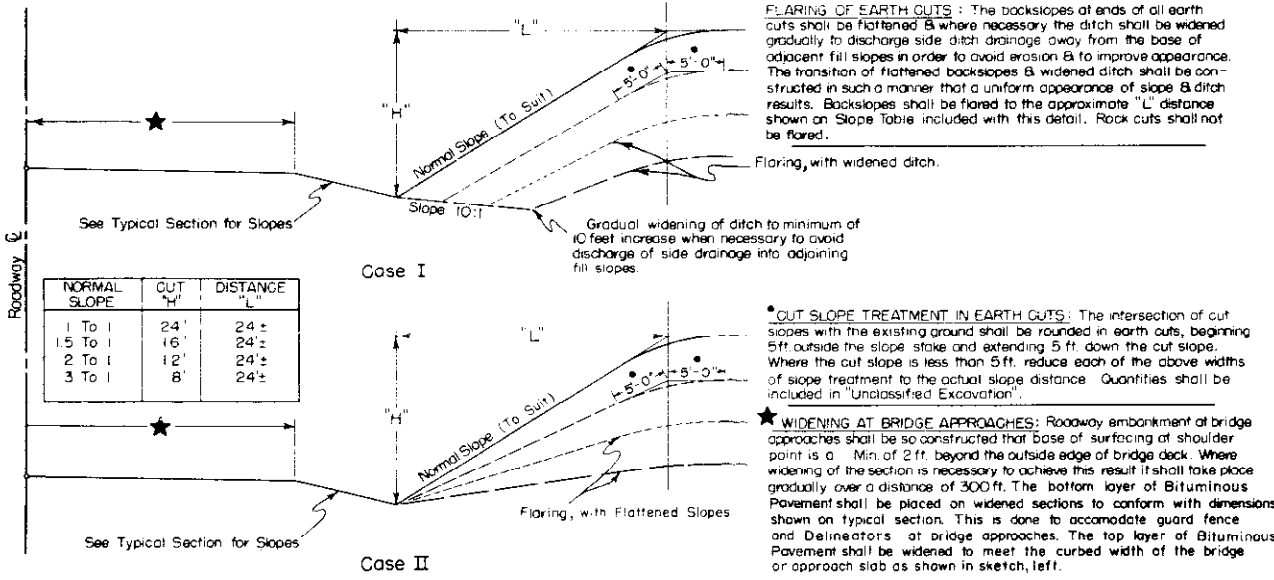
STANDARD SIDE APPROACH ROADS, FLARING, CUT SLOPE TREATMENT & WIDENING AT BRIDGES AND AT CREST OF GRADES

STANDARD M-203-B
(JULY 1, 1965)

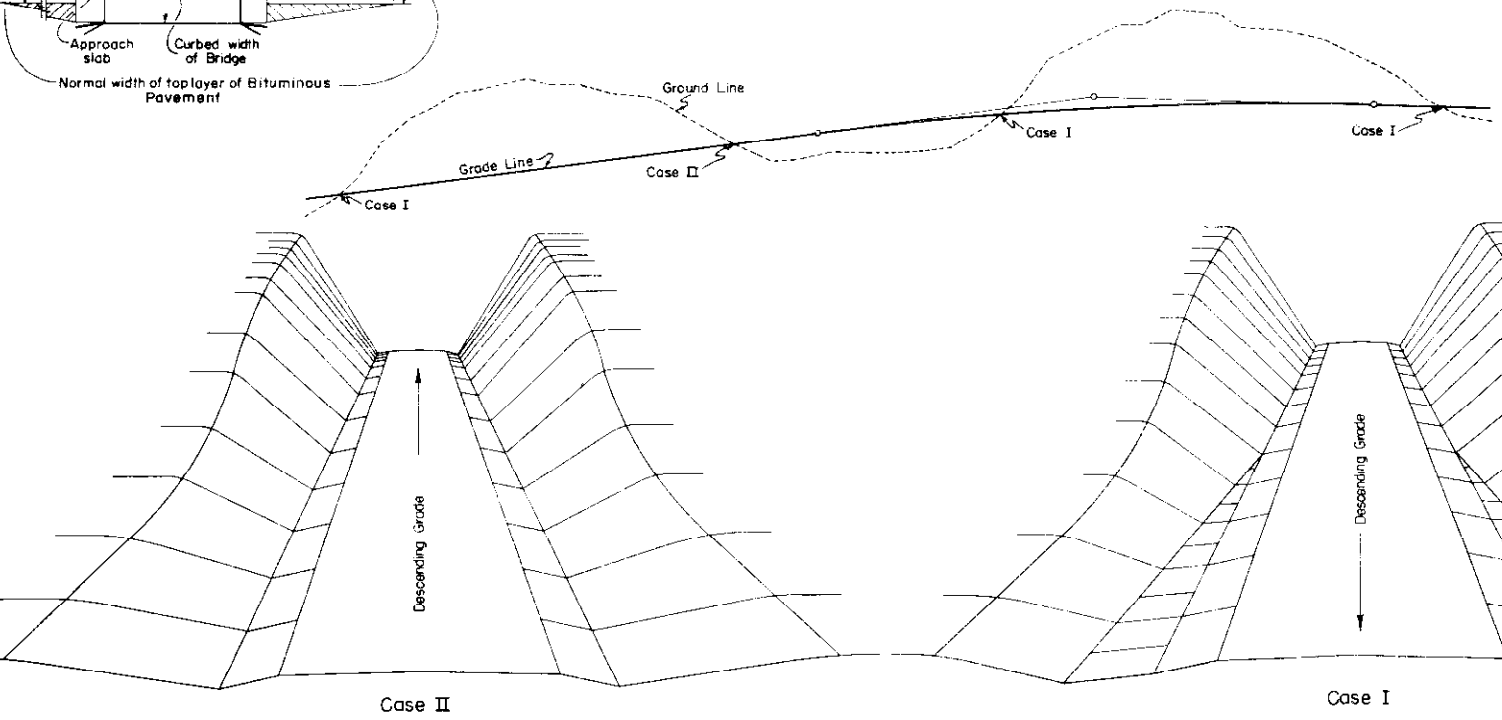
FED. ROAD RES. NO.	DIVISION	PROJECT NO.	SHEET NO.
8	COLO.		

REVISIONS	

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



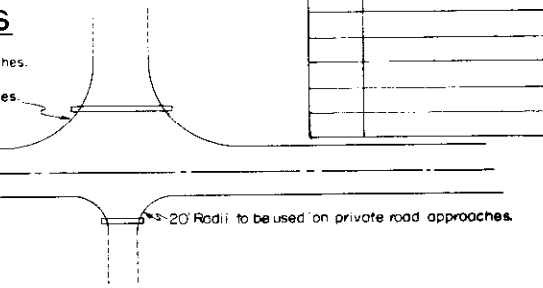
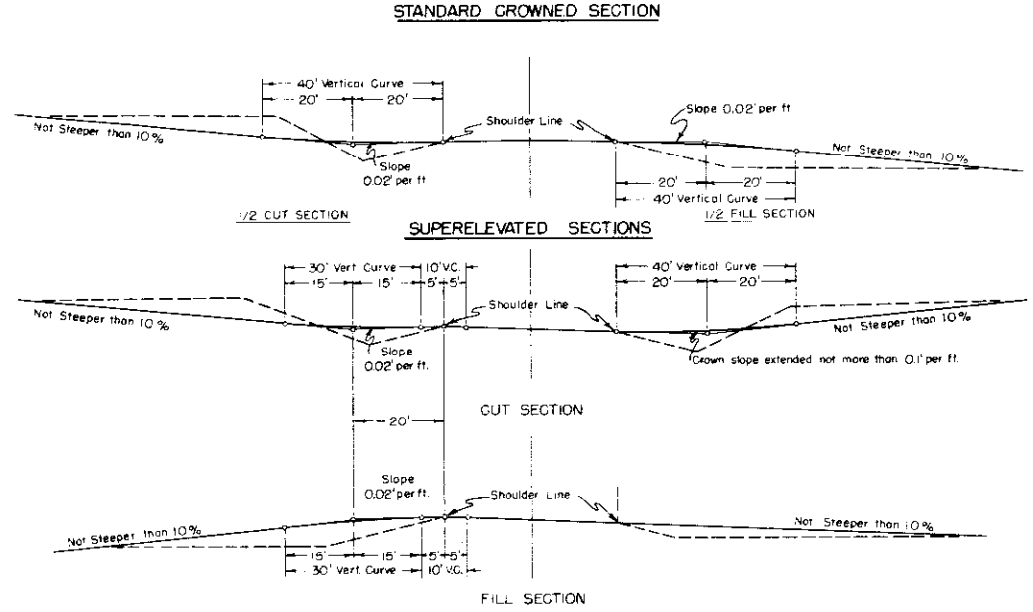
PLAN OF FLARING IN EARTH CUTS



TYPICAL PLANS FOR SIDE APPROACH ROADS

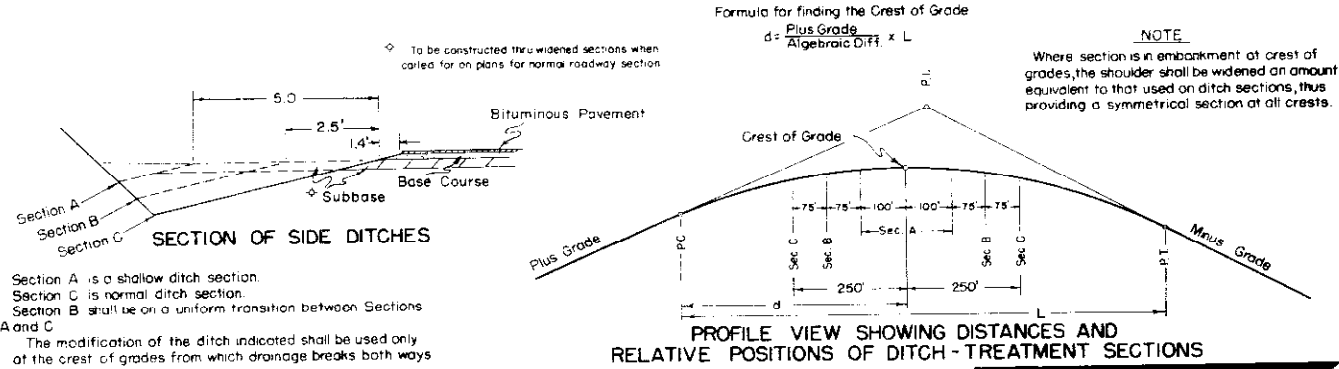
Where practical Side Drains are to be placed in line with the roadway ditches.

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



NOTE: Road Approaches shall conform to the above details unless otherwise indicated on plans. The width of the crowned section shall not be less than the width of the crowned section of the existing approach road and the new construction shall not be less than 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)



GENERAL NOTES

All work shall be done in accordance with the Standard Specifications applicable to the Project.

All side approach roads to the Project shall be Gravel Surfaced with a 4 inch thickness of Aggregate Base Course extending approximately to the Right of Way Line. Estimated tonnage and class of material required for this operation are shown in the Aggregate Base Course 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.
Made by J. M. BASH
Checked by C. R. S.

Approved by J. E. Dorn
Staff Design Engr.
Date: July 1, 1965.

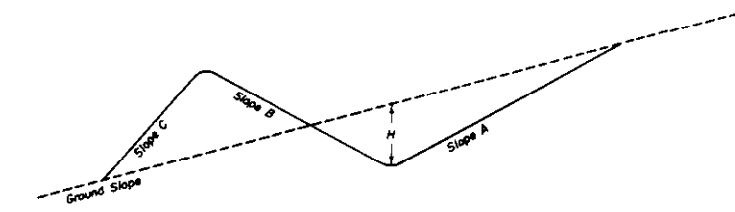
STANDARD TYPES *of* DITCHES *and* CONSTRUCTION METHODS

STANDARD M-203-C
(JULY 1, 1965)

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

DETAILS *for* CONTOUR INTERCEPTING DITCHES

Typical Section for Contour Intercepting Ditches



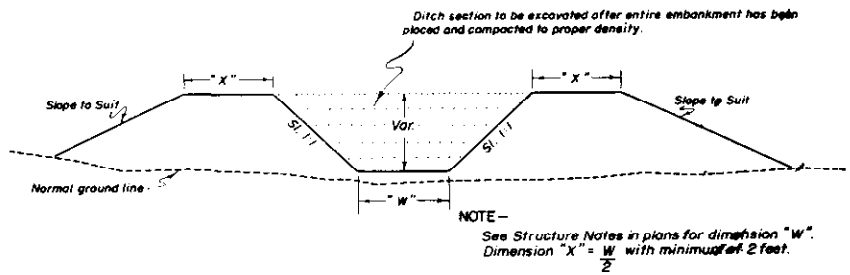
PURPOSE & USE OF THE TABLE
The primary purpose of the information for Contour and Intercepting Ditches shown on this sheet is to serve as a guide in construction and to readily arrive at yardages of excavation involved.
Foremost consideration in constructing these ditches is given first to the natural 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.

Table of Slopes and Yardages

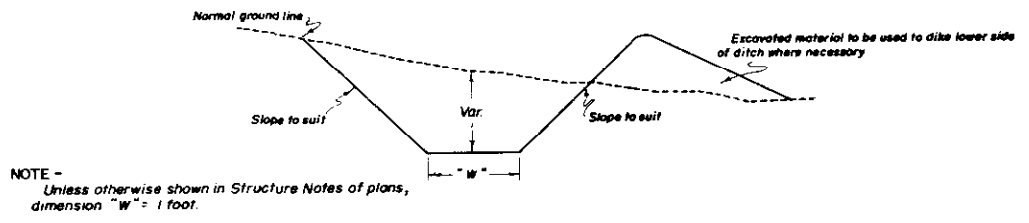
SLOPES				H	Cubic Yards per 100 lin. ft. of Ditch
Ground	A	B	C		
5:1 Or Flatter	2:1	4:1	2:1	15"	16
				18"	23
				21"	32
		3:1		15"	15
				18"	22
				21"	30
	1-1/2:1	2:1		15"	14
				18"	20
				21"	27
		1-1/2:1		15"	13
				18"	19
				21"	25
4:1	1-1/2:1	4:1	1-1/2:1	15"	12
				18"	18
				21"	25
		3:1		15"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

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

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



For Embankment Sections
(Generally for use in Irrigation Ditches & Channel Changes)



For Cut Sections

REVISIONS	

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications applicable to the Project.

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

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

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

The following horizontal spacing of ditches is recommended:

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

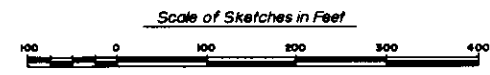
Where ditch checks are required the intervening ditch between one set of ditch checks shall not exceed a grade of 1.0%. Details of checks will be shown on plans when required.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

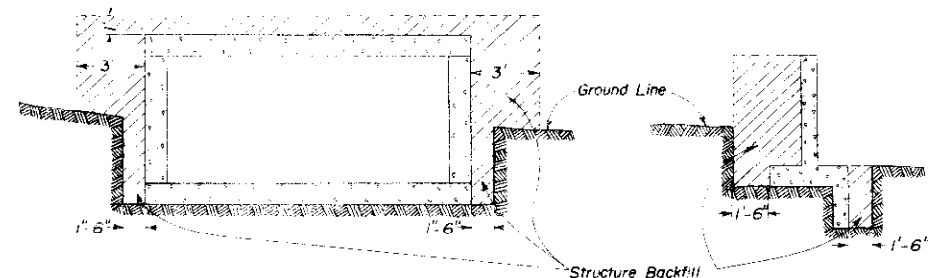
DITCH TYPES

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

Approved by *[Signature]*
Staff Design Engr.
Date: July 1, 1965

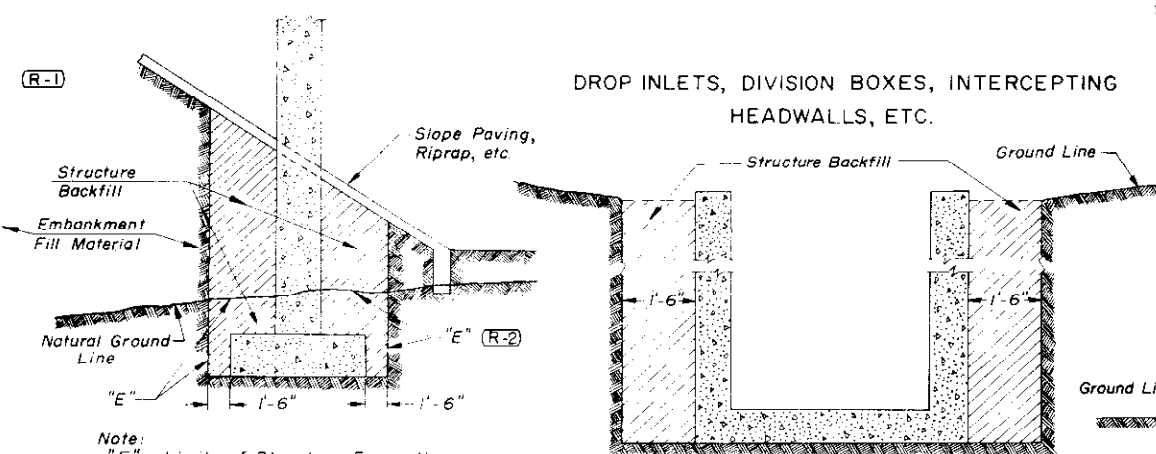
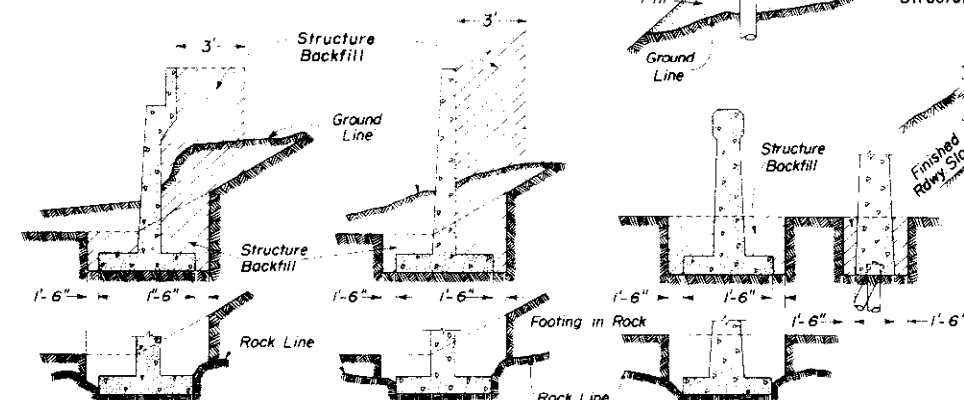


CONCRETE BOX CULVERTS & WINGWALLS



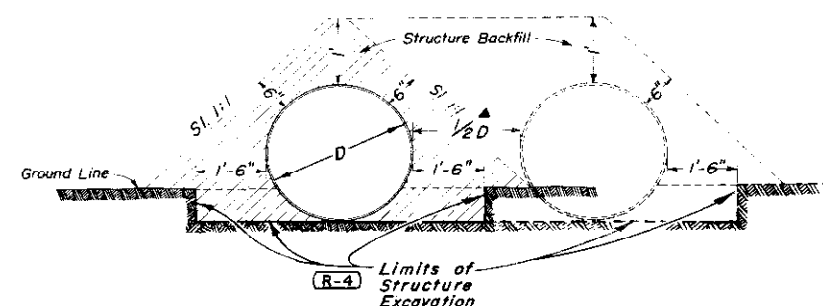
PIERS, ABUTMENTS, RETAINING WALLS ETC.

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.

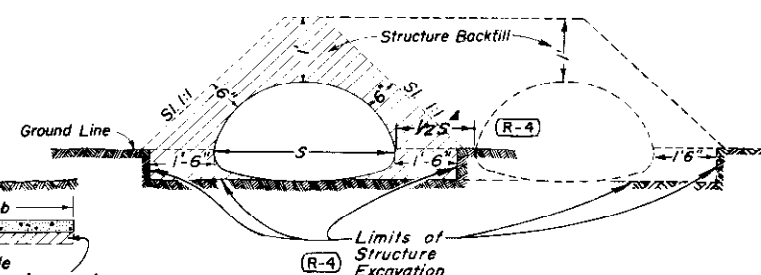


Note: "E" = Limits of Structure Excavation

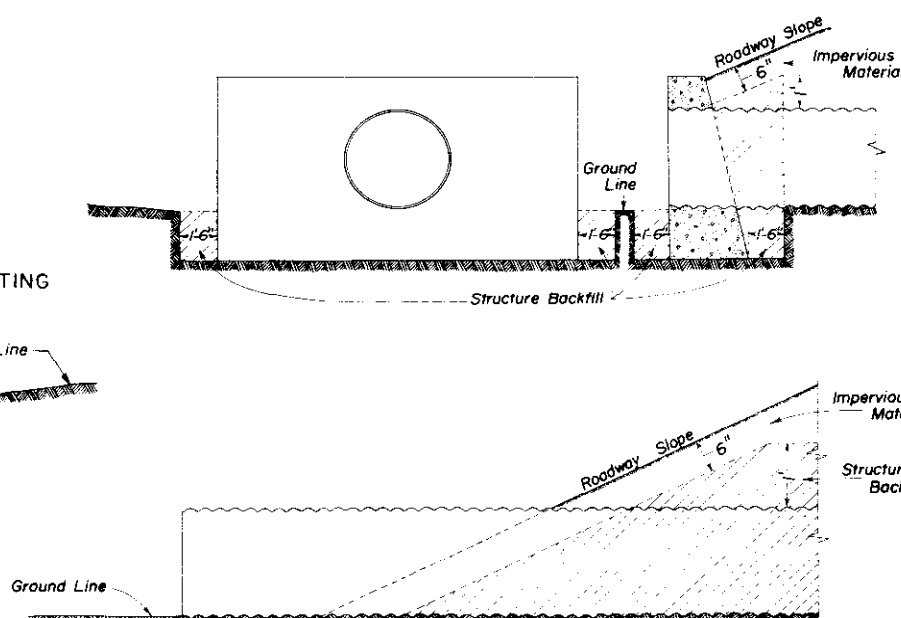
CIRCULAR CONDUIT



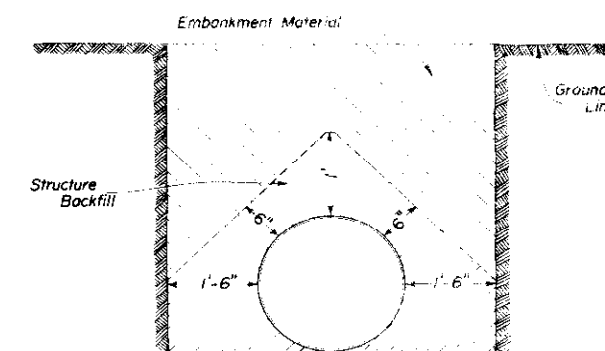
ELLIPTICAL OR ARCH CONDUIT



HEADWALLS AND END OF CULVERTS



SIPHONS OR CONDUIT IN TRENCH



NOTES:

When two or more conduits are laid side by side they shall be spaced so that adjacent sides of pipe shall be $\frac{1}{2}$ the Diameter or Span or 3 feet apart whichever is less. Minimum spacing shall not be less than 1 foot. For additional culvert installation details see M Standards for metal, concrete, or structural plate pipe culverts.

GENERAL NOTES

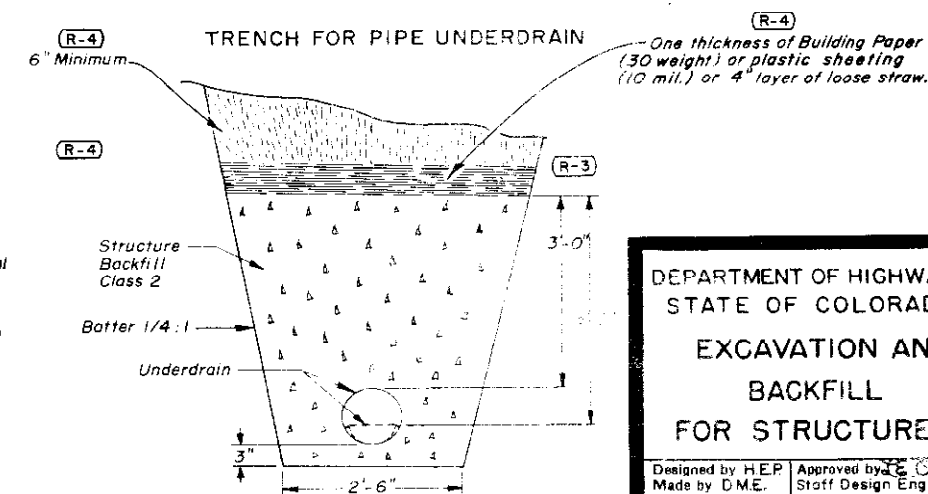
All work shall be done according to the Standard Specifications applicable to the Project.

Where the roadway cross section is in fill, excavation for concrete footings (except those in rock or those on piles) and for box culverts shall be done according to the following:

Embankment shall be built up and compacted to a point one foot above the flowline of the box or the top of the footing. The trench shall then be excavated to accommodate construction of the box or footing.

Excavation and backfill patterns different from those indicated on these sheets will be shown elsewhere on the plans.

Excavation for structure installation shall be classified as "Structure Excavation" unless otherwise shown on plans.



DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
EXCAVATION AND
BACKFILL
FOR STRUCTURES

Designed by HEP
Made by DME
Checked by LEO
Approved by
Staff Design Engr.
Date: July 1, 1965

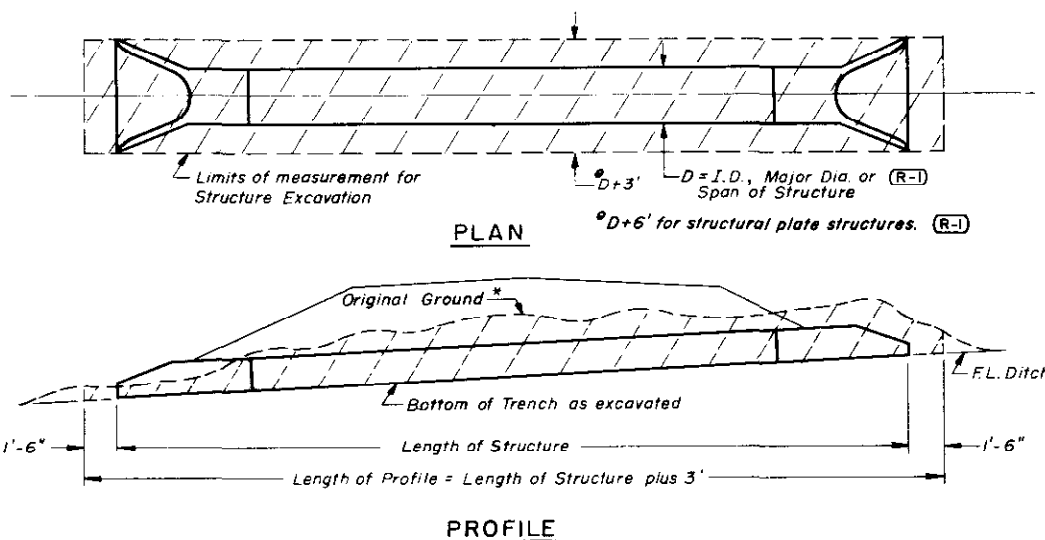
STANDARD M-206-A

(SHEET 2)
(JULY 1, 1965)

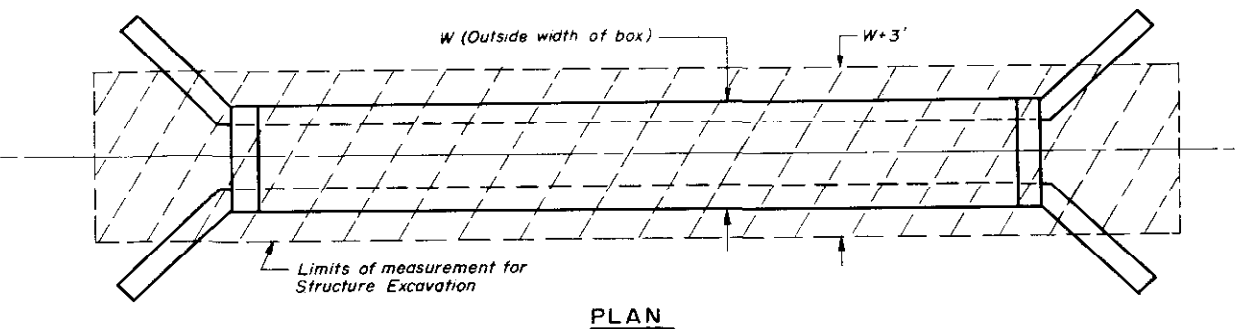
FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO			

REVISIONS:	
(R-1)	3-17-67 I. D. on Pipe Culvert Span or D. M.R.H.

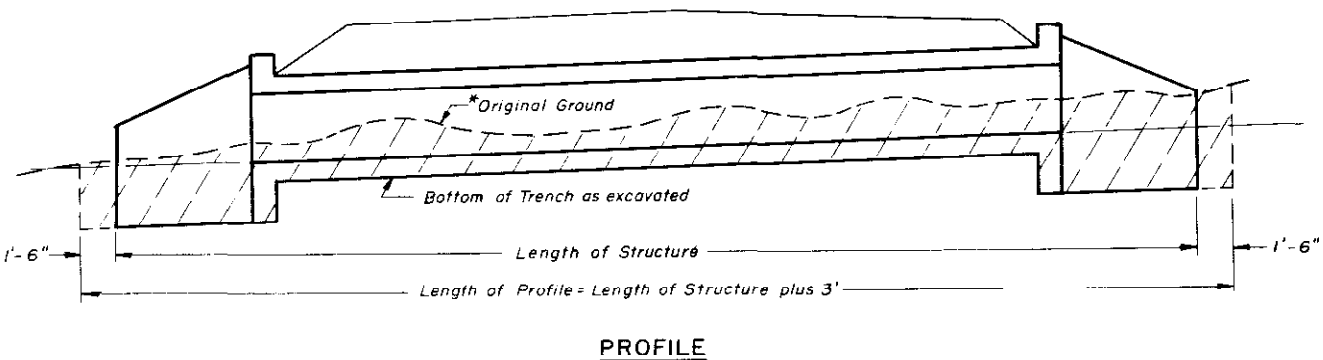
STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS



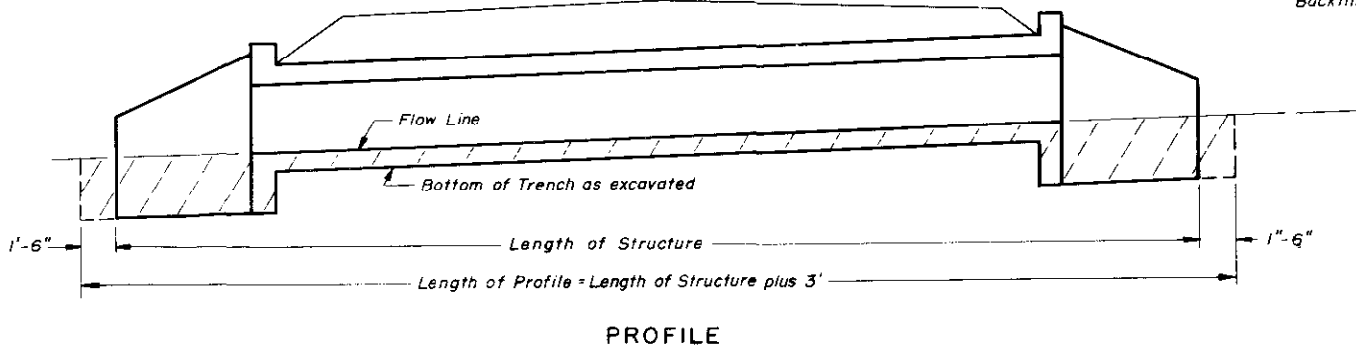
STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS



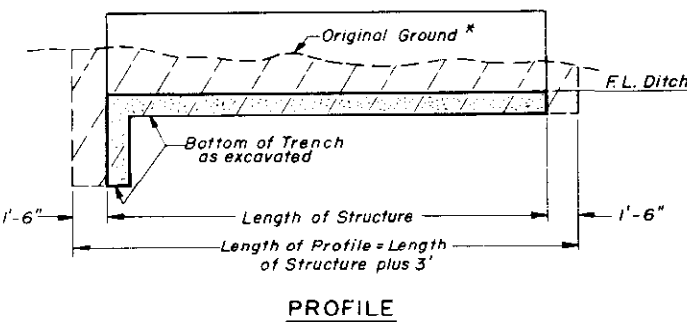
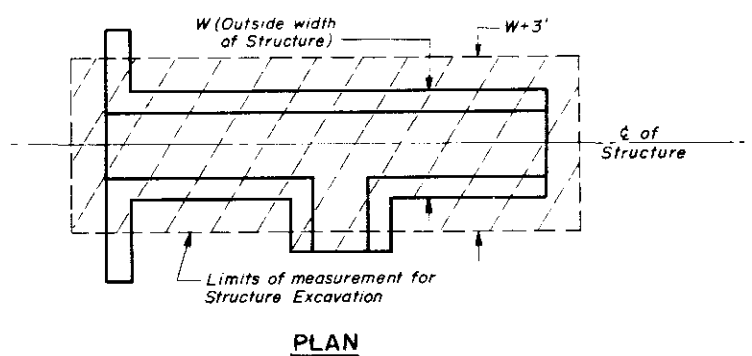
Without Channel Change or Channel Improvement



With Channel Change or Channel Improvement



STRUCTURE EXCAVATION MEASUREMENT FOR DIVERSION OR DIVISION BOXES



* Along $\bar{C}$ of Structure

Areas to be used for Structure Excavation computations.

NOTE:
See Sheet 1 for General Notes and Backfilling Details.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

EXCAVATION AND
BACKFILL
FOR STRUCTURES

Designed by: M.R.H. Approved by: *[Signature]*
Made by: H.P.B. Staff Design Engr.
Checked by: Date: July 1, 1965

SINGLE CONCRETE BOX CULVERT

STANDARD M-60I-A

(JULY 1, 1965)

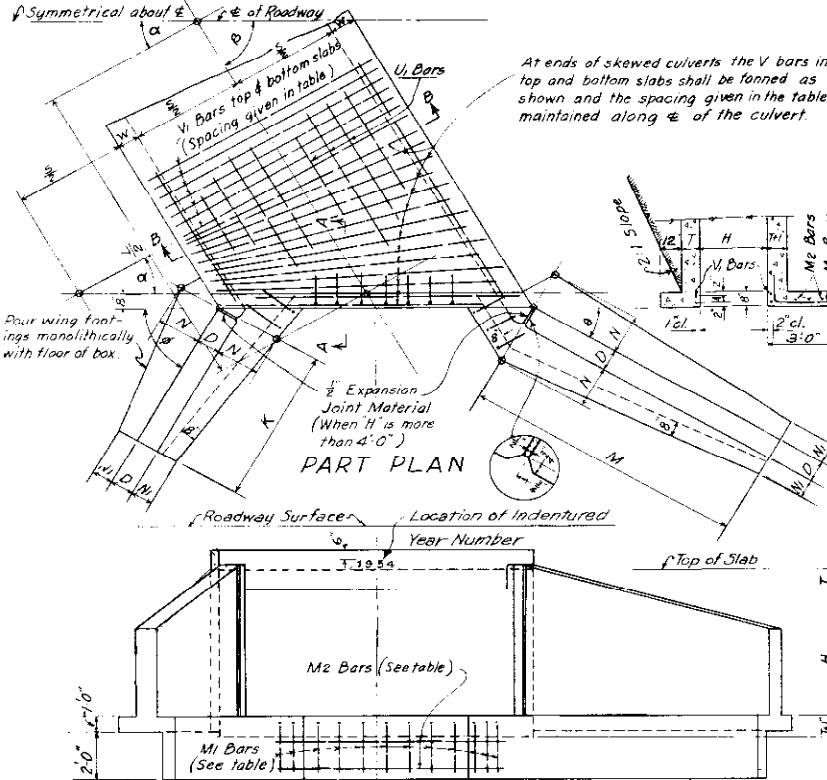
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		

Dimensions & Quantities (see Wingwall Standard for Wings)

Height of Fill Allowed	Type	Span S	Height H	Slab T	Wall W	Bar Size & Spacing	No. Bars Required	Quantities for One Lin. Ft. of Box	Quantities for Two Headwalls
								Concrete Cu Yds	Steel Lbs
35'-0"	2A	2'-0"	2'-0"	6"	8"	5/8" @ 12"	8	2.25	175
30'-0"	3A	3'-0"	3'-0"	7"	8"	5/8" @ 12"	8	2.39	185
20'-0"	4A	4'-0"	4'-0"	7"	8"	5/8" @ 12"	8	2.42	190
16'-0"	5A	5'-0"	5'-0"	8"	8"	5/8" @ 12"	8	2.49	195
20'-0"	5B	5'-0"	5'-0"	8 1/2"	8"	5/8" @ 12"	8	2.50	200
14'-0"	6A	6'-0"	6'-0"	8 1/2"	8"	5/8" @ 12"	8	2.54	205
20'-0"	6B	6'-0"	6'-0"	10"	8"	5/8" @ 12"	8	2.70	225
12'-0"	7A	7'-0"	7'-0"	9"	9"	3/4" @ 12"	7	2.77	235
15'-0"	7B	7'-0"	7'-0"	10"	9"	3/4" @ 12"	7	2.87	245
20'-0"	7C	7'-0"	7'-0"	11"	9"	3/4" @ 12"	7	2.88	250
10'-0"	8A	8'-0"	8'-0"	9 1/2"	10"	3/4" @ 12"	7	2.90	255
16'-0"	8B	8'-0"	8'-0"	11 1/2"	10"	3/4" @ 12"	7	2.95	260
20'-0"	8C	8'-0"	8'-0"	12 1/2"	10"	3/4" @ 12"	7	2.98	265
7'-0"	9A	9'-0"	9'-0"	10"	11"	3/4" @ 12"	8	3.10	280
14'-0"	9B	9'-0"	9'-0"	12"	11"	3/4" @ 12"	8	3.17	285
20'-0"	9C	9'-0"	9'-0"	14"	11"	1" @ 12"	7	3.22	290
5'-0"	10A	10'-0"	10'-0"	10 1/2"	12"	7/8" @ 12"	8	3.34	300
10'-0"	10B	10'-0"	10'-0"	12"	12"	7/8" @ 12"	7	3.42	305
16'-0"	10C	10'-0"	10'-0"	14"	12"	1" @ 12"	8	3.51	310
5'-0"	11A	11'-0"	11'-0"	10"	11"	7/8" @ 12"	7	3.55	315
9'-0"	11B	11'-0"	11'-0"	12 1/2"	11"	1" @ 12"	8	3.58	320
13'-0"	11C	11'-0"	11'-0"	14"	12"	1" @ 12"	8	3.62	325
5'-0"	12A	12'-0"	12'-0"	12"	12"	7/8" @ 12"	7	3.65	330
10'-0"	12B	12'-0"	12'-0"	14"	12"	1" @ 12"	8	3.72	335
4'-0"	13A	13'-0"	13'-0"	12 1/2"	12"	7/8" @ 12"	7	3.74	340
8'-0"	13B	13'-0"	13'-0"	14"	12"	1" @ 12"	8	3.77	345
4'-0"	14A	14'-0"	14'-0"	13 1/2"	12"	1" @ 12"	8	3.81	350
6'-0"	14B	14'-0"	14'-0"	15"	12"	1" @ 12"	8	3.84	355

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

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



END ELEVATION

Note: All wing faces to receive Class I finish

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

Mark	Size	No. Req'd	Type	Length
V1	See table	10+ 24L	I	S+2W-6
W1	See table	6+ 24L	I	H+2T-5
U1	5/8"	See table	I	L+1/0"
M1	5/8"	See table	II	3'-6"
M2	5/8"	4	I	S+2W-6 Cos α

Mark	Size	No. Req'd	Type	Length
V1	See table	10+ 24L	I	S+2W-6
W1	See table	6+ 24L	I	H+2T-5
U1	5/8"	See table	I	L+1/0"
M1	5/8"	See table	II	3'-6"
M2	5/8"	4	I	S+2W-6 Cos α

Possible Combinations (Span & Height)

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

SECTION B-B

Bar dimensions are to 1/2" of bar unless marked 'cl' (clear).

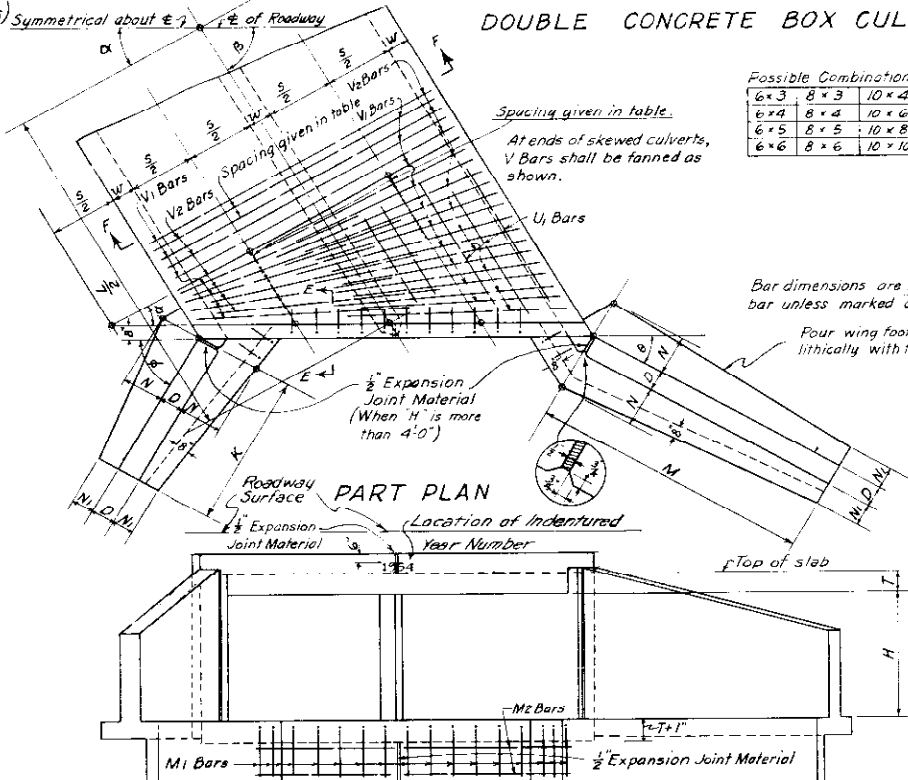
DOUBLE CONCRETE BOX CULVERT

Dimensions & Quantities (see Wingwall Standard for Wings)

Height of Fill Allowed	Type	Span S	Height H	Slab T	Wall W	Bar Size & Spacing	No. Bars Required	Quantities for One Lin. Ft. of Box	Quantities for Two Headwalls
								Concrete Cu Yds	Steel Lbs
10'-0"	6-6-A	6'-0"	6'-0"	8 1/2"	8"	5/8" @ 12"	8	2.48	195
15'-0"	6-6-B	6'-0"	6'-0"	10 1/2"	8"	5/8" @ 12"	8	2.52	200
20'-0"	6-6-C	6'-0"	6'-0"	12 1/2"	8"	5/8" @ 12"	8	2.56	205
10'-0"	8-8-A	8'-0"	8'-0"	10"	10"	5/8" @ 12"	8	2.64	210
15'-0"	8-8-B	8'-0"	8'-0"	11"	10"	5/8" @ 12"	8	2.68	215
20'-0"	8-8-C	8'-0"	8'-0"	12 1/2"	10"	5/8" @ 12"	8	2.72	220
5'-0"	10-10-A	10'-0"	10'-0"	10"	12"	7/8" @ 12"	8	2.80	225
10'-0"	10-10-B	10'-0"	10'-0"	12"	12"	7/8" @ 12"	8	2.84	230
15'-0"	10-10-C	10'-0"	10'-0"	14"	12"	1" @ 12"	8	2.88	235
5'-0"	12-12-A	12'-0"	12'-0"	12"	12"	7/8" @ 12"	7	2.92	240
10'-0"	12-12-B	12'-0"	12'-0"	14"	12"	1" @ 12"	8	2.96	245
15'-0"	12-12-C	12'-0"	12'-0"	16"	12"	1" @ 12"	8	3.00	250
5'-0"	14-14-A	14'-0"	14'-0"	12"	15"	1" @ 12"	8	3.04	255
10'-0"	14-14-B	14'-0"	14'-0"	16"	15"	1" @ 12"	8	3.08	260

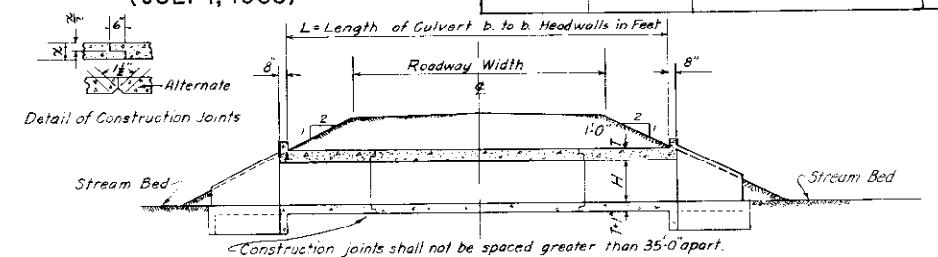
Quantities for one culvert shall be (quantity for one lin. ft. of box times L) plus (quantity for two headwalls) plus (quantities for four wings).

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



END ELEVATION

Note: All wing faces to receive Class I finish.



TYPICAL SECTION THROUGH CULVERT

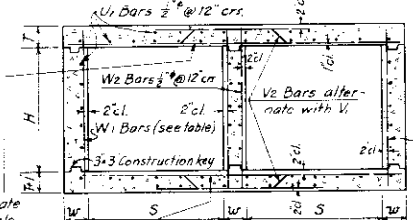
REVISIONS

NO.	DESCRIPTION	DATE

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

Possible Combinations (Span & Height)

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



SECTION F-F

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

Mark	Size	Number Required	Type	Length	Total Length
V1	See table	24(L+2)	I	S+15W+4"	2L
W1	See table	Spacing	II	0.75S+4"	2L+m
W2	5/8"	2(L+2)	I	H+2T-4"	L
U1	5/8"	See table	I	L+12"	L
M1	5/8"	See table	III	L+12"	3'-6"
M2	5/8"	8	I	S+15W+4"	L

(Bar dimensions are out to out of bar.)
For General Notes, Loading and Design Data, see Wingwall Standard.

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

Designed by: WWD Approved by: JLM
Made by: WWD Bridge Engineer
Checked by: TJM Date: July 1, 1965

STANDARD M-60I-C

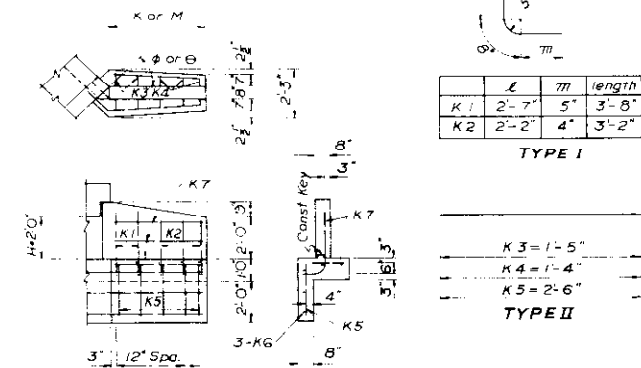
(SHEET 1 OF 2 SHEETS)
(JULY 1, 1965)

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

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

B	α	φ	θ	H = 2'-0"		H = 3'-0"		H = 4'-0"		H = 5'-0"		H = 6'-0"	
				K	M	K	M	K	M	K	M	K	M
45°	45°	67°30'	22°30'	3'-3"	8'-0"	4'-6"	11'-0"	6'-0"	14'-9"	7'-6"	18'-0"	8'-9"	21'-0"
60°	30°	60°	30°	3'-6"	6'-0"	5'-0"	8'-6"	6'-6"	11'-3"	8'-0"	14'-0"	9'-3"	16'-0"
75°	15°	52°30'	37°30'	3'-9"	5'-0"	5'-6"	7'-0"	7'-3"	9'-3"	8'-9"	11'-6"	10'-0"	13'-3"
90°	0°	45°	45°	4'-3"	4'-3"	6'-0"	6'-0"	5'-0"	8'-0"	10'-0"	10'-0"	11'-6"	11'-6"
105°	15°	37°30'	52°30'	5'-0"	3'-9"	7'-0"	5'-6"	9'-3"	7'-3"	11'-6"	8'-9"	13'-3"	10'-0"
120°	30°	30°	60°	6'-0"	3'-6"	8'-6"	5'-0"	11'-3"	6'-6"	14'-0"	9'-3"	16'-0"	9'-3"
135°	45°	22°30'	67°30'	8'-0"	3'-3"	11'-0"	4'-6"	14'-9"	6'-0"	18'-0"	7'-6"	21'-0"	8'-9"

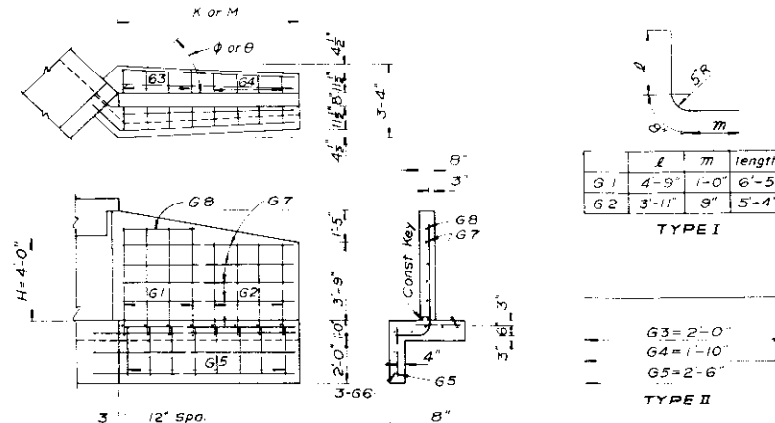
B equals the angle between ϕ of culvert & ϕ of roadway, α equals the angle between ϕ of culvert and a normal to ϕ of roadway.
 ϕ and θ are angles between the wingwall and a line parallel with the ϕ of roadway.
EXAMPLE FOR USING THE ABOVE TABLE: Suppose a stream makes an angle of $\beta = 65^\circ$ with the ϕ of roadway, then, from the table, select the nearest angle. $\beta = 60^\circ$ then α, ϕ & θ equal $30^\circ, 60^\circ$ & 30° respectively. If the desired height "H" of culvert is 6'-0", then K & M will be 9'-3" and 16'-0". Locate the WING DETAIL WHEN H=6'-0" on this sheet.



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

When ϕ or θ equals	K1	K2	K3	K4	K5	3-K6	4-K7	One Wing
22°30'	4	4	4	4	8	9'-10"	7'-8"	1.47 80
30°	3	3	3	3	6	7'-4"	5'-8"	1.10 59
37°30'	3	3	3	3	5	6'-1"	4'-8"	0.92 50
45°	2	3	2	3	5	5'-2"	3'-11"	0.78 45
52°30'	2	2	2	2	4	5'-1"	3'-5"	0.69 39
60°	2	2	2	2	4	4'-6"	3'-2"	0.64 37
67°30'	2	2	2	2	4	4'-0"	2'-11"	0.60 36

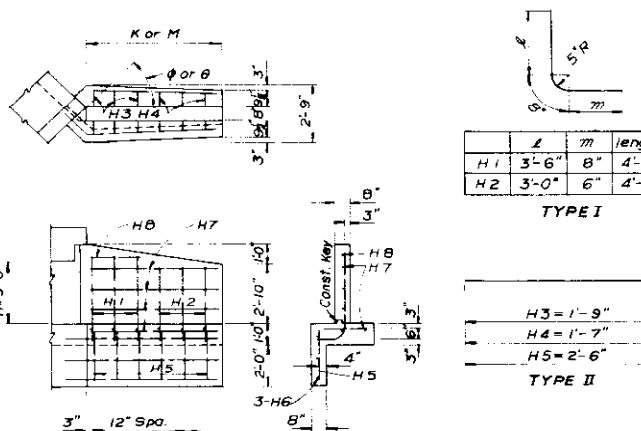
WING DETAIL WHEN H=2'-0"



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

When ϕ or θ equals	G1	G2	G3	G4	G5	3-G6	8-G7	1-G8	One Wing
22°30'	6	9	6	9	15	17'-4"	14'-5"	5'-2"	3.97 219
30°	5	7	5	7	12	13'-2"	10'-11"	4'-2"	3.03 170
37°30'	4	6	4	6	10	10'-10"	8'-11"	3'-2"	2.49 141
45°	4	4	4	4	8	9'-4"	7'-8"	3'-2"	2.15 118
52°30'	3	5	3	5	8	9'-0"	6'-11"	2'-2"	1.95 112
60°	3	4	3	4	7	7'-10"	6'-2"	2'-2"	1.75 99
67°30'	3	3	3	3	6	7'-0"	5'-8"	2'-2"	1.61 88

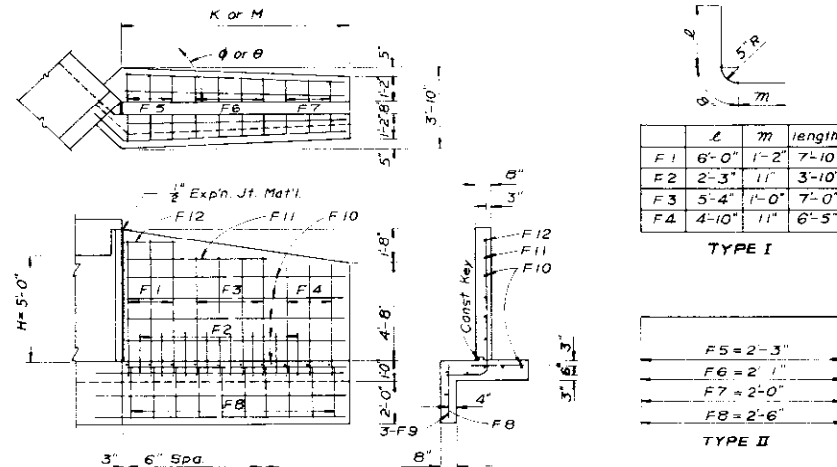
WING DETAIL WHEN H=4'-0"



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

When ϕ or θ equals	H1	H2	H3	H4	H5	3-H6	5-H7	1-H8	One Wing
22°30'	6	5	6	5	11	13'-2"	10'-8"	5'-2"	2.47 131
30°	5	4	5	4	9	10'-2"	8'-2"	4'-2"	1.91 104
37°30'	4	3	4	3	7	8'-4"	6'-8"	3'-2"	1.57 82
45°	3	3	3	3	6	7'-1"	5'-8"	2'-2"	1.35 70
52°30'	3	3	3	3	6	7'-0"	5'-2"	2'-2"	1.23 68
60°	3	2	3	2	5	6'-2"	4'-8"	2'-2"	1.12 59
67°30'	3	2	3	2	5	5'-4"	4'-2"	2'-2"	1.01 56

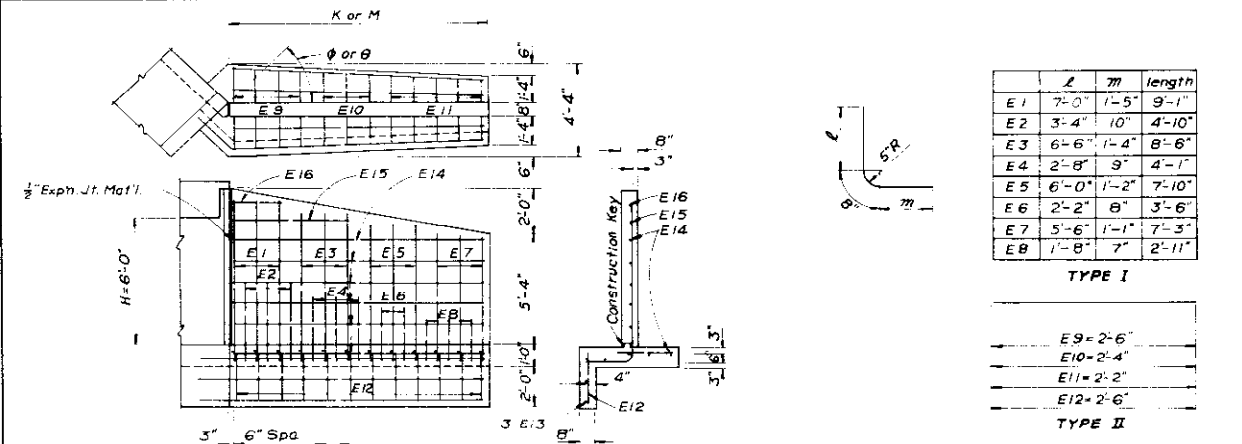
WING DETAIL WHEN H=3'-0"



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

When ϕ or θ equals	F1	F2	F3	F4	F5	F6	F7	F8	3-F9	8-F10	1-F11	1-F12	One Wing
22°30'	6	14	7	5	6	7	5	18	20'-11"	17'-8"	12'-2"	5'-2"	5.61 328
30°	5	11	5	4	5	5	4	14	16'-2"	13'-8"	9'-2"	4'-2"	4.36 254
37°30'	4	9	4	4	4	4	4	12	13'-3"	11'-2"	7'-2"	3'-2"	3.98 211
45°	3	8	4	3	3	4	3	10	11'-6"	9'-8"	6'-2"	2'-2"	3.11 180
52°30'	3	7	3	3	3	3	3	9	10'-8"	8'-5"	5'-2"	2'-2"	2.72 160
60°	3	6	2	3	3	2	3	8	9'-6"	7'-8"	4'-2"	2'-2"	2.49 143
67°30'	3	6	3	2	3	3	2	8	8'-7"	7'-2"	5'-2"	2'-2"	2.33 140

WING DETAIL WHEN H=5'-0"



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

When ϕ or θ equals	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	3-E13	9-E14	1-E15	1-E16	One Wing
22°30'	6	5	5	5	5	5	5	5	6	7	8	21	24'-3"	20'-8"	10'-2"	5'-2"	7.30 430
30°	4	4	4	4	4	4	4	4	5	5	6	16	18'-5"	15'-8"	7'-2"	3'-2"	5.56 326
37°30'	4	3	3	3	3	3	3	3	4	4	5	14	15'-3"	12'-11"	6'-2"	3'-2"	4.60 278
45°	3	3	3	3	3	3	3	3	4	3	5	12	13'-2"	11'-2"	5'-2"	2'-2"	3.99 240
52°30'	3	2	2	2	2	2	2	2	3	3	4	10	12'-1"	9'-8"	4'-2"	2'-2"	3.47 202
60°	3	2	2	2	2	2	2	2	3	3	3	9	10'-10"	8'-11"	4'-2"	2'-2"	3.21 194
67°30'	3	2	2	2	2	2	2	2	3	3	3	9	9'-11"	8'-5"	4'-2"	2'-2"	3.04 180

WING DETAIL WHEN H=6'-0"

LOADING DATA INTERSTATE ALTERNATE
LIVE LOAD: A.A.S.H.O. (HS 20-44)
DEAD LOAD: CONCRETE 150 POUNDS PER CUBIC FOOT
EARTH 84 POUNDS PER CUBIC FOOT
DESIGNING DATA
A.A.S.H.O. 1953 UNIT STRESS EXCEPT AS NOTED
Reinforcing Steel fs 20,000 lbs. per sq. in.
Structural Steel fs 18,000 lbs. per sq. in.
fc 1200 lbs. per sq. in.
n 10

GENERAL NOTES

ALL WORK SHALL BE DONE ACCORDING TO THE STANDARD SPECIFICATIONS APPLICABLE TO THE PROJECT.

ALL CONCRETE SHALL BE CLASS "A".
ALL WING SURFACES TO RECEIVE CLASS 1 FINISH.
WING FOOTINGS & FLOOR OF BOX SHALL BE POURED MONOLITHICALLY.
FOOTINGS IN ROCK SHALL BE POURED OUT TO ROCK AND NOT FORMED.
SOUNDING 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 RE-DESIGN IS NECESSARY.
ALL REINFORCING STEEL SHALL BE INTERMEDIATE GRADE STEEL OF A DEFORMED TYPE. EACH BAR SHALL BE TAGGED WITH THE NUMBER DESIGNATION AND THE STATION NUMBER OF THE PROJECT. SECONDARY BARS WHEN SPICED SHALL LAP IT DIAMETERS OF THE BAR. DIMENSIONS FOR REINFORCING STEEL NOT SHOWN AS CLEAR SHALL BE TO THE CENTER LINE OF THE BAR. OUT TO OUT DIMENSIONS SHALL BE USED ON BAR BENDING DETAILS.
SUPPORTING SOILS FOR ALL CULVERTS MUST BE COMPOSED OF FIRM AND UNIFORM MATERIAL THROUGHOUT. HORIZONTAL CONSTRUCTION KEYS ARE NOT REQUIRED WHEN FOOTING AND WALL ARE POURED MONOLITHICALLY. ALL CONSTRUCTION KEYS SHOWN BETWEEN FOOTINGS AND WALLS ARE 3" X 3".

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

(R-1) WHEN EXCAVATING FOR FOOTINGS THE FINAL SURFACE ELEVATION SHALL BE UNDISTURBED NATURAL OR COMPACTED SOIL.

STRUCTURE NO.

REVISIONS		
No.	General Note	M.R.H.
1	7-17-67	

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
WINGWALLS FOR
CONCRETE BOX CULVERTS
4:1 SIDE SLOPES

Across Sta. Sec. T. R.
Near
Designed by D.P. Approved by J.M. B.L.S.
Made by J.M. B.L.S. Bridge Engineer
Checked by J.M. B.L.S. Date: July 1, 1965

STANDARD M-60I-C
(SHEET 2)
(JULY 1, 1965)

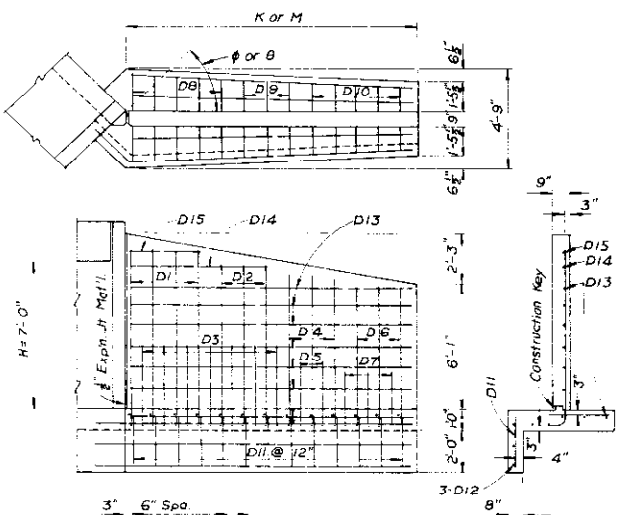
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

TABLE SHOWING VALUES OF K & M WHEN θ & H ARE GIVEN

A	α	ϕ	A	H=7'-0"		H=8'-0"		H=9'-0"		H=10'-0"	
				K	M	K	M	K	M	K	M
45°	45°	67°30'	22°30'	10'-0"	23'-9"	11'-0"	26'-9"	12'-3"	29'-6"	13'-6"	32'-3"
60°	30°	60°	30°	10'-6"	18'-3"	11'-9"	20'-6"	13'-0"	23'-9"	14'-3"	24'-9"
75°	15°	52°30'	37°30'	11'-6"	15'-0"	13'-0"	16'-9"	14'-3"	18'-6"	15'-9"	20'-3"
90°	0°	45°	45°	13'-0"	13'-0"	14'-6"	14'-6"	16'-0"	16'-0"	17'-6"	17'-6"
105°	15°	37°30'	52°30'	15'-0"	11'-6"	16'-9"	13'-0"	18'-6"	14'-3"	20'-3"	15'-9"
120°	30°	30°	60°	18'-3"	10'-6"	20'-6"	11'-9"	23'-9"	13'-0"	24'-9"	14'-3"
135°	45°	22°30'	67°30'	23'-9"	10'-0"	26'-9"	11'-0"	29'-6"	12'-3"	32'-3"	13'-6"

θ equals the angle between ϕ of culvert and ϕ of roadway, α equals the angle between ϕ of culvert and a normal to ϕ of roadway, ϕ and θ are angles between the wingwall and a line parallel with the ϕ of roadway.

EXAMPLE FOR USING THE ABOVE TABLE. Suppose a stream makes an angle of $\theta=65^\circ$ with ϕ of roadway, then, from the table, select the nearest angle $\theta=60^\circ$, then α, ϕ equal $50^\circ, 60^\circ$ respectively. If the desired height "H" of culvert is 8'-0", then "K" & "M" will be 11'-9" & 20'-6". Locate the WING DETAIL WHEN H=8'-0" on this sheet.



WING DETAIL WHEN H=7'-0"

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

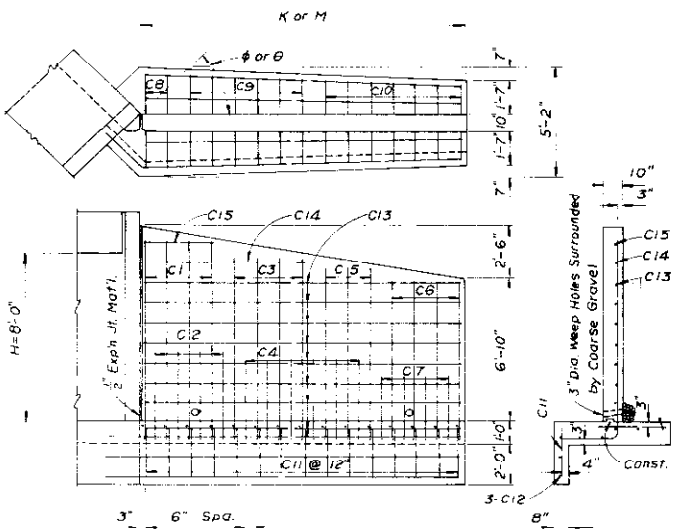
TYPE I

D8=2'-8"
D9=2'-6"
D10=2'-4"
D11=2'-6"

TYPE II

When θ or ϕ equals	Number of bars required											Length of bars				quantities for One Wing	
	D1 $\frac{1}{2}\phi$ Type I	D2 $\frac{1}{2}\phi$ Type I	D3 $\frac{3}{4}\phi$ Type I	D4 $\frac{1}{2}\phi$ Type I	D5 $\frac{1}{2}\phi$ Type I	D6 $\frac{1}{2}\phi$ Type I	D7 $\frac{1}{2}\phi$ Type I	D8 $\frac{1}{2}\phi$ Type II	D9 $\frac{1}{2}\phi$ Type II	D10 $\frac{1}{2}\phi$ Type II	D11 $\frac{1}{2}\phi$ Type II	3-D12 $\frac{1}{2}\phi$ Type II	1-D13 $\frac{1}{2}\phi$ Type II	1-D14 $\frac{1}{2}\phi$ Type II	1-D15 $\frac{1}{2}\phi$ Type II	Concrete Cu.Yd.	Steel Lb.
22°30'	7	6	12	6	6	5	5	8	7	9	24	27'-4"	23'-5"	12'-2"	6'-2"	9.62	592
30°	5	5	9	5	5	4	4	6	6	7	19	20'-11"	17'-11"	9'-2"	4'-2"	7.39	457
37°30'	4	4	8	4	3	3	3	5	5	5	15	17'-2"	14'-8"	7'-2"	3'-2"	6.07	368
45°	4	3	7	3	2	2	2	5	5	5	13	14'-10"	12'-8"	6'-2"	3'-2"	5.26	321
52°30'	3	3	6	3	2	2	2	4	4	4	12	13'-10"	11'-2"	5'-2"	2'-2"	4.66	287
60°	3	3	5	3	2	2	2	4	3	4	11	12'-3"	10'-2"	5'-2"	2'-2"	4.25	262
67°30'	3	3	5	2	2	2	2	4	3	3	10	11'-4"	9'-8"	5'-2"	2'-2"	4.05	245

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



WING DETAIL WHEN H=8'-0"

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

TYPE I

C8=3'-0"
C9=2'-9"
C10=2'-6"
C11=2'-6"

TYPE II

When θ or ϕ equals	Number of bars required										Length of bars				Quantities for One Wing	
	A1 $\frac{1}{2}\phi$ Type I	A2 $\frac{1}{2}\phi$ Type I	A3 $\frac{3}{8}\phi$ Type I	A4 $\frac{3}{8}\phi$ Type I	A5 $\frac{1}{2}\phi$ Type I	A6 $\frac{1}{2}\phi$ Type I	A7 $\frac{3}{8}\phi$ Type II	A8 $\frac{3}{8}\phi$ Type II	A9 $\frac{1}{2}\phi$ Type II	A10 $\frac{1}{2}\phi$ Type II	3-A11 $\frac{3}{8}\phi$ Type II	13-A12 $\frac{1}{2}\phi$ Type II	1-A13 $\frac{1}{2}\phi$ Type II	1-A14 $\frac{1}{2}\phi$ Type II	Cu.Yd.	Lb.
22°30'	9	16	8	8	16	8	10	12	11	33	36'-10"	31'-11"	16'-2"	8'-2"	19.74	1224
30°	7	12	6	6	12	6	7	10	8	25	28'-2"	24'-5"	12'-2"	6'-2"	15.14	930
37°30'	6	10	5	5	10	5	6	8	7	21	23'-11"	19'-11"	10'-2"	5'-2"	12.39	775
45°	5	9	4	4	8	4	5	7	6	18	19'-9"	17'-2"	8'-2"	4'-2"	10.71	665
52°30'	5	8	3	3	7	4	5	6	5	16	18'-9"	15'-5"	7'-2"	4'-2"	9.63	597
60°	4	7	3	3	6	4	4	5	4	15	16'-6"	13'-11"	7'-2"	3'-2"	8.72	543
67°30'	4	7	3	3	6	3	4	5	4	14	15'-2"	13'-2"	6'-2"	3'-2"	8.26	515

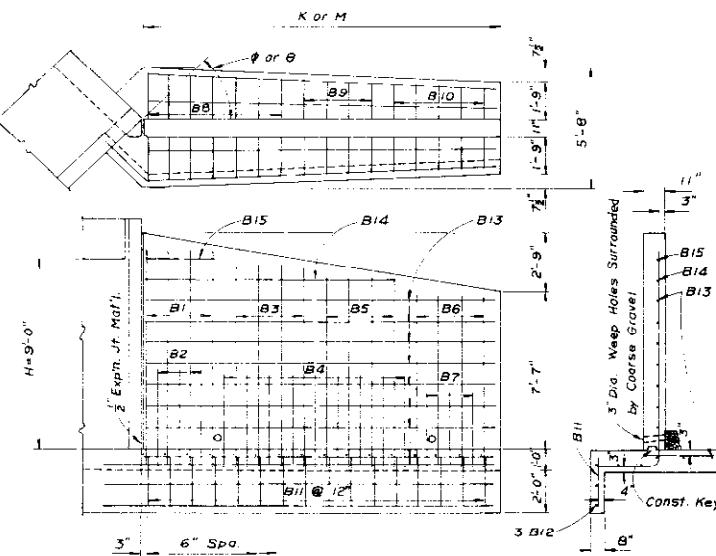
BAR LIST & QUANTITIES FOR ONE WING WHEN H=10'-0"

When θ or ϕ equals	Number of bars required											Length of bars					Quantities for	
	C1 $\frac{1}{8}" \phi$ Type I	C2 $\frac{1}{4}" \phi$ Type I	C3 $\frac{3}{8}" \phi$ Type I	C4 $\frac{1}{2}" \phi$ Type I	C5 $\frac{5}{8}" \phi$ Type I	C6 $\frac{3}{4}" \phi$ Type I	C7 $\frac{7}{8}" \phi$ Type I	C8 $1" \phi$ Type II	C9 $1\frac{1}{8}" \phi$ Type II	C10 $1\frac{1}{4}" \phi$ Type II	C11 $1\frac{3}{8}" \phi$ Type II	3-C12 Type II	2-C13 Type II	1-C14 $1\frac{1}{2}" \phi$ Type II	1-C15 $1\frac{3}{4}" \phi$ Type II	One Cu.Yd.	Wing Steel Lb.	
22°30'	8	7	6	12	6	7	7	5	10	12	27	30'-8"	26'-5"	13'-2"	7'-2"	12.53	779	
30°	6	5	5	10	4	6	5	4	7	10	21	23'-5"	20'-2"	10'-2"	5'-2"	9.60	601	
37°30'	5	4	4	8	4	4	4	3	6	8	17	19'-11"	16'-5"	8'-2"	4'-2"	7.84	487	
45°	4	4	4	6	3	4	4	2	6	7	15	16'-6"	14'-2"	7'-2"	3'-2"	6.79	424	
52°30'	4	3	3	6	3	3	3	2	5	6	13	15'-6"	12'-8"	6'-2"	3'-2"	6.08	374	
60°	4	3	2	6	3	3	2	2	4	6	12	13'-8"	11'-5"	5'-2"	3'-2"	5.50	341	
67°30'	3	3	3	5	2	3	2	2	4	5	11	12'-5"	10'-8"	5'-2"	2'-2"	5.15	315	

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

When ϕ or θ equals	Number of bars required											Length of bars					Quantities for	
	B_1 $\frac{1}{2} \phi$	B_2 $\frac{2}{3} \phi$	B_3 $\frac{3}{4} \phi$	B_4 $\frac{4}{5} \phi$	B_5 $\frac{5}{6} \phi$	B_6 $\frac{2}{3} \phi$	B_7 $\frac{1}{2} \phi$	B_8 $\frac{3}{4} \phi$	B_9 $\frac{1}{2} \phi$	B_{10} $\frac{1}{2} \phi$	B_{11} $\frac{1}{2} \phi$	3-B12	1-B13	1-B14	1-B15	One	Wing	
	Type I	Type I	Type I	Type I	Type I	Type I	Type I	Type II	Type II	Type II	Type II	Type II	Type II	Type II	Type II	Type II	Concrete Cu.Yd.	Steel Lb.
22°30'	7	6	8	16	8	7	7	13	8	9	30	33'-9"	29'-2"	22'-2"	6'-2"	15.93	930	
30°	5	5	7	13	6	6	5	10	7	7	24	27'-0"	23'-5"	17'-2"	4'-2"	12.82	742	
37°30'	4	4	5	10	5	5	4	8	5	6	19	21'-11"	18'-2"	13'-2"	3'-2"	9.98	580	
45°	4	3	4	9	4	4	3	7	4	5	16	18'-2"	15'-8"	11'-2"	3'-2"	8.63	495	
52°30'	3	3	4	8	4	4	3	6	4	5	15	17'-0"	13'-11"	10'-2"	2'-2"	7.69	453	
60°	3	3	4	7	3	3	2	6	3	4	13	15'-11"	12'-8"	9'-2"	2'-2"	7.01	406	
67°30'	3	2	3	7	4	3	3	5	3	5	13	13'-9"	11'-11"	9'-2"	2'-2"	6.61	385	

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



WING DETAIL WHEN H=9'-0"

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

TYPE I

B8=3'-3"
B9=2'-9"
B10=2'-7"
B11=2'-6"

TYPE II

REVISIONS			

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

WINGWALLS FOR
CONCRETE BOX CULVERTS
4:1 SIDE SLOPES

Across Sta. Sec. T. R.

Designed by J. C. P. Approved by J. M. S. *J. M. S.*
Made by J. M. S. Bridge Engineer
Checked by J. M. S. Date: July 1, 1965

STANDARD M-603-M
(MARCH 20, 1967)

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

FILL HEIGHT AND GAGE TABLES FOR METAL CULVERT PIPE (RIVETED, WELDED OR HELICAL FABRICATION)

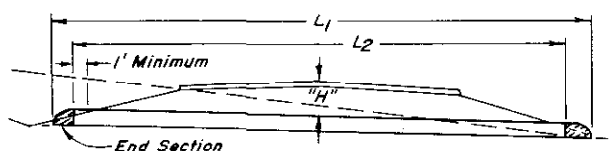
TABLE I
CORRUGATED STEEL PIPE
(2" x 1/2") OR (2-2/3" x 1/2") CORRUGATIONS

PIPE SIZE (B _g) Inches	AREA (Sq.Ft.)	HEIGHT OF FILL OVER TOP OF PIPE IN FEET															
		1 to 10	10+ to 15	15+ to 20	20+ to 25	25+ to 30	30+ to 35	35+ to 40	40+ to 45	45+ to 50	50+ to 55	55+ to 60	60+ to 70	70+ to 80	80+ to 90	90+ to 100	
G A G E																	
12	0.8	16	16	16	16	16	16	16	16	16	16	16	16	16	14	12	
15	1.2	16	16	16	16	16	16	16	16	16	16	16	16	14	12	10	
18	1.8	16	16	16	16	16	16	16	16	14	14	12	12	10	8		
24	3.1	16	16	16	16	16	14	12	10	10	8	----- See General Note.					
30	4.9	16	16	16	16	14	14	12	12	10	8						
36	7.1	16	16	16	16	14	12	10	8								
42	9.6	16	16	16	16	16	14	14	12								
48	12.6	16	16	16	16	14	14	12	8								
54	15.9	14	14	14	14	14	12	12	----- See General Note.								
60	19.6	12	12	12	12	12	12	10									8
66	23.8	12	12	12	12	10	10	8									
72	28.3	10	10	10	10	8											
78	33.0	8	8	8	8												
84	38.0	8	8	----- See General Note.													

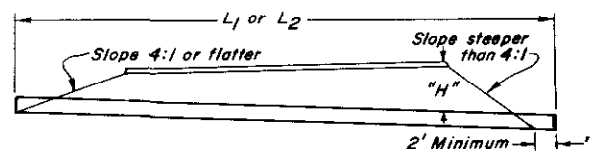
TABLE II
CORRUGATED STEEL PIPE ARCH
(2" x 1/2") OR (2-2/3" x 1/2") CORRUGATIONS

PIPE SIZE Span- Rise (Inches)	AREA (Sq. Ft.)	CORNER RADIUS (Inches)	HEIGHT OF FILL OVER TOP OF PIPE IN FEET					
			1.5 to 7	7+ to 8	8+ to 9	9+ to 10	10+ to 12	12+ to 13
			GAGE					
18 x 11	1.1	3 1/2	16	16	16	16	16	16
22 x 13	1.6	4	16	16	16	16	16	
25 x 16	2.2	4	16	16	16	16		
29 x 18	2.8	4 1/2	16	16	16	16		
36 x 22	4.4	5	16	16	16			
43 x 27	6.4	5 1/2	16					
50 x 31	8.7	6	14					
58 x 36	11.4	7	12					
65 x 40	14.3	8	12					
72 x 44	17.6	9	10					

METAL CULVERT WITH END SECTIONS



METAL CULVERT WITHOUT END SECTIONS



"H" = Maximum height of fill over top of Culvert, including pavement.

L₁ = Length of Culvert to be measured when placed in accordance with Section 617.

L₂ = Length of pipe to be measured when placed in accordance with Section 603.

TABLE III
CORRUGATED STEEL PIPE
RIVETED OR HELICAL FABRICATION 3" x 1" CORRUGATIONS

PIPE SIZE (B _g) Inches	AREA (Sq. Ft.)	HEIGHT OF FILL OVER TOP OF PIPE IN FEET															
		1 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55	55 to 60	60 to 70	70 to 80			
36	7.1	16	16	16	16	16	14	12	12	12	12	10	8				
42	9.6	16	16	16	16	14	14	12	12	12	12	8					
48	12.6	16	16	16	14	14	12	12	12	10	8						
54	15.9	16	16	14	14	12	12	10	8								
60	19.6	16	16	14	12	12	10										
66	23.8	16	16	14	12	12	10										
72	28.3	16	16	14	12	12	10										
78	33.0	16	16	14	12	10	8										
84	38.0	14	14	12	12												
90	44.0	14	14	12	12												
96	50.3	12	12	12	12	10											
102	57.0	12	12	12	12												
108	64.0	12	12	12	10												
114	70.9	10	10	10	8												
120	78.6	10	10	10	8												

5/16" rivets or helical fabrication shall be used on pipes with gages to the left of or above the heavy solid line.

3/8" rivets or helical fabrication shall be used on pipes with gages to the right of or below the heavy solid line.

TABLE IV
CORRUGATED STEEL PIPE
* SPOT WELDED OR BOLTED (1/2" ASTM A 325 BOLTS) FABRICATION 3" x 1" CORRUGATIONS

PIPE SIZE (B _g) Inches	AREA (Sq.Ft.)	HEIGHT OF FILL OVER TOP OF PIPE IN FEET															
		1 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55	55 to 60	60 to 70	70 to 80	80 to 90	90 to 100	
GAGE																	
36	7.1	16	16	16	16	16	16	14	14	14	12	12	12	12	10		
42	9.6	16	16	16	16	16	16	14	14	12	12	12	10	8			
48	12.6	16	16	16	16	16	14	14	14	12	12	12	10	8			
54	15.9	16	16	16	16	16	14	14	12	12	10	10					
60	19.6	16	16	16	16	14	14	12	12	10	8						
66	23.8	16	16	16	14	14	12	12	10	8							
72	28.3	16	16	16	14	14	12	12	10								
78	33.0	16	16	16	14	12	12	10	8								
84	38.0	14	14	14	14	12	12	10									
90	44.0	14	14	14	14	12	12	10									
96	50.3	12	12	12	12	12	10	8									
102	57.0	12	12	12	12	12	10	8									
108	64.0	12	12	12	12	12	10										
114	70.9	10	10	10	10	10	8										
120	78.6	10	10	10	10	10											

----- See General Note.

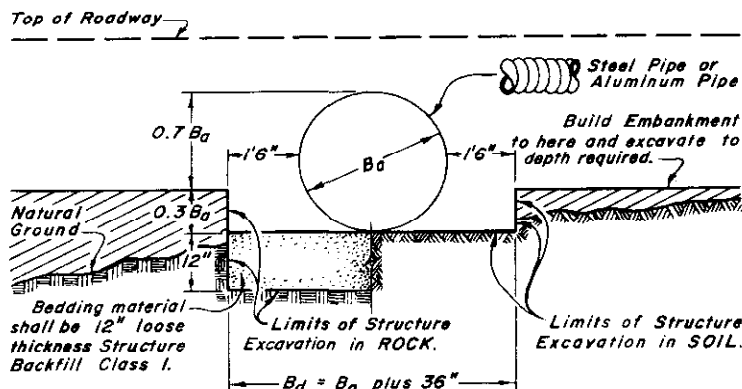
* 3/8" rivets may be used on pipes with gages to the left of or above the heavy solid line.

7/16" rivets may be used on pipes with gages to the right of or below the heavy solid line.

TABLE V
CORRUGATED STEEL PIPE ARCH 3" x 1" CORRUGATIONS

PIPE SIZE Span- Rise (Inches)	AREA (Sq.Ft.)	CORNER RADIUS (Inches)	HEIGHT OF FILL OVER TOP OF PIPE IN FEET				
			1.5 to 10	10+ to 11	11+ to 12	12+ to 14	14+ to 15
GAGE							
43 x 27	6.4	7 3/4	16	16	16		
50 x 31	8.7	9	16	16	16		
58 x 36	11.4	10 1/2	16	16	16		
65 x 40	14.3	12	16	16	16		
72 x 44	17.6	13 1/4	16	16	16		
73 x 55	22.0	18	16	16	16	16	16
81 x 59	26.0	18	14	14	14	14	14
87 x 63	31.0	18	14	14	14	14	
95 x 67	35.0	18	12	12	12		
103 x 71	41.0	18	12	12			
112 x 75	46.0	18	12				
117 x 79	52.0	18	12				
128 x 83	58.0	18	10				

INSTALLATION OF METAL CULVERT PIPE



NOTE: Spacing for multiple pipe installations shall conform to the details shown on M Standard for Excavation and Backfill for Structures.

GENERAL NOTES

- All work shall be done in accordance with the Standard Specifications applicable to the project.
- The tables on this sheet show minimum gages for structural requirements only. They are intended for use only where corrosive and/or abrasive conditions are negligible. Heavier gages and/or protective coatings shall be used where site investigations indicate corrosive and/or abrasive conditions.
- Gages shown are U.S. Standard and are minimum requirements for use with adequate bedding and backfill, in accordance with the Standard Specifications.
- Gages shown are for finished construction. During construction, adequate cover shall be provided to protect the structure from damage.
- The minimum depth of fill excluding pavement over corrugated metal pipe culverts shall be as stated by the Engineer but in no case shall it be less than shown in the following tabulation:
- | Diameter of Culvert (B _g) | Minimum Allowable Cover |
|---------------------------------------|-------------------------|
| 96" and smaller | 1 foot |
| 102" and larger | 2 feet |
| Pipe Arch | 1.5 feet |
- Structural plate pipes of equal or larger diameter, conforming to Section 510 of the Standard Specifications, may be substituted for the pipes shown on this sheet at no additional cost to the State.
- NOTES FOR TABLES
- Pipes with gages to the right of or below the heavy dashed line shown in the tables on this sheet, shall be elongated 5 percent on the vertical axis as installed. (Tables I, III, IV and VI)
- Maximum fill heights shown are for bearing pressures of 2 tons per square foot. (Tables II, V and VII)
- Fill heights greater than 90' shall be used only after thorough investigation of foundation material. (Tables I and IV)
- Variations from corner radii shown will be acceptable provided the pipe is of sufficient strength to support its designated fill height. (Tables II, V, and VII)

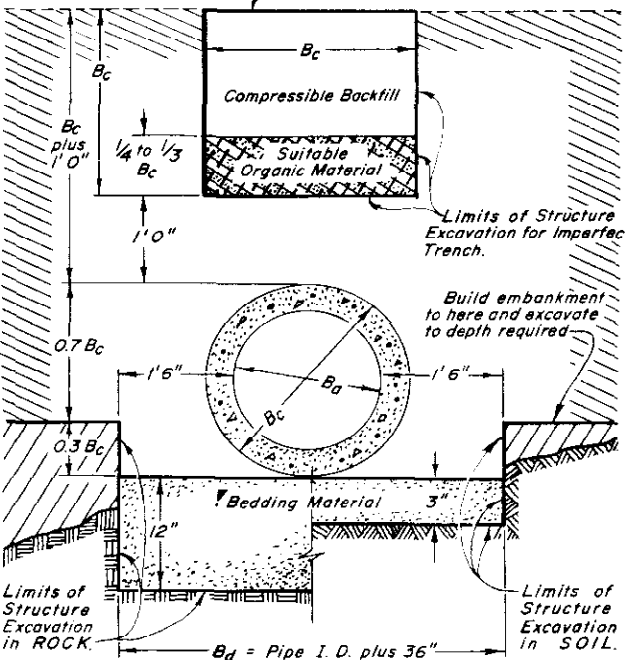
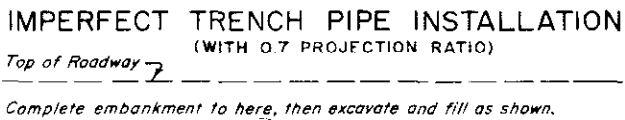
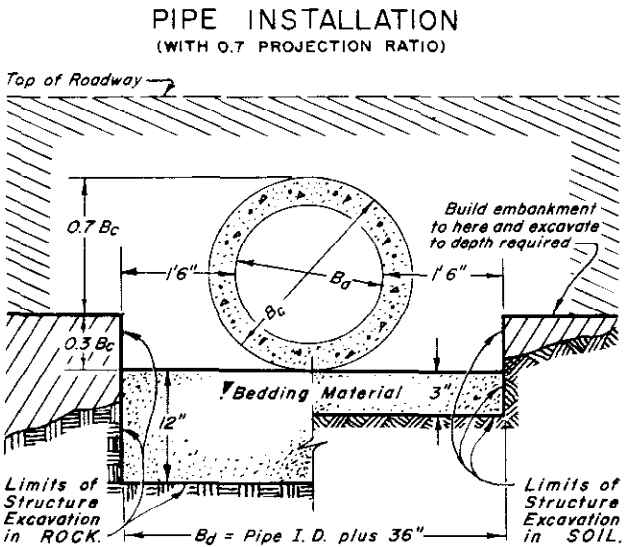
DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

METAL CULVERT PIPE
H-20 LOADING

Designed by M.R.H. Approved by
Made by J.R.B. Staff Design Engineer
Checked by R.S.M. Date:

STANDARD M-603-RC
(MARCH 20, 1967)

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



Bedding Material for SOIL shall be 3" loose thickness Structure Backfill Class 3.
Bedding Material for ROCK shall be 12" loose thickness Structure Backfill Class 1.

REINFORCED CONCRETE
PIPE DIMENSIONS
(FOR INFORMATION ONLY)

PIPE SIZE (In. I.D.) B_o	* WALL THICKNESS (Inches)	OUTSIDE DIAMETER (Feet) B_c	0.3 B_c (Feet)	0.7 B_c (Feet)
12	2	1.33	0.40	0.93
15	2-1/4	1.63	0.49	1.14
18	2-1/2	1.92	0.58	1.34
21	2-3/4	2.21	0.66	1.55
24	3	2.50	0.75	1.75
27	3-1/4	2.79	0.84	1.95
30	3-1/2	3.08	0.92	2.16
33	3-3/4	3.38	1.01	2.37
36	4	3.67	1.10	2.57
42	4-1/2	4.25	1.28	2.97
48	5	4.83	1.45	3.38
54	5-1/2	5.42	1.62	3.80
60	6	6.00	1.80	4.20
66	6-1/2	6.58	1.97	4.61
72	7	7.17	2.15	5.02
78	7-1/2	7.75	2.32	5.43
84	8	8.33	2.50	5.83
90	8-1/2	8.92	2.68	6.24
96	9	9.50	2.85	6.65
102	9-1/2	10.08	3.02	7.06
108	10	10.67	3.20	7.47

* Wall thickness dimensions are based on ASTM Designation C 76 (Wall B).

SAFE HEIGHTS OF FILL OVER
REINFORCED CONCRETE PIPE

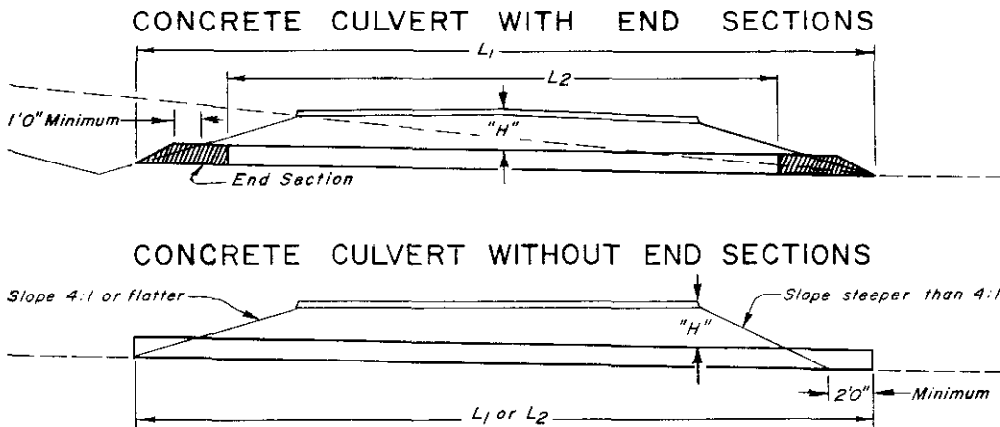
PIPE SIZE (In. I.D.) B_o	HEIGHT OF FILL OVER TOP OF PIPE IN FEET							
	CLASS II 1000 - D		CLASS III 1350 - D		CLASS IV 2000 - D		CLASS V 3000 - D	
Thru...	Min.	to	Min.	to	Min.	to	Min.	to
12	18	23	23	36	36	45	45	45
21	19	24	24	36	36	45	45	45
30	19	25	25	37	37	46	46	46
42	19	25	25	37	37	46	46	46
51	20	26	26	37	37	47	47	47
66	20	26	26	37	37	48	48	48
75	20	26	26	37	37	48	48	48
87	20	26	26	37	37	48	48	48

Pipe design is based on safety factor of 1.33 on ultimate strength. Pipe Class is designated at .01 inch crack D-load. (See ASTM Designation C 76.)

Safe heights of fill over top of pipe are based on unit weight of soil at 120 lbs. per cubic foot.

Changes in design factors will require compensating change in pipe design.

For Imperfect Trench, compute pipe class required as outlined in the Concrete Pipe Handbook prepared by the American Concrete Pipe Association (for other references with Iowa State College Theories).



"H" = Maximum height of fill over top of Culvert, including pavement.
 L_1 = Length of Culvert to be measured when placed in accordance with Section 617.
 L_2 = Length of Pipe to be measured when placed in accordance with Section 603.

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications applicable to the project.

Class II pipe shall not be used on main roadway but is permissible in medians, road approaches and other areas not subject to repeated traffic loads.

IMPERFECT TRENCH

Fill heights greater than maximum allowed in the Safe Heights of Fill Table on this sheet will require Imperfect Trench type of installation or special design of structure. If possible, use safe overfill and stronger pipe up to the limit shown on the Safe Heights of Fill Table.

Minimum cover excluding pavement shall be 1 foot.

Spacing for multiple pipe installations shall conform to the details shown on M Standard for Excavation and Backfill for Structures.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

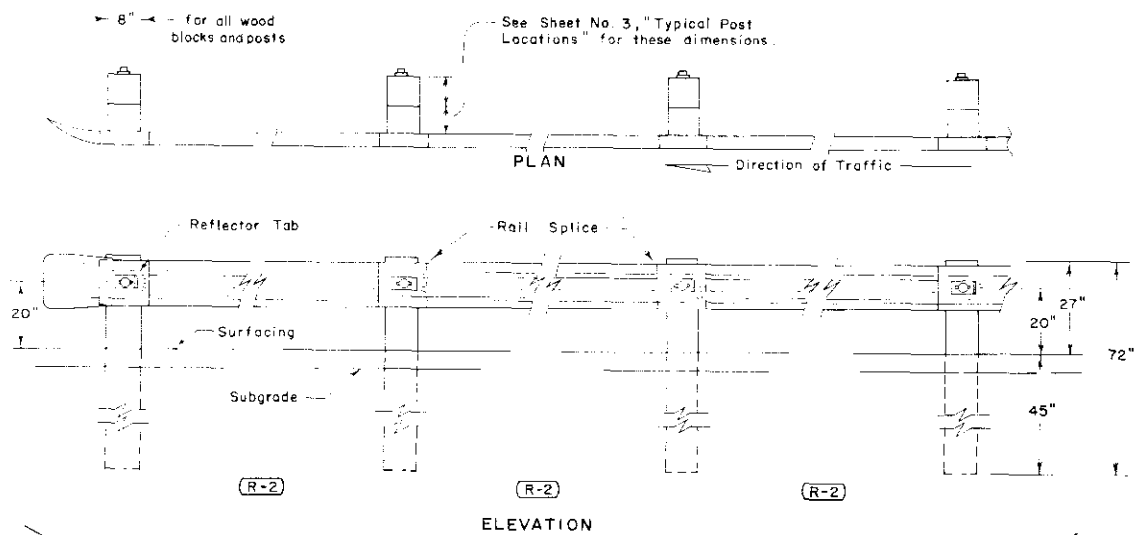
REINFORCED CONCRETE
PIPE

Designed by M. R. H. Approved by
Made by J. R. B. Staff Design Eng'r.
Checked by R. S. M. Date:

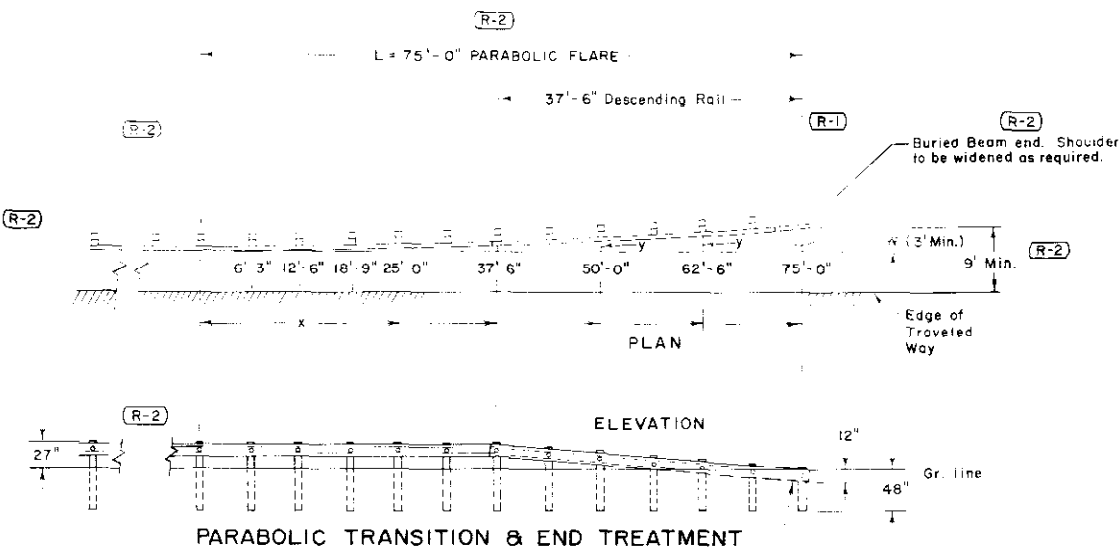
STANDARD M-606-AA
(MAY 26, 1967)
(SHEET 1 OF 3)

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

REVISIONS			
R-1	6-26-67	Added rail for 2-lane bridges	M.R.H.
R-2	8-1-67	Guard Rail at Bridges, Post Sp.	R.S.M.



TYPICAL GUARD RAIL FOR ROADWAYS



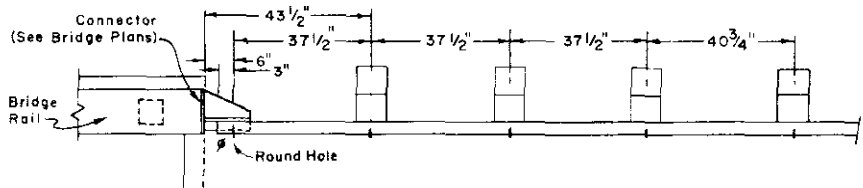
LEGEND
W = Full Parabolic Offset.
L = Length of Parabolic Transition.
x = Distance - $\bar{L}$'s of Posts, from $\bar{L}$ of first Post at beginning of Flare.
y = Offset at each Post. = $W \cdot \frac{x^2}{L^2}$

TABLE OF OFFSETS FOR 75' PARABOLIC FLARES							
x	W=3'	W=4'	W=5'	W=6'	W=7'	W=8'	
6'-3"	0.02	0.03	0.03	0.04	0.05	0.06	
12'-6"	0.08	0.11	0.14	0.17	0.19	0.22	
18'-9"	0.19	0.25	0.31	0.37	0.44	0.50	
25'-0"	0.33	0.44	0.56	0.67	0.78	0.89	
31'-3"	0.52	0.69	0.87	1.04	1.22	1.39	
37'-6"	0.75	1.00	1.25	1.50	1.75	2.00	
43'-9"	1.02	1.36	1.70	2.04	2.38	2.72	
50'-0"	1.33	1.78	2.22	2.67	3.11	3.56	
56'-3"	1.69	2.25	2.81	3.38	3.94	4.50	
62'-6"	2.08	2.78	3.47	4.17	4.86	5.56	
68'-9"	2.52	3.36	4.20	5.04	5.88	6.72	
75'-0"	3.00	4.00	5.00	6.00	7.00	8.00	

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications applicable to the project.
All timber shall be close grained Douglas Fir of the Coast Region, Dense Longleaf or Shortleaf Southern Pine, or Lodgepole Pine. Timber shall be free of heart centers and shall conform to Construction Grade, Paragraph 125 B of Standard No. 15 Grading and Dressing Rules of West Coast Douglas Fir (1956) or Dense Structural 5B and L Structural 5B, Paragraph 285 of 1956 Grading Rules for Southern Pine.
All timber shall be square edged, full sawn, and the tops of posts shall be beveled as shown. Blocks and posts shall be 8"x8" except that posts fabricated from Lodgepole Pine shall be 8"x10" (install with 8" face parallel to roadway center line).
Timber shall be incised and pressure treated with Grade I Creosote to a net retention of 8 pounds per cubic foot with a minimum penetration of $\frac{5}{8}$ of an inch, except that blocks need not be incised before treatment. All bolt holes are to be drilled $\frac{1}{16}$ inch larger than diameter of bolt before treatment is applied.
Posts shall be spaced at 6'-3" center to center except when otherwise designated by note or in the guardrail tabulation on the plans, and except for the first rail section adjacent to the bridge as shown hereon.
Where pedestrian hazards exist, sidewalks are to be constructed on the roadway shoulder. Guard rail shall be placed between the sidewalk and the edge of traffic lane.

Guard rail plate shall not be lighter than No. 12 U.S. Standard Gage. 25' long elements will be permitted.
Metal plate guard rail shall be painted in accordance with standard specifications.
Metal plate guard rail galvanized in accordance with AASHTO Designation M-111 or with Coating Class 2.50 of Table I of ASTM Designation A 525 may be furnished in lieu of painting requirements.
Standard galvanized wrought steel washers shall be used under all bolt heads or nuts coming in contact with wood posts.



NOTE: The first rail panel section shall require holes and additional posts as indicated.
Factory punch $\frac{3}{4}$ " hole in center of rail 3" from this end. Omit rail splice holes at this end.

* NOTE:
250' Over 60 mph.
200' Up to 60 mph.
Up to 60 mph. 125' Tangent
75' Flare
Over 60 mph. 175' Tangent
75' Flare

BRIDGE APPROACH GUARD RAIL

GUARD RAIL AT BRIDGES

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

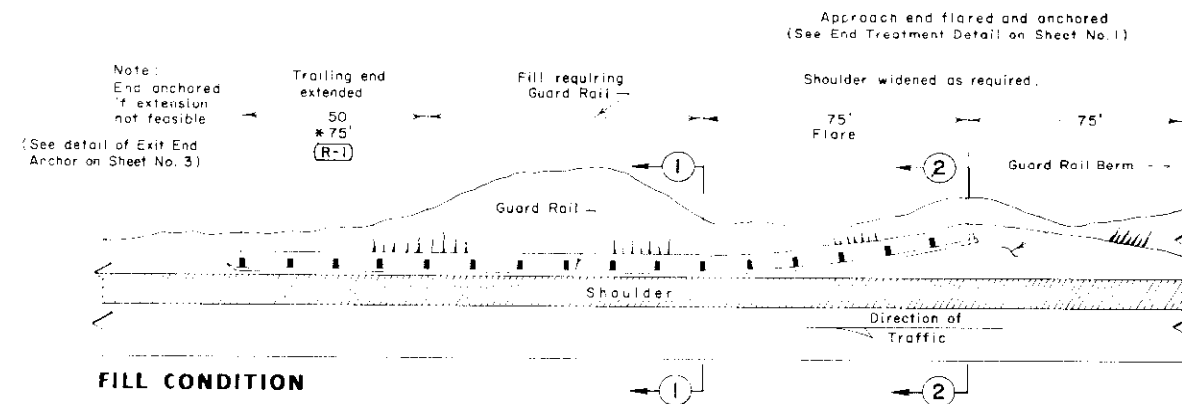
GUARD RAIL
TYPE 3

Designed by M.R.H. Approved by J.R.B.
Made by J.R.B. Staff Design Engineer
Checked by R.S.M. Date MAY 26, 1967

STANDARD M-606-AA

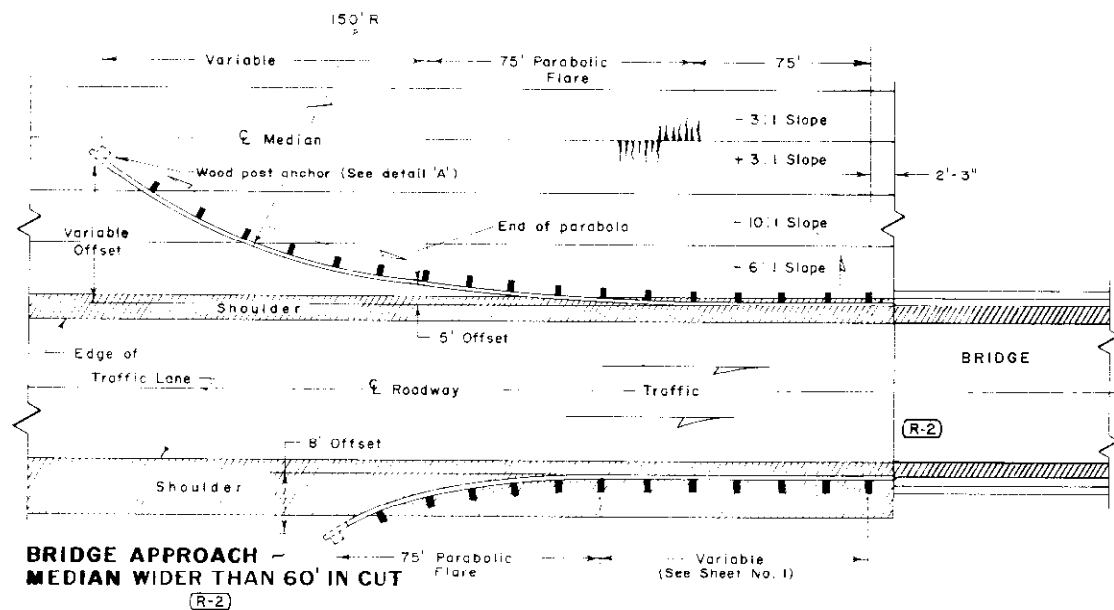
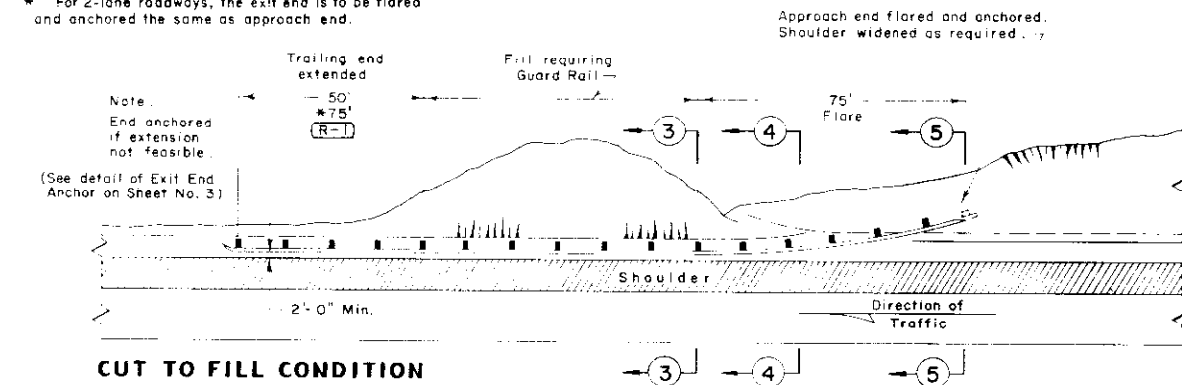
(MAY 26, 1967)
(SHEET 2)

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



(R-1) NOTE:

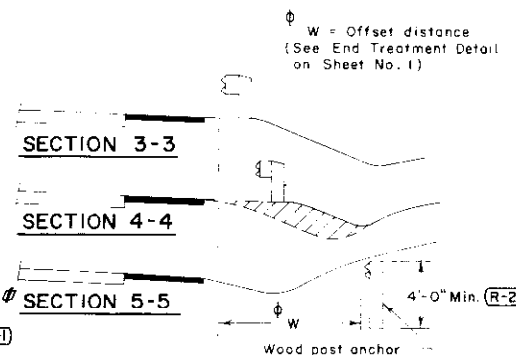
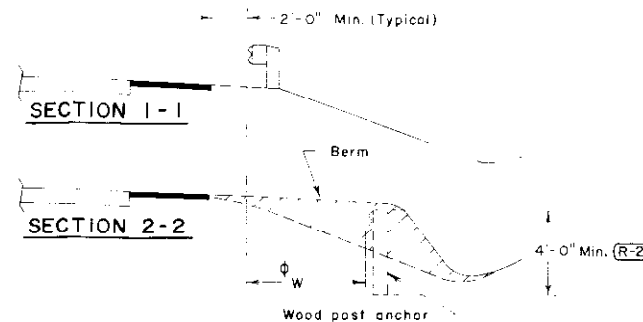
* For 2-lane roadways, the exit end is to be flared and anchored the same as approach end.



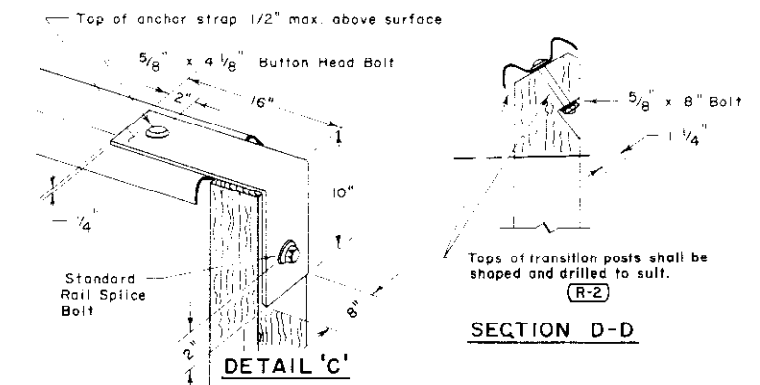
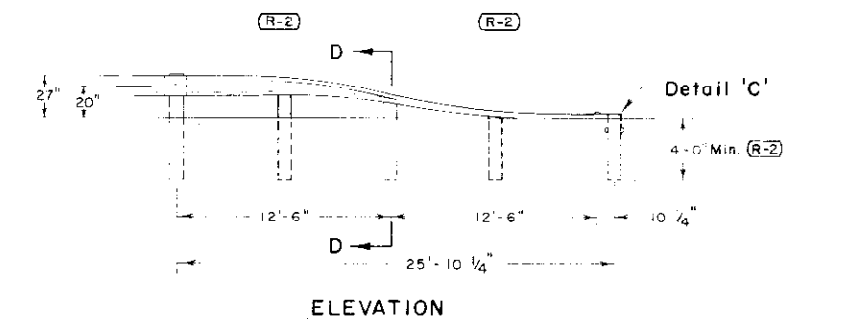
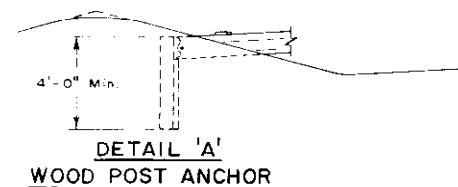
(R-2)

Medians wider than 60' in fill — Treat as separate roadways with Guard Rail on both sides.

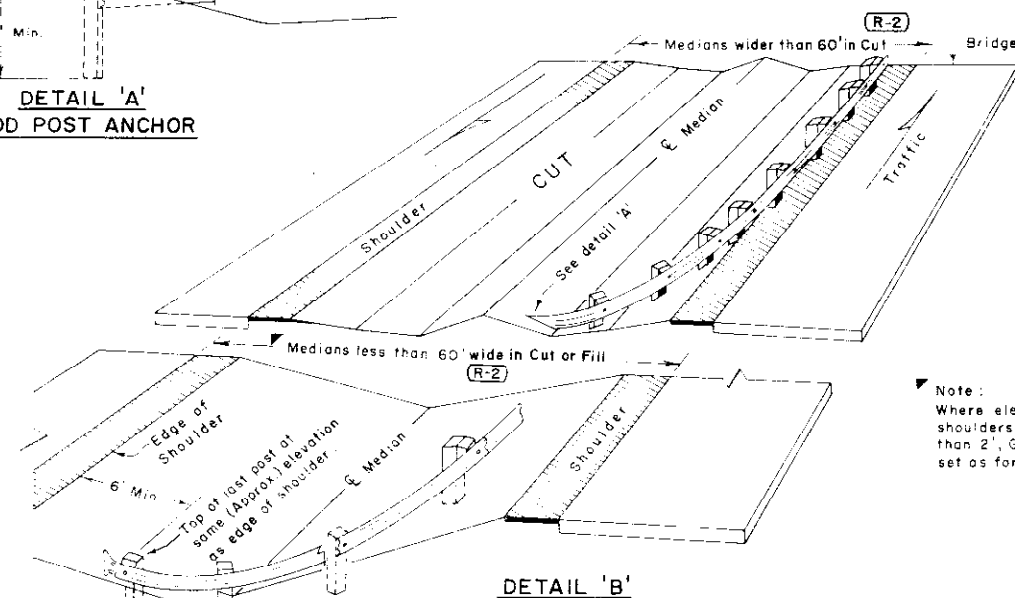
GUARD RAIL END TREATMENT



NOTE: Flare side ditch, as shown in Section 2-2 above, where practicable.



ALTERNATE END TREATMENT - 90° TWISTED BEAM



Note:
Where elevations of paved shoulders differ by more than 2', Guard Rail shall be set as for separate roadways.

REVISIONS			
(R-1)	6-26-67	Added note for 2-lane; Ditch flare.	M.R.H.
(R-2)	8-1-67	Bridge Approach, End Treatment	R.S.M.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

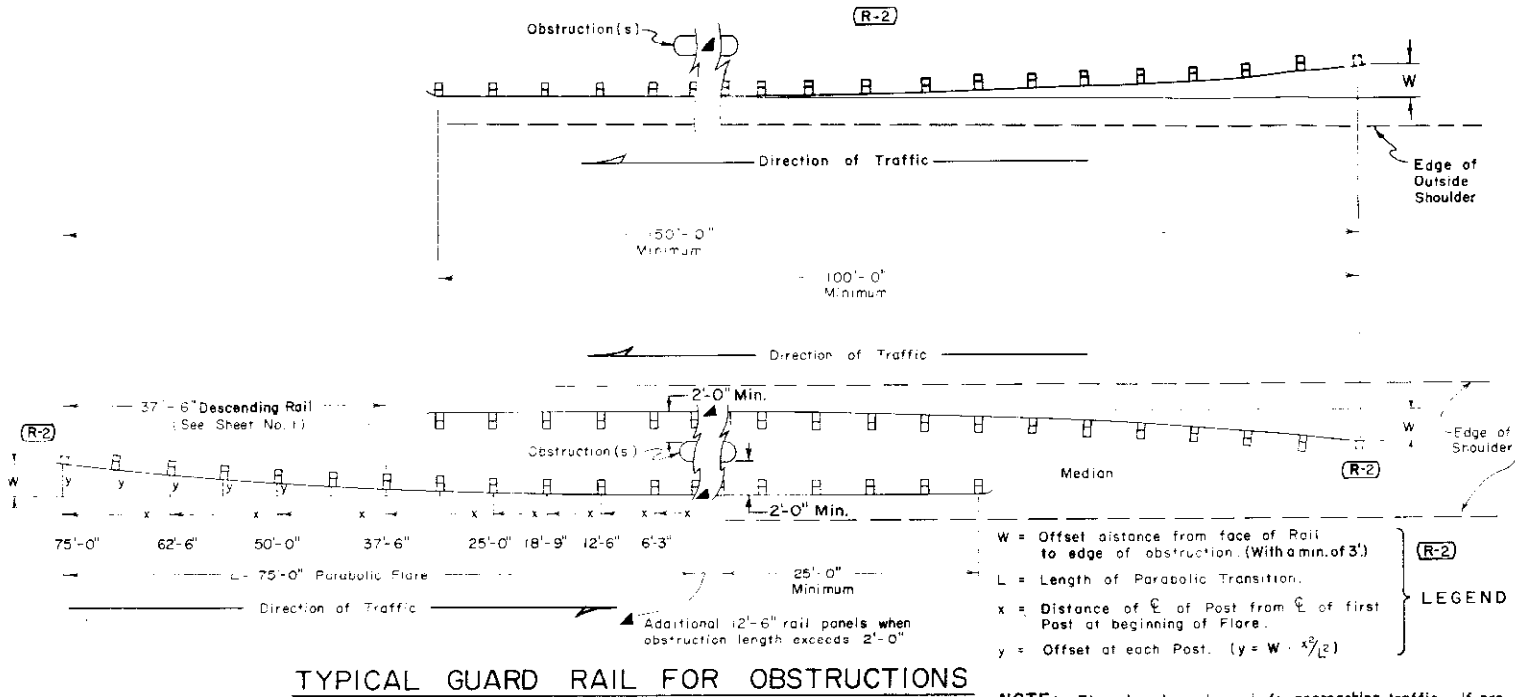
GUARD RAIL TYPE 3

Designed by M.R.H. Approved by R.S.M.
Made by R.R.B. Staff Design Engineer
Checked by R.S.M. Date: MAY 26, 1967

STANDARD M-606-AA
(MAY 26, 1967)
(SHEET 3)

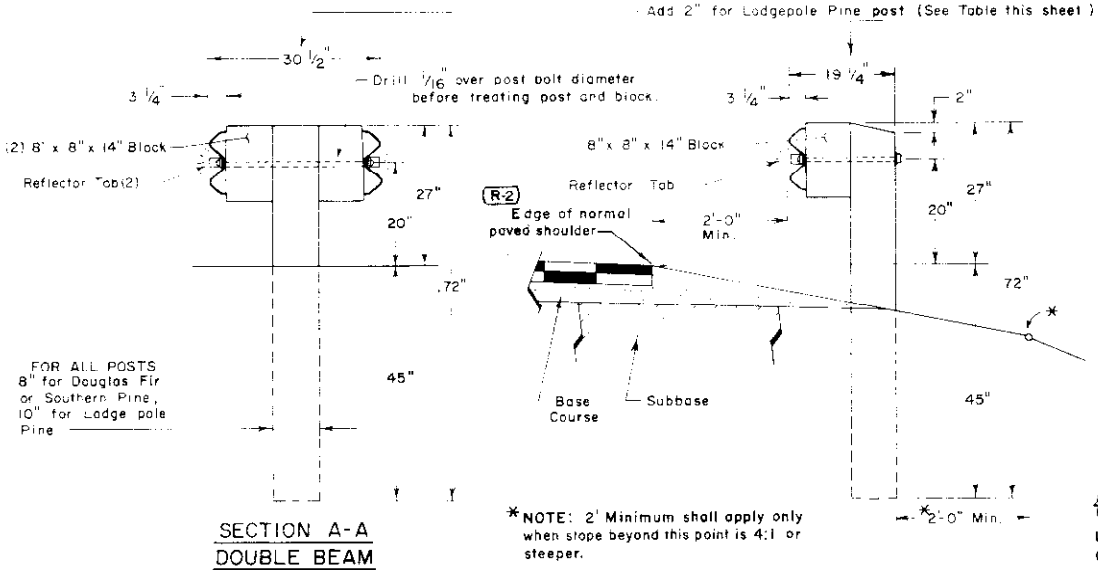
FEDERAL ROAD REG. NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO			

REVISIONS:
(R-2) 8-1-67 Guard Rail for Obstr. & Medians R.S.M.

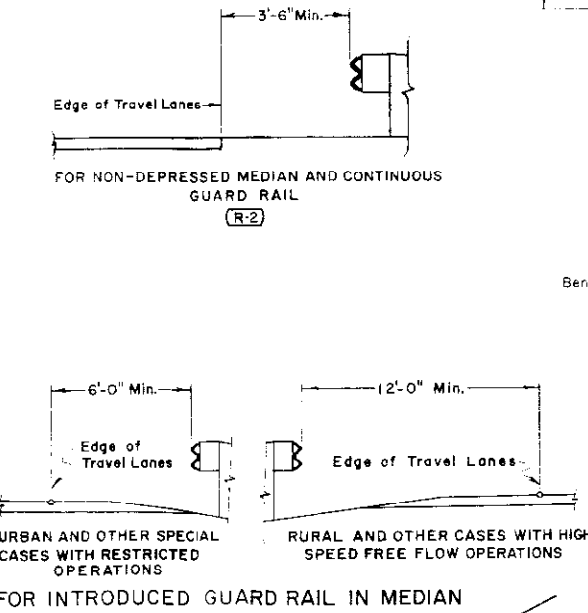


TYPICAL GUARD RAIL FOR OBSTRUCTIONS

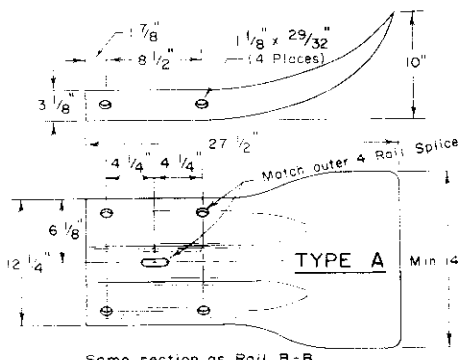
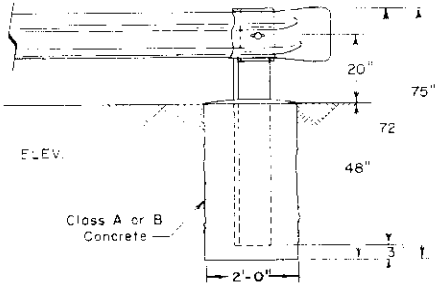
NOTE: Flared end as shown is for approaching traffic. If protection is for traffic from both directions, the 75-foot flare shall be on both ends.



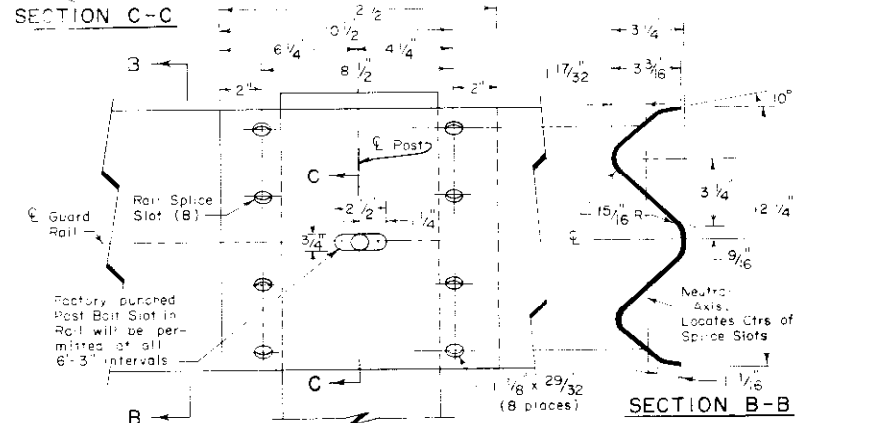
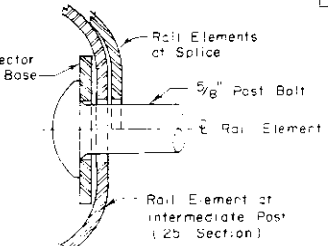
TYPICAL POST INSTALLATIONS



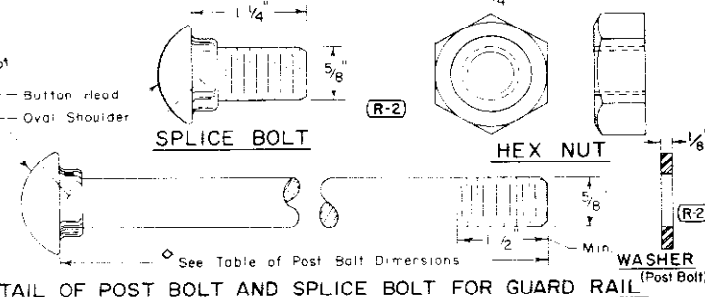
EXIT END ANCHOR (Concrete)



DETAILS OF TERMINAL SECTIONS



DETAIL OF RAIL SPLICE (Reflector Tab, Bolts Not Shown)



TYPE POST	BOLT SIZE
8" x 8" Double Rail	5/8" x 25 3/4"
8" x 8" Single Rail	5/8" x 17 1/2"
Lodgepole Pine	
8" x 10" Double Rail	5/8" x 27 3/4"
8" x 10" Single Rail	5/8" x 19 1/2"
Number Splice Bolts Required: 8 per Splice or 'B' Terminal, 4 per 'A' or 'C' Term.	

TABLE OF POST BOLT DIMENSIONS

INSTALLATION DETAILS OF REFLECTOR TAB

Reflector Tab shall be furnished and installed with Guard Rail.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

GUARD RAIL
TYPE 3

Designed by M.R.H.
Made by J.R.B. by R.S.M.
Checked by R.S.M.

Approved by J.R.B.
Staff Design Engineer
Date MAY 26, 1967

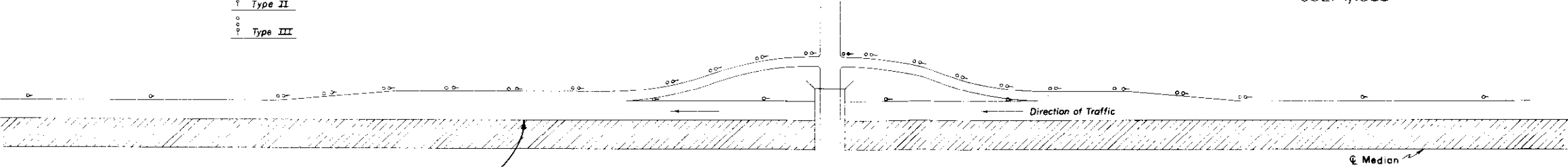
STANDARD M-612-C

(SHEET 1 OF 2 SHEETS)
JULY 1, 1965

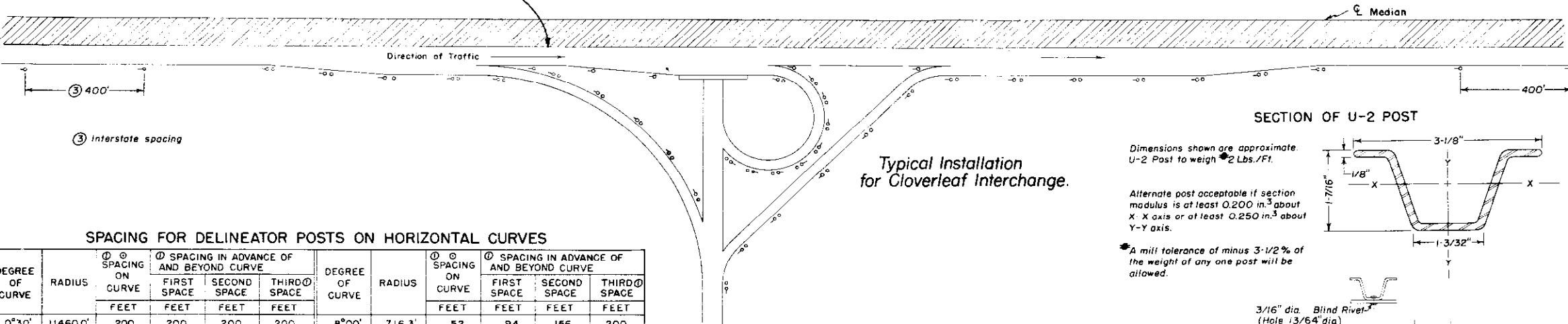
FED. ROAD REG. NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO		

REVISIONS	

Type I
Type II
Type III



EDGE OF PAVED SHOULDER
Typical Installation for Diamond Interchange.



Typical Installation for Cloverleaf Interchange.

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications 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 100' on Interstate and 200' on Primary and Secondary Projects. 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.

Type, location and spacing of delineators for tunnels and snow sheds shall be as directed by the Engineer.

Delineator Posts are not to be placed along Frontage Roads.

Color of Posts shall be Interstate Green.

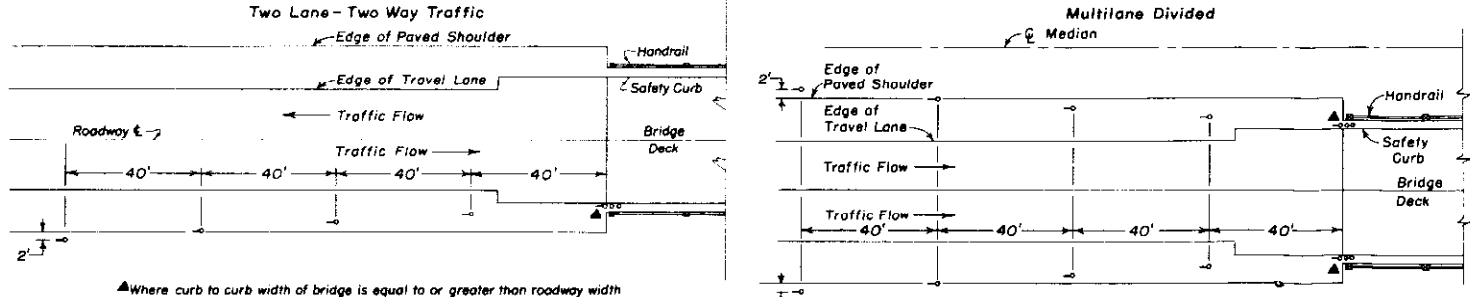
SPACING FOR DELINEATOR POSTS ON HORIZONTAL CURVES

DEGREE OF CURVE	RADIUS	① SPACING ON CURVE	② SPACING IN ADVANCE OF AND BEYOND CURVE			DEGREE OF CURVE	RADIUS	① SPACING ON CURVE	② SPACING IN ADVANCE OF AND BEYOND CURVE		
			FIRST SPACE	SECOND SPACE	THIRD SPACE				FIRST SPACE	SECOND SPACE	THIRD SPACE
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						

① S = 2 √ R - 50 1-ST. SPACE = 1.8 S 2-ND. SPACE = 3 S 3-RD. SPACE = 6 S
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. For curves less than 2 degrees on Interstate through roadways use Interstate tangent spacing.

Typical Installation at Bridge Approaches



▲ Where curb to curb width of bridge is equal to or greater than roadway width plus usable shoulder width, use this delineator only and omit all others.
Note: Where guard rail is present, place delineators outside of guard rail and at height which will permit clear view of all three Delineator buttons.

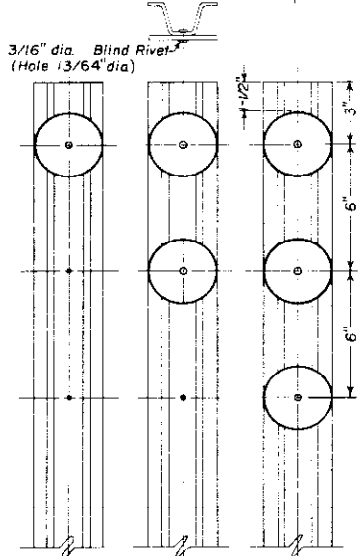
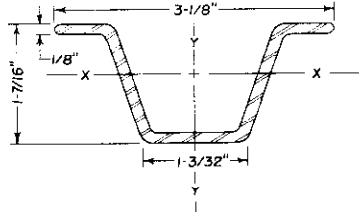
When approach slab has curb, place Type III delineator immediately behind curb.

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.

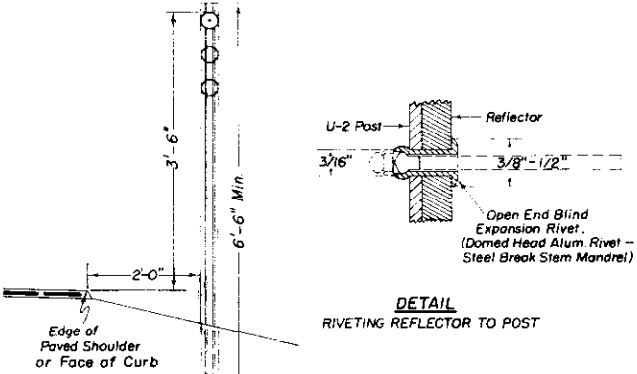


TYPE I
1-3" dia. Crystal Reflector on U-2 Post

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

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

Min. 3 holes in all posts required as shown.



DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DELINEATORS

Designed by CKM
Made by WNC
Checked by LEO

Approved by [Signature]
Staff Design Engr.
Date: July 1, 1965

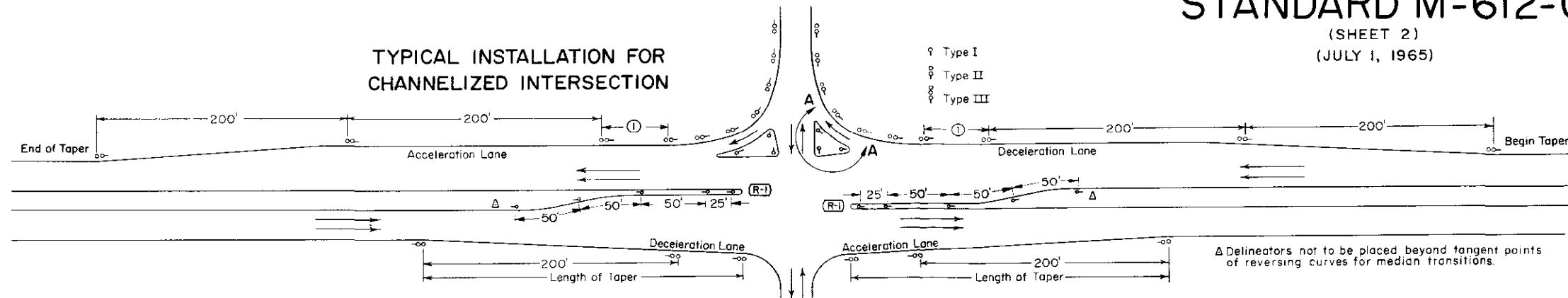
STANDARD M-612-C

(SHEET 2)
(JULY 1, 1965)

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

REVISIONS		
(R-1)	5-4-67	Median and Island Delineators
		M.R.H.

TYPICAL INSTALLATION FOR CHANNELIZED INTERSECTION



GENERAL NOTES

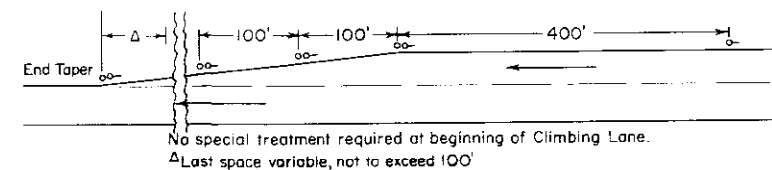
For Radii greater than 200 Feet, use spacing from Table included on Sheet 1 of this Standard.

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

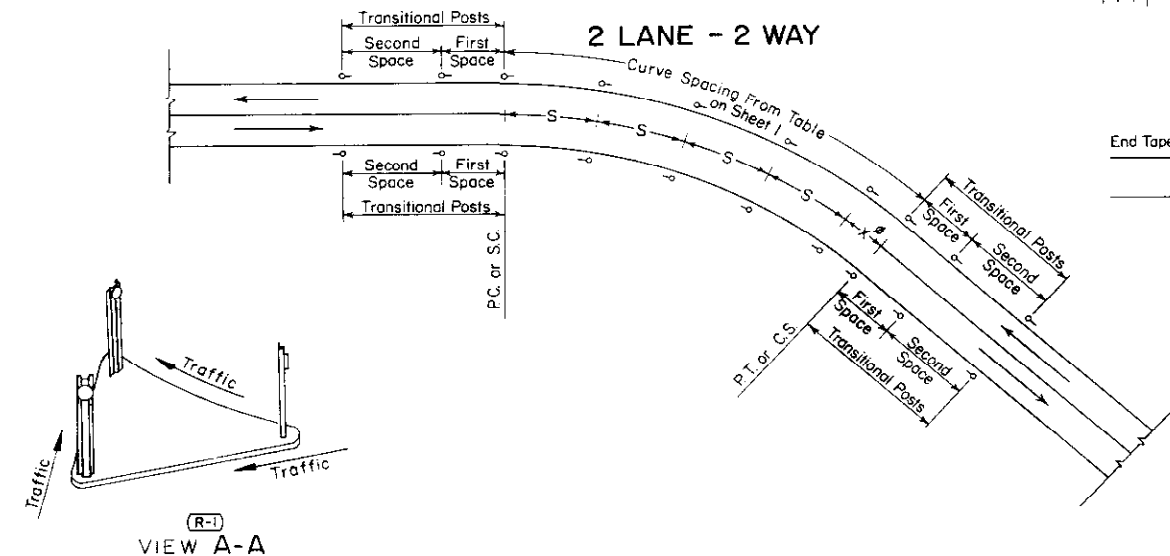
Place face of button at 90° to C of roadway.

Lengths of speed change lanes including tapers shall be as shown on plans.

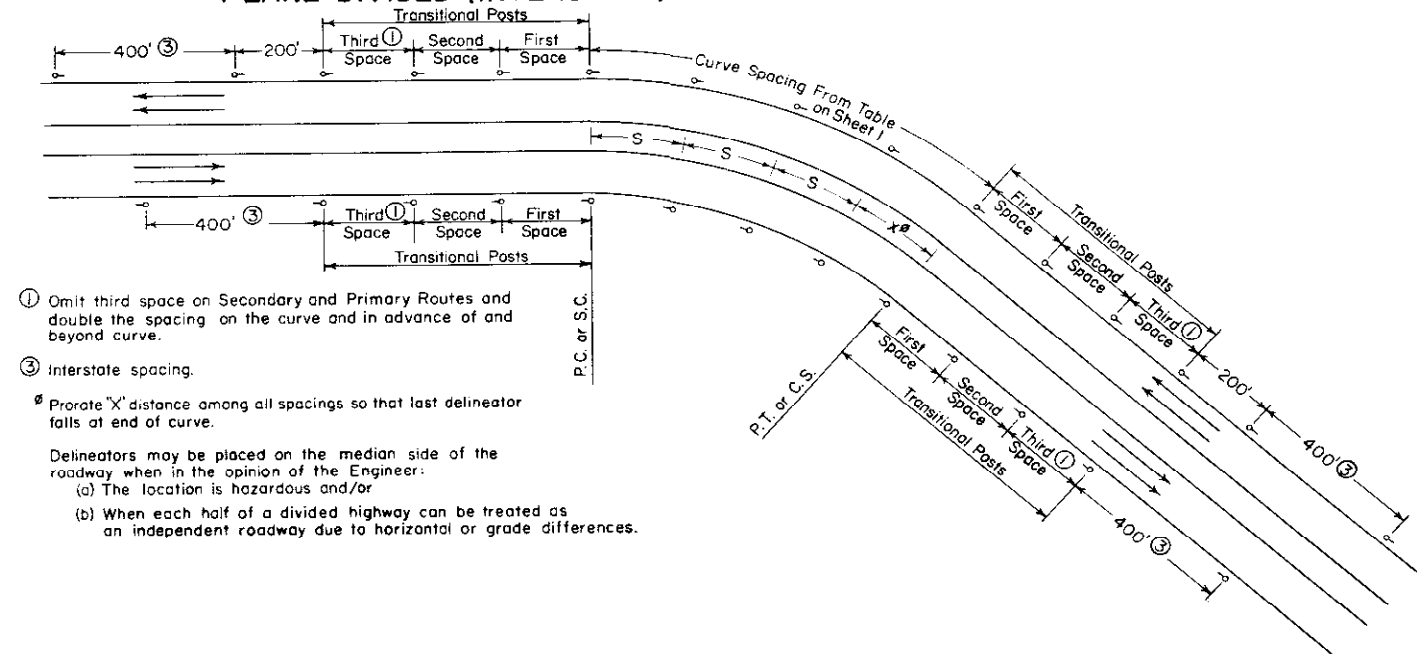
TYPICAL INSTALLATION FOR CLIMBING LANE TRANSITION



2 LANE - 2 WAY



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.

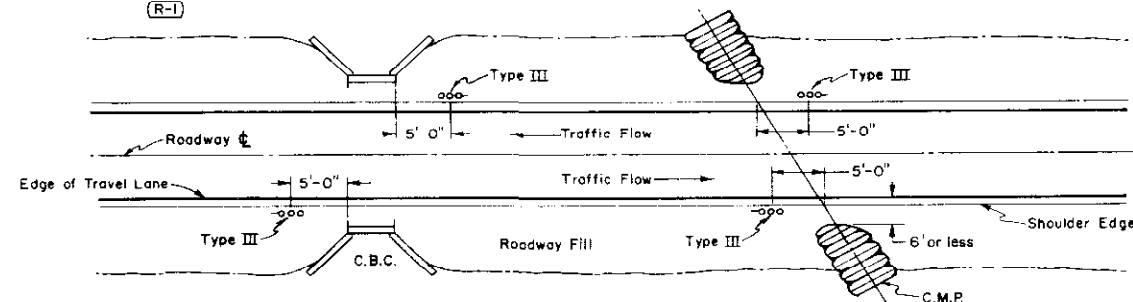
Prorate "X" distance among all spacings so that last delineator falls at end of curve.

Delineators may be placed on the median side of the roadway when in the opinion of the Engineer:

(a) The location is hazardous and/or

(b) When each half of a divided highway can be treated as an independent roadway due to horizontal or grade differences.

TYPE III DELINEATOR PLACEMENT AT HAZARDOUS MINOR STRUCTURES



Type III Delineators shall be placed as shown to mark hazardous ends of culverts and other minor structures. These structures are considered hazardous when the exposed barrel of the culvert or the roadway side of headwall or box is 6' or less from the edge of travel lane.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

DELINEATORS

Designed by C.K.M. Approved by J.E. Osuna
Made by T.E.F. Staff Design Engr.
Checked by L.E.O. Date: July 1, 1965

STANDARD M-614-A

(JULY 1, 1965)

FEDERAL ROAD REGION NO.	DISTRICT	PROJECT NO.	SHEET NO.
9	COLORADO		
REVISIONS			

GENERAL NOTES

- All work shall be done in accordance with the Standard Specifications applicable to the Project.
- All signs and sign materials shall conform to the standards set forth in the "Manual on Uniform Traffic Control Devices for All Classes of Streets and Highways" published by the Department of Highways and this standard.
- The various types and combinations of approved Signs and Beacons for Barricades required for each project shall be governed by field conditions and subject to approval by the Engineer. All traffic controls shall be placed for best visibility and legibility and maintained in good condition at all times. Oversigning is to be avoided.
- Painting shall conform with Subsection 508.08 of the Standard Specifications. All skids, braces, and posts shall be painted with 2 coats of "Exterior Black Paint." Planking and wings on all barricades shall be painted with 2 coats of "Exterior Black Paint" on all sides before adding reflective strips. Reflective strips shall be "cut from smooth surface yellow reflective sheeting" of a type approved by the Department.
- Each barricade rail shall be striped on the face side only with reflective yellow strips slanting downward at a 45° angle toward the side to which traffic is to turn or pass. See "DETAIL OF RAIL AND WING STRIPING."
- When barricades are designated on plans the portion of the posts below ground line shall either be dipped in or painted with hot creosote oil. The portion of the post above ground line shall be painted with 2 coats of "Exterior Black Paint."
- All skids, braces, and posts shall be nailed together with No. 20d nails. All screws, bolts, nuts, and washers shall be galvanized or cadmium plated. Skids (bases) of movable barricades shall be weighted where necessary to provide stability.
- All timber used shall conform to the Standard Specifications for Miscellaneous Untreated Timber S4S. Timber shall conform to Construction grade Paragraph 123B or 125B of Standard No. 15 Grading & Dressing Rule for West Coast Douglas Fir (1956) or Dense Structural 5B and LL Structural 5B Paragraph 284 or 285 of 1956 Grading Rules for Southern Pine.
- Detachable extension wings for bypassing of construction equipment are permitted. "W" is variable, length shall be adequate to provide closing of borrow pit and/or shoulder as required.
- Alternate materials or other reflective elements on Traffic signs or Barricades will be permitted only after approval of such material by the Department in writing.
- A Flashing Beacon for use on Barricades is a section of a standard traffic signal head or a similar-type device having a yellow lens in the face, which is illuminated by intermittent flashes. Where commercial power is not available, the beacon may be adapted to operate from storage batteries. Each signal unit lens shall have a visible diameter of not less than 8 inches. Each unit complete shall be of such design as to render the lens when illuminated clearly visible to traffic facing the signal at all distances up to 1000 feet under all atmospheric conditions except dense fog. The color of the yellow lens for caution shall be in accordance with Technical Report No. 1 of the Institute of Traffic Engineers. All beacon flashers shall be equipped with filters for suppression of radio interference. The illuminating element in a flashing yellow beacon shall be flashed at a rate of not less than 50 times nor more than 60 times per minute. The illuminated period of each flash shall be not less than half and not more than two-thirds of the total cycle. The use of Flashing Beacons will be governed by field conditions. Flashing Beacons when warranted generally should be operated continuously throughout the 24 hours of the day. Warrant for Flashing Beacons may be found in Sec. 36 of the "Manual on Uniform Traffic Control Devices for Streets and Highways" published by the U.S. Department of Commerce, Bureau of Public Roads, June, 1961 (or latest revision).
- Flashers are portable, power-operated, lens-directed, enclosed lights, illuminated by rapid intermittent flashes of short duration. Flashers may be used in connection with barricades when approved by the Engineer. An array of random flashers which tends to obscure rather than delineate the traveled way will not be permitted. The use of flashers on a job will be governed by Sec. 5D of the "Manual on Uniform Traffic Control Devices for Streets and Highways" published by the U.S. Department of Commerce, Bureau of Public Roads, June, 1961 (or latest revision). The color of the light emitted by a flasher shall be yellow.
- Flashing Beacons and Flashers, when used, shall be positioned above the top rail of the barricades to produce the most effective results.
- Barricades used as "Traffic Controls for Highway Construction" are not to be paid for separately.
- Barricades will be paid for separately when designated on plans as bid items.
- For additional general information on control of traffic through work areas refer to the "Manual on Uniform Traffic Control Devices for Streets and Highway", Part V, published by the U.S. Department of Commerce, Bureau of Public Roads, June, 1961 (or latest revision).

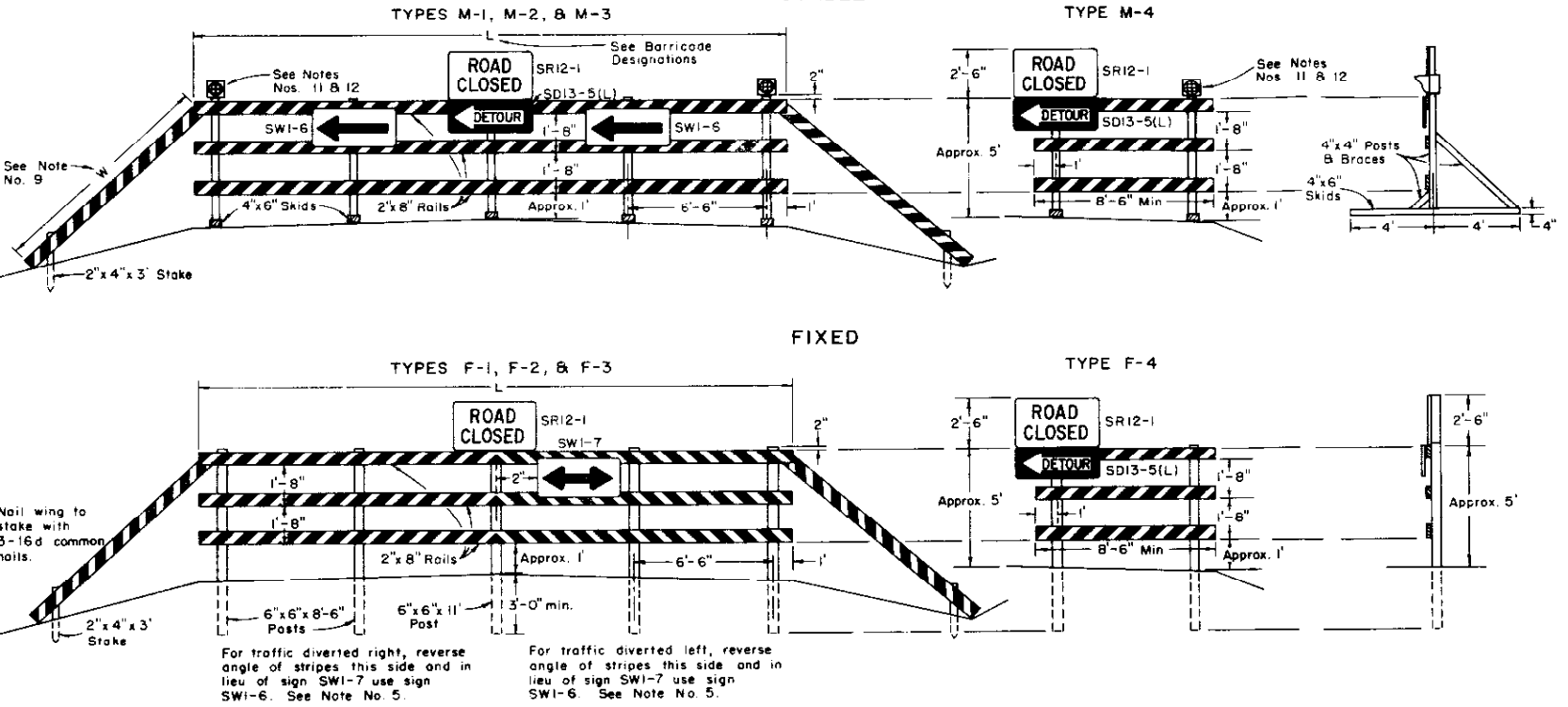
BARRICADE DESIGNATIONS					
Class	Type		Roadway Width	L	Description
	Movable	Fixed			
I	M-1	F-1	26'-34'	28'	Barricade complete with SR12-1 sign and SW1-6 or SW1-7 signs as required.
I	M-2	F-2	35'-44'	41'	Barricade complete with SR12-1 sign and SW1-6 or SW1-7 signs as required.
I	M-3	F-3	Variable	28'	Barricade (without extension wings) complete with SR12-1 sign and SW1-6 or SW1-7 signs as required.
I	M-4	F-4	Variable	Variable 8'-6" min.	Wing Barricade(signs only as appropriate).
II	-	F-6	Variable	28'	Barricade complete with appropriate signs.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

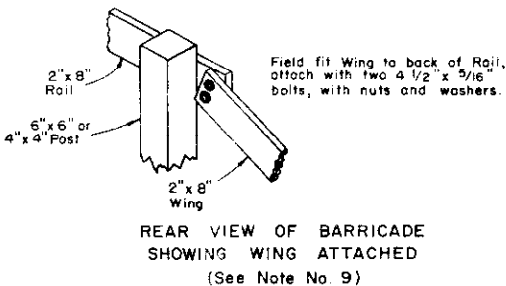
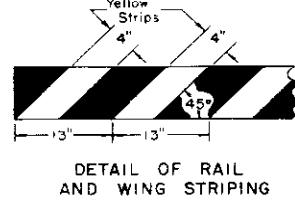
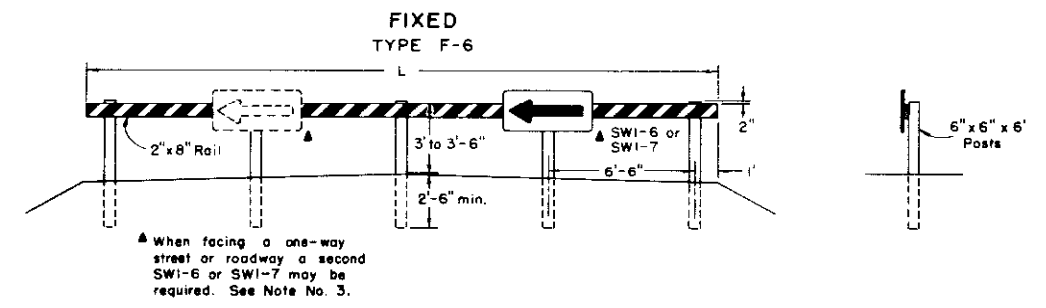
TIMBER BARRICADES

Designed By: D.R.W.
Made By: JLS
Checked By: J.B.
Approved By: 
Date: JULY 1, 1965

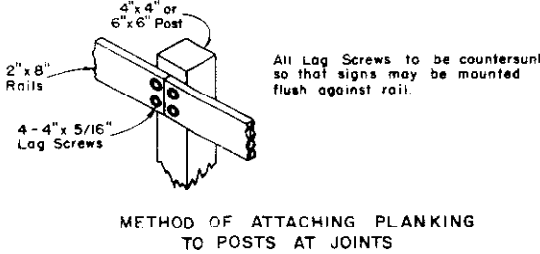
CLASS I BARRICADES (3 RAILS) MOVABLE



CLASS II BARRICADE (1 RAIL) FIXED TYPE F-6

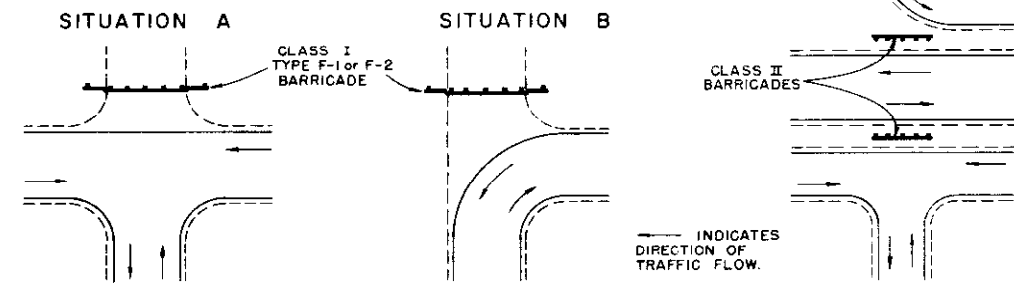


REAR VIEW OF BARRICADE
SHOWING WING ATTACHED
(See Note No. 9)



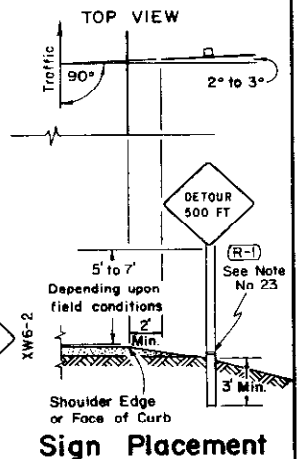
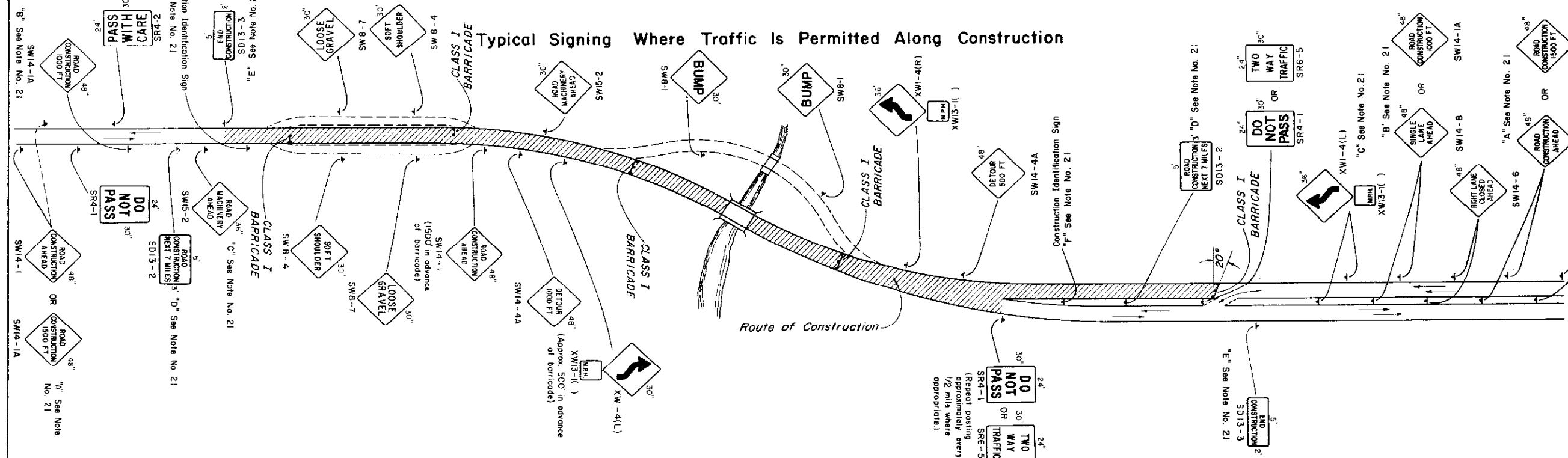
METHOD OF ATTACHING PLANKING
TO POSTS AT JOINTS

SITUATION C



(JULY 1, 1965)

NOTE:
See Sheet 2 for detailed drawings of signs.
See Sheet 3 for General Notes applicable to
Sheets 1 and 2.



DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

TRAFFIC SIGNING
FOR HIGHWAY
CONSTRUCTION

Designed By: D.R.W.	Approved By: <i>[Signature]</i>
Made By: J.L.S.	Traffic Engineer
Checked By: J.B.	Date: <u>AUGUST 9, 1965</u>

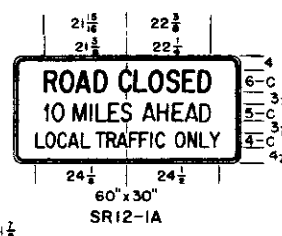
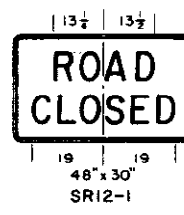
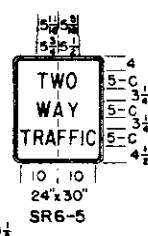
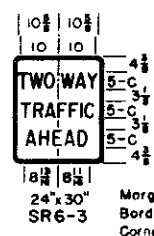
STANDARD M-614-TB

(SHEET 2 OF 3 SHEETS)

(JULY 1, 1965)

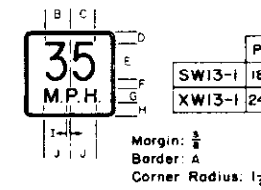
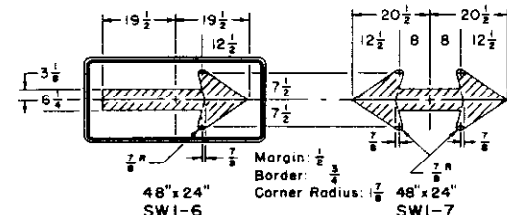
REGULATORY SIGNS

See Note No. 9



WARNING SIGNS

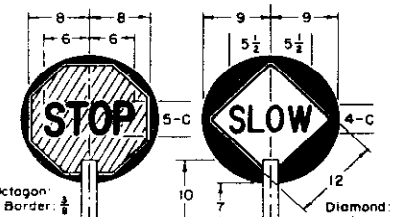
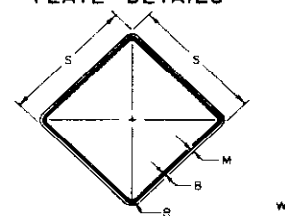
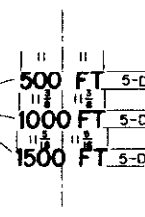
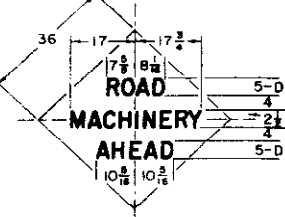
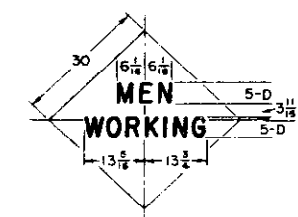
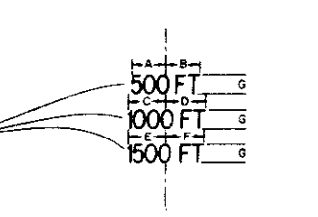
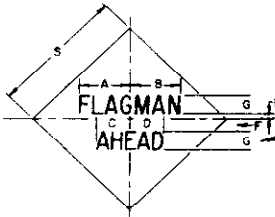
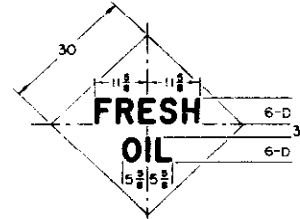
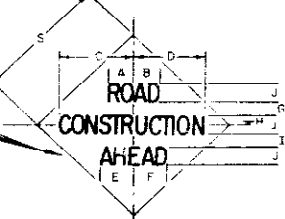
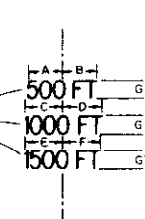
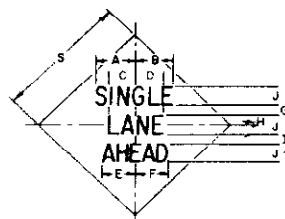
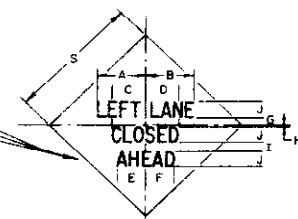
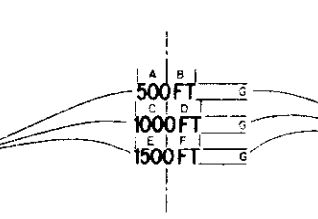
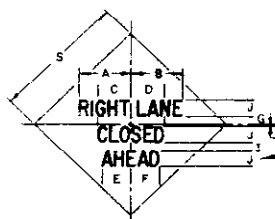
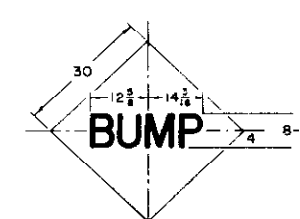
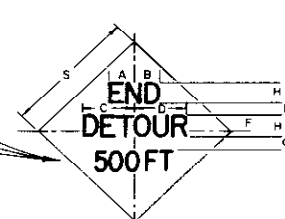
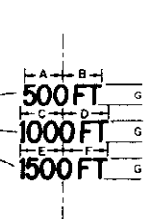
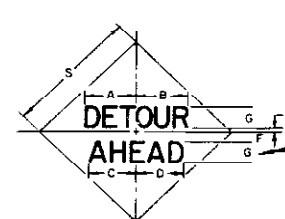
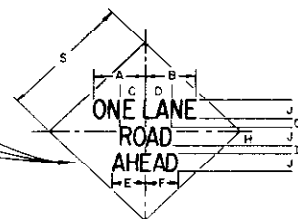
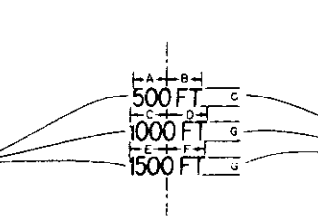
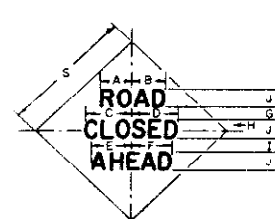
See Note No. 10



Panel	A	B	C	D	E	F	G	H	I	J
SW13-1	18" x 18"	3/8"	5/16"	2 1/2"	8-C	2	3-E	2 1/4"	5/16"	5/16"
XW13-1	24" x 24"	3/8"	5/16"	3 1/2"	10-C	2 1/2"	4-E	4	5/16"	5/16"

WARNING SIGNS

See Note No. 10



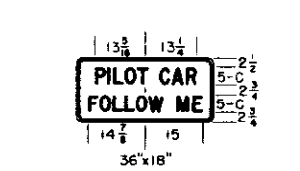
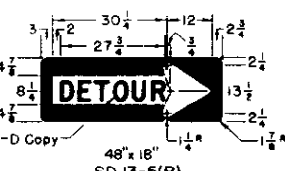
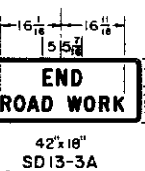
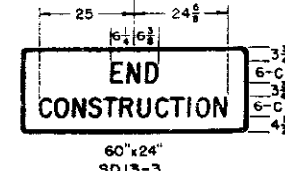
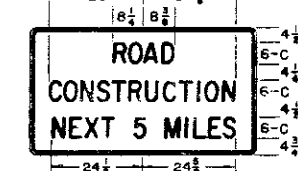
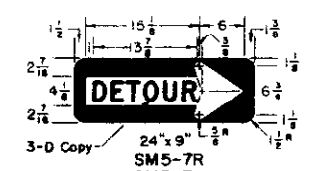
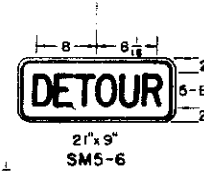
NOTES:

SEE SHEET 1 FOR TYPICAL SIGNING AND SIGN PLACEMENT.
SEE SHEET 3 FOR GENERAL NOTES APPLICABLE TO SHEETS 1 AND 2.

ALL DIMENSIONS THAT ARE NOT LABELED ARE IN INCHES.

GUIDE SIGNS

See Note No. 11



DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

TRAFFIC SIGNING
FOR HIGHWAY
CONSTRUCTION

Designed By: D.R.W.
Made By: H.B.D.
Checked By: J.B.

Approved By: [Signature]
Traffic Engineer
Date: AUGUST 9, 1965

STANDARD M-614-TB
(SHEET 3 OF 3 SHEETS)
(JULY 1, 1965)

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	1	
REVISIONS			
7-12-67	Added Note 23		G.W.F.

GENERAL NOTES

1. All work shall be done in accordance with: (a) the Standard Specifications applicable to the Project, and (b) the "Manual on Uniform Traffic Control Devices for all Classes of Streets and Highways" published by the Department of Highways.

2. 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 (including connecting roads) with well-maintained Barricades, Warning, and Guide Signs. All Barricades and Signs shall be moved, added to, changed or removed as required during the progress of construction and removed entirely when the Project is completed.

3. Where traffic is prohibited from the Project the Detour will be marked by the Department except that the Contractor shall provide, erect and maintain Barricades, complete, (when required) at the ends of the Project, ends of the Detour and connecting roads. All U.S. or State Route Markers required for the Project will be furnished and installed by the Department. The location and positioning of Warning Signs, Barricades, and Regulatory Signs shall be as recommended by the appropriate District Engineering Forces of the Department.

4. Work on the Project shall not be started until all required signs are in place and approved by the Engineer. Where speed control appears necessary such speed control shall be requested from the Engineer by the Contractor. Control of speed through a construction zone may be achieved by Advisory Speed plates in conjunction with Warning Signs (SW13-1 for use with 30" Warning Signs and XW13-1 for use with 36" and 48" Warning Signs). The Advisory Speed plate is to be posted only at those locations where the safe speed is lower than the imposed Regulatory speed limit.

5. All Signs and Barricades shall be placed for best visibility and legibility, maintained in good condition and kept clean and free of dirt at all times. Contractor's and Engineer's vehicles and equipment must be parked so that signs and barricades are visible to approaching traffic at all times.

6. Where two identical signs are used for dual posting they are to be staggered on the two sides of the roadway for a minimum distance of 75' to avoid a tunneling effect.

7. Examples for marking Projects, as shown on Sheet 1, are typical of signs required and are subject to alteration to fit actual conditions encountered in the field. Locations for control devices are to be staked by the Engineer. In all cases Warning signs are to be placed well in advance of the hazard, the distance depending on topography and existing approach speeds. 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.

8. Desirable sizes for signs are shown on Sheet 1 of this Standard. Larger or smaller signs shall be used where warranted. Detailed dimensions for signs normally used in connection with construction are shown on Sheet 2 of this Standard. For information on standard roadway signs not detailed on this Standard see the "Manual on Uniform Traffic Control Devices for all Classes of Streets and Highways" published by the Department of Highways.

9. Signs with the prefix "R" in the sign code are Regulatory signs and as such impose legal compulsions or restrictions on drivers and should only be used as authorized by the Engineer.

10. Signs with the prefix "W" in the sign code are Warning signs and are used to alert traffic to existing or potentially hazardous conditions.

11. Signs with the prefix "D" or "M" in the sign code are Guide signs. Those with the prefix "D" convey general information and those with the prefix "M" are used for marking the traffic route.

12. All signs shall be reflectorized unless otherwise specified on plans. Regulatory and Guide signs (unless otherwise specified) shall have a screen processed black legend and border on a white flexible reflective sheeting, non-exposed lens background. The back side of Regulatory and Guide signs shall be painted with two coats of "Exterior Sign White Paint." Warning signs shall have a screen processed black legend and border on a highway yellow flexible reflective sheeting, non-exposed lens background. The back side of Warning signs shall be painted with two coats of "Federal Yellow Synthetic Sign Enamel."

13. Painting for wood surfaces shall conform with Section 508 of the Standard Specifications.

14. Posts for regulatory, warning, and guide signs will normally be 4" x 4" or 6" x 6" and shall conform to the Standard Specifications for Untreated Timber-S4S. Timber shall conform to Construction grade Paragraph 123B or 125B of Standard No. 15 Grading & Dressing Rules for West Coast Douglas Fir (1956) or Dense Structural 5B and LL Structural 5B Paragraph 284 or 285 of 1956 Grading Rules for Southern Pine. Posts shall be painted with one coat of "White Wood Primer" and one coat of "Outside White Paint."
15. Sign panels furnished by the Contractor for use only during construction may be fabricated from plywood, aluminum, steel or other suitable material but shall be stable and durable enough to meet other requirements of this Standard.

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

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

18. Torches and Lanterns shall be either of the fuel-burning or battery-powered type approved by the Department. Particular care shall be taken to protect all signs and barricades from smoke and smudge.

19. Barricades, Flashing Beacons and Flashers - Refer to appropriate "M" Standard (Timber Barricades) for details.

20. Flagman Sign - This sign shall have a black painted background on both sides to form a contrast for the octagonal Stop sign and the diamond Warning sign. The "STOP" sign shall be fabricated by reverse screen process using transparent red paint on smooth surface silver reflective sheeting. The "SLOW" side of the Flagman Sign shall be black process paint on smooth surface yellow reflective sheeting. Handle to be grooved on one side to indicate reading of sign to Flagman.

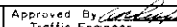
21. Sign "A": This is the first advance warning sign and shall be placed 1,500 feet ahead of Barricade or project terminal. Postings are required on both sides of the roadway on divided highways. Dual posting is required where warranted on two-lane, two-way highways.
Sign "B": This is the second advance warning sign and shall be placed 1,000 feet ahead of barricade or project terminal. Postings are required on both sides of the roadway on divided highways and singly on two-lane, two-way highways.
Sign "C": This is the third advance warning sign in cases where barricades are used and shall be placed 500 to 750 feet ahead of barricade or potentially hazardous condition. Postings are required on both sides of the roadway on divided highways and singly on two-lane, two-way highways.
Sign "D": SD13-2 - This sign shall be placed to mark the beginning of a Project of more than 2 miles in extent, where traffic is maintained through the project. It shall be placed singly and near the beginning of construction.
Sign "E": SD13-3 - 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 "F": Construction identification signs shall be furnished and installed by the Department on all Federal-Aid and Forest Highway Projects where actual construction is in progress and visible to highway users. These signs should be located so as not to obscure or detract from the effectiveness of other official signs. Where two or more projects are contiguous the appropriate data may be included in one set of signs. Refer to appropriate "M" Standard (Identification Signs) for sign details.
Signs A through F shall be furnished, installed and maintained by the Department.

22. When Flags are used in lieu of the Flagman Sign, they shall be a minimum of 18"x18", made of a good grade of bright red material, and fastened securely to a staff of approximately 3 foot length. The free edge should be weighted to insure that the flag will hang vertically, even in heavy winds.

23. Each timber post shall be provided with a single hole drilled through the neutral axis normal to the roadway 3" above the ground level. The holes shall be 1 1/4" Ø for 6"x6" and 1" Ø for 4"x4" timber posts. The underground portion plus 6" shall be treated with creosote.
- SPECIAL NOTE: Requirements of this Standard are optional to those of Standard M-614-TA through 12-31-65. Following that date Standard M-614-TA will be obsolete.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

TRAFFIC SIGNING
FOR HIGHWAY
CONSTRUCTION

Designed By: D.R.W.
Made By: J.L.S.
Checked By: J.B.
Approved By: 
Traffic Engineer
Date: AUGUST 9, 1965