TITLE SHEET

FEDERAL ROAD REGION NO	DIVISION	PROJECT NO	SHEET NO
9	COLORADO	RS 0089(5)	1

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS — STATE OF COLORADO

PLAN AND PROFILE OF ~~PROPOSED~~ COMPLETED

FEDERAL AID PROJECT NO. RS 0089(5)

STATE HIGHWAY NO. 89

PROWERS AND BACA COUNTIES

CONVENTIONAL SIGNS

CENTER LINE (PLAN SHEET)
COUNTY LINE
TOWNSHIP OR RANGE LINE
LAND LINES (SECTION LINE, 1/4 SECTION LINE, 1/16 SECTION LINE)
CITY LIMITS
RAILROAD (PLAN SHEET, TITLE SHEET)
BARBED WIRE FENCE
WOVEN WIRE - COMBINATION FENCE (TO BE REMOVED)
TELE. & TELEG. LINE
POWER LINE (RELOCATED)
PRESENT ROAD (PLAN SHEETS)
RIGHT OF WAY LINE (R.O.W. MARKER)
ACCESS POINTS (FREEWAYS) (24' OP., OP. OPENING, 16' OP.)
C OF A LINE (CONTROL OF ACCESS)
ACCESS DENIED BY DEED
TOP OF CUTS
TOE OF FILLS
DETOUR

INDEX OF SHEETS

"As Constructed" No Revisions
Sheets 8, 10-19

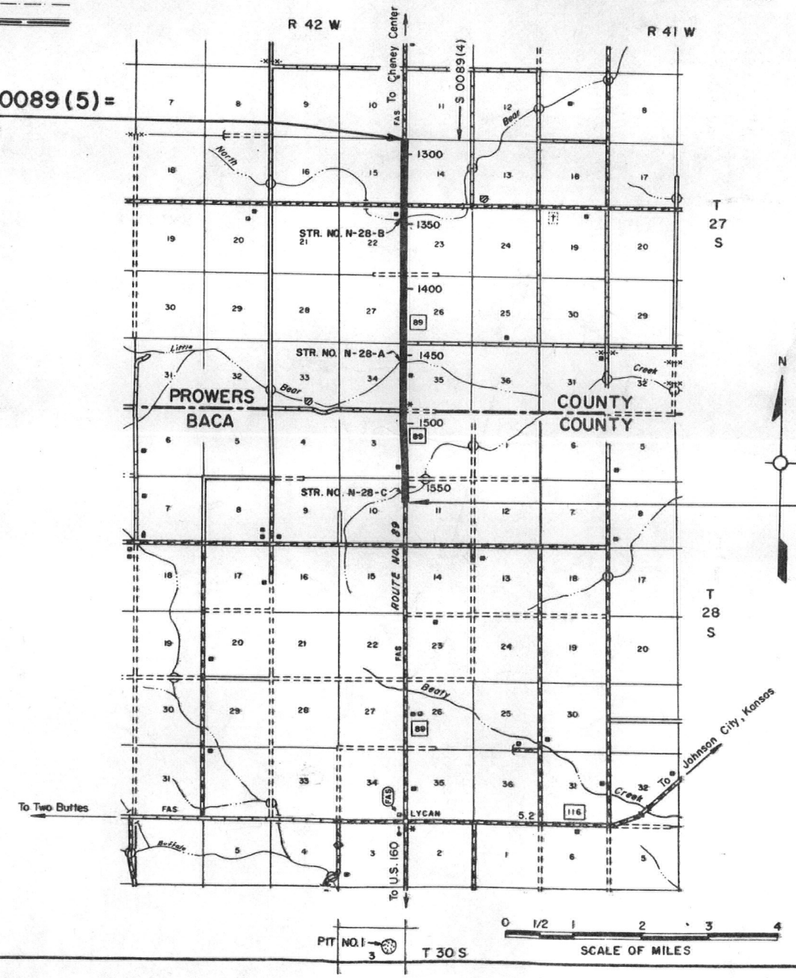
PROJECT STARTED - DECEMBER 1, 1971
PROJECT COMPLETED - JULY 7, 1972
CONTRACTOR - ROCKY MTN. PAVING INC.
RESIDENT ENGINEER - L. D. MULLER

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

STA. 1285+00 BEGIN RS 0089(5) =
STA. 1285+00 END S 0089(4)



STA. 1556+00 END RS 0089(5)

TABULATION OF LENGTH AND DESIGN DATA

STATION	ROADWAY PROWERS LIN. FT.	ROADWAY BACA LIN. FT.
1285+00.0 - BEGIN RS 0089(5) = 1285+00.0 - END S 0089(4)		
	6,385.5	
1348+85.5 - BEGIN BRIDGE STR. NO. N-28-B	28.6	
1349+14.1 - END BRIDGE		
	11,033.4	
1459+47.5 - BEGIN BRIDGE STR. NO. N-28-A	68.0	
1460+15.5 - END BRIDGE		
1497+71.0 - PROWERS-BACA CO. LINE	3,755.5	
1554+12.0 - BEGIN BRIDGE STR. NO. N-28-C		5,641.0
		29.0
1554+41.0 - END BRIDGE		
		159.0
1556+00.0 - END RS 0089(5)		
TOTALS	21,271.0	5,829.0

SUMMARY:	LIN. FT.	MILES
ROADWAY - PROWERS COUNTY	21,271.0	4.029
ROADWAY - BACA COUNTY	5,829.0	1.104
TOTAL ROADWAY (NET & GROSS LENGTH)	27,100.0	5.133

DESIGN DATA:

MAXIMUM DEGREE OF CURVE	TANGENT
MAXIMUM GRADE	4.26 %
MINIMUM S.S.D. - HORIZONTAL	> 900'
MINIMUM S.S.D. - VERTICAL	375'
MAXIMUM DESIGN SPEED	50 M.P.H.
1991 DESIGN TRAFFIC VOLUME	ADT 250; DHV 30

SEE SPECIAL PROVISIONS FOR NOTICE TO BIDDERS

DIVISION OF HIGHWAYS
APPROVED L. L. Bower 10-13-71
CHIEF ENGINEER DATE

DIVISION OF HIGHWAYS
APPROVED: Dan L. Pino 8-18-72
DIST. CONST. ENGR. DATE

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
APPROVED: DATE
DIVISION ENGINEER

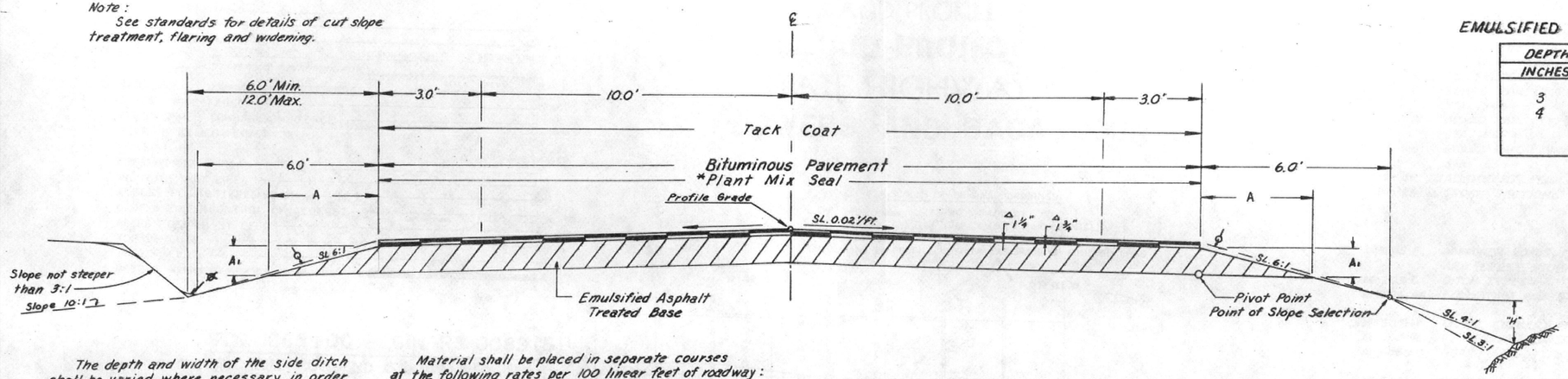
D.H.H.

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS — STATE OF COLORADO
FORM D.O.H. # 76
JULY, 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	2	26

TYPICAL SECTION

Note:
See standards for details of cut slope treatment, flaring and widening.



EMULSIFIED ASPHALT TREATED BASE

DEPTH INCHES	A FEET	A₁ FEET
3	1.7	0.3
4	2.3	0.4

Fill Slopes

Slope 4:1 where "H" is 3' or less.
Slope *3:1 where "H" is over 3'.
*In special cases, slope may be steepened.

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

Excavation below 6:1 slope and/or 10:1 slope will not be permitted.

☒ Break points on slopes and in bottom of ditches shall be rounded on construction for a pleasing appearance.

Material shall be placed in separate courses at the following rates per 100 linear feet of roadway:

Bituminous Pavement	Top Layer	19 tons
	Bottom Layer	26 tons
3" Emul. Asphalt Treated Base		47 tons
4" Emul. Asphalt Treated Base		63 tons

* Future Construction

Δ Approximate thickness

ϕ The Contractor will be required to place suitable material to this line after completion of paving operation.

GENERAL NOTES

For preliminary plan quantities of Bituminous Materials the following rates of application were used:

Tack Coat, Emul. Asph. @ 0.10 Gals. per Sq. Yd. (Diluted)

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

Flexible conduits on this project with helical corrugations, joined by dimpled connecting bands, shall use a sealing compound or gasket with the connecting band.

The Type of Compaction for reconditioning shall be AASHO T-99.

Depth of Moisture-Density control for Grading Sections shall be as follows:
Bases of Cuts and Fills - 6 inches.
Full depth of all embankments.

Excavation required for compaction of bases of cuts and fills will be considered as subsidiary to that operation and will not be paid for separately.

Plain water shall be used as a dust palliative where required. Locations shall be as ordered.

Through areas of reconditioning, the road, including shoulders, shall be scarified to a depth of 6 inches. Est. Quantity = 4.5 miles.

The Contractor shall conduct his operations so that a minimum of existing vegetation, adjacent to the roadway, is destroyed.

Any layer of bituminous pavement that is to have a succeeding layer placed thereon shall be completed full width before succeeding layer is placed.

Road approaches which require bituminous pavement shall be tacked and a 3" thickness of bituminous pavement placed as follows:

Public approaches and entrances to buildings or residences shall be tacked 50 ft. out from edge of Shoulder or to the Right of Way line, whichever is less. Field entrances shall be tacked 4 ft. out from edge of shoulder.

Approaches shall have Emulsified Asphalt Treated Base.

It is estimated that 20 hours Blading will be required.

Guard posts, signs and delineators will be removed by State Forces.

It is estimated that ~~1000~~ 284 Hours of Flagging for controlling traffic will be required for this project.

Ski-type device 30 feet in length and short shoe shall be furnished with the automatic control system of each bituminous paver.

It is estimated that ~~225~~ 287 gal. of Pavement Marking Paint will be required for this project. This quantity includes the following:

White Paint . . . . . ~~179~~ 230 gal.
Yellow Paint . . . . . ~~52~~ 57 gal.

The Engineer will establish all terminal points for no-passing zones on the project.

The Force Account item, "Cleaning Bridge Decks", shall include the removal of all dirt, gravel, etc. from bridge floor prior to placement of pavement on bridges.

SUMMARY OF APPROXIMATE QUANTITIES

AS CONSTRUCTED
REVISED DATE JUL 7 1972

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089 (5)	3	26

INDEX BOOK	INDEX PAGE	INDEX SHEET	CONTRACT ITEM NO	CONTRACT ITEM	UNIT	INDEX BOOK	INDEX PAGE	SHEET	PROWERS COUNTY	PROWERS COUNTY FINAL	BACA COUNTY	BACA COUNTY FINAL	PROJECT TOTALS	FINAL PROJECT TOTALS	DIFF.
			202	Removal of Structure	Each	Plans		4	5	5			5	5	0
			202	Removal of Portions of Present Structure	Each	1	21,36,46		2	2	1	1	3	3	0
			203	Unclassified Excavation	Cu. Yd.	Plans		5	3,750	3,025	250	402	4,000	3,427	-573
			203	Stripping	Cu. Yd.	1	54		8,000	8,162	2,000	0	10,000	8,162	-1,838
			203	Compaction (AASHO T 99)	Cu. Yd.	Plans		5	4,500	4,008	500	212	5,000	4,220	-780
			203	Blading	Hour	D.O.H. FORM 7			15	20	5	0	20	20	0
			204	Haul	Yd. Mi.	Plans		5	2,300	2,078	100	39	2,400	2,117	-283
			204	Haul	Ton Mi.	Haul Sheets	& Plans	5	345,900	341,986	76,300	72,221	422,200	414,207	-7,993
			206	Structure Excavation	Cu. Yd.	Plans		4	90	88	30	21	120	109	-11
			206	Structure Backfill (Class 2)	Cu. Yd.	Plans		4	60	60	10	7	70	67	-3
			209	Wetting	M Gal.	D.O.H. Form 7	& 7A		655	1,024	155	280	810	1,304	+494
			210	Reset Mailbox Structure	Each	1	58		3	1	1	1	4	2	-2
			303	Emulsified Asphalt Treated Base (Class 7)	Ton	D.O.H. Form 87	(4 Books)		14,600	14,486.75	4,000	3,597.80	18,600	18,084.55	-515.45
			306	Reconditioning	Mile	D.O.H. Form 266	- 27		3.5	3.5	1.0	1.0	4.5	4.5	0
			403	Hot Bituminous Pavement (Grading F)	Ton	D.O.H. Form 87	(5 Books)		9,740	9,614.70	2,660	2,632.10	12,400	12,246.80	-153.20
			411	Asphalt Cement (AC-10)	Ton	D.O.H. Form 49	(2 Sheets)		700	622.52	190	170.42	890	792.94	-97.06
			411	Emulsified Asphalt (CSS-1)	Gal.	D.O.H. Form 49	(2 Sheets)		143,600	136,487	38,600	37,399	182,200	173,886	-8,314
			509	Structural Steel (Galvanized)	Lb.	1	21,36,46		10,085	10,085	3,320	3,320	13,405	13,405	0
			606	End Anchor Type 1	Each	1	59		8	8	4	4	12	12	0
			606	Guard Rail Type 3 (6-3 Post Spacing)	Lin. Ft.	1	57		900	900	425	425	1,325	1,325	0
			606	Guard Rail Type 3A	Lin. Ft.	1	21,36,46		217	225	66	75	283	300	+17
			612	Delineator (Type I) (C.O. NO. 02108)	Each	1	60			16		8		24	
			612	Delineator (Type III) (C.O. NO. 02108)	Each	1	60			4		2		6	
			614	Flagging, See C.O. 02121	Hour	D.O.H. Form 7			800	284	200	0	1,000	284	-716
			614	Pavement Marking Paint	Gal.	1	56		175	217	50	70	225	287	+62
			617	18 Inch Culvert Pipe	Lin. Ft.	Plans		4	210	210	40	40	250	250	0
			617	24 Inch Culvert Pipe	Lin. Ft.	Plans		4	94	94			94	94	0
			617	30 Inch Culvert Pipe	Lin. Ft.	Plans		4	10	10			10	10	0
			620	Field Office	Each	D.O.H. Form 266	- 4		1	1			1	1	0
			620	Field Laboratory	Each	D.O.H. Form 266	- 4		1	1			1	1	0
			620	Sanitary Facility	Each	D.O.H. Form 266	- 4		1	1			1	1	0
			626	Mobilization	L.S.	D.O.H. Form 305	(Quantity Book)		Prorated		Prorated		•	•	0
				FORCE ACCOUNT											
				Cleaning Bridge Deck	Each	W.O. #15199			2	2	1	1	3	3	0
				STATE FORCES											
				Furnishing and Installing Identification Sign	Each	1	8,50		1	1	1	1	2	2	0
				Signing Entire Project (Non Federal Aid)	L.S.								•		
				RIGHT OF WAY											
				Easement	L.S.								•		

DEPARTMENT OF HIGHWAYS, STATE OF COLORADO
FORM D.O.H. 125 (LINEN)
REV. OCT. 1967

STRUCTURE QUANTITIES

AS CONSTRUCTED
REVISED DATE

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	RS 0089(5)	4

	LOCATION	REMOVAL OF STRUCTURE (EACH)	UNCLASSIFIED EXCAVATION CUBIC YARD: EXCAV.	EMB.	DITCH	STRUCTURE EXCAVATION CUBIC YARD		STRUCTURE BACKFILL CUBIC YARD: CL. 2		E.A.T.B. (CLASS 7) TON		AGGREGATE BASE COURSE SURFACING (CLASS __) TON	HOT BITUMINOUS PAVEMENT (GRADING F) TON			CONCRETE CUBIC YARD: CL. A		REINFORCING STEEL LB.	INDEX: BOOK	PAGE	SHEET	CULVERT PIPE LINEAR FEET: 18"		24"		30"						"H" OVER CULV. FT.	SLOPE AND DITCH PAVING CUBIC YARD	END SECTION EACH				MISCELLANEOUS
PROWERS COUNTY	1285+00																		1	8																		1 - Identification Sign (State Forces)
	1289+25		4	15						27.15 ~~11~~			★ ~~2~~						1	10																		
	1301+20		4	15		14		5		28.80 ~~11~~			★ ~~2~~						1	12		30											1					
	1326+50	1	8	30		17		12		~~45.50~~ ~~22~~			★ ~~4~~						1	14		30		30									1					
	1339+74		40	160						45.25 ~~110~~			49.00 ~~56~~						1	16																		
	1345+75	1	4	15		1		3		27.50 ~~11~~			9.10 ~~6~~						1	18						10							1					
	1347+80		4	15						28.20 ~~11~~			★ ~~2~~						1	20																		
	1348+99.8		72																1	21																		
	1366+21		8	30		27		10		~~45.50~~ ~~22~~			★ ~~4~~						1	22		30 / 30											1 / 1					
	1380+75		4	15						21.00 ~~11~~			20.35 ~~2~~						1	24																		
	1384+30		4	15						21.00 ~~11~~			9.30 ~~2~~						1	26																		
	1388+31		4	15						25.00 ~~11~~			21.35 ~~2~~						1	28																		
	1392+69		8	30						41.50 ~~22~~			★ ~~4~~						1	30																		
	1418+77		4	15						13.65 ~~11~~			★ ~~2~~						1	32																		
	1444+48	1	4	15		3		5		16.40 ~~11~~			★ ~~2~~						1	34		30											1					
	1445+15		20	80		3		5		16.45 ~~55~~			10.90 ~~28~~						1	35		30											1					
	1468+49	2	8	30		9		15		16.40 ~~22~~			13.80 ~~10~~						1	37				30 / 34									1 / 1					
	1497+59		3	15		14		5		14.60 ~~11~~			★ ~~2~~						1	39		30											1					
	Sub-Total (Prowers Co.)	5	203 ~~131~~	510		88		60		433.00 ~~363~~			139.80 ~~130~~									210		94		10											
BACA COUNTY	1497+80		3	15						14.60 ~~11~~			★ ~~2~~						1	40																		
	1538+20		3	15		21		7		13.50 ~~11~~			18.65 ~~8~~						1	42		40											1					
	1550+53		392							28.00 ~~22~~			★ ~~4~~						1	44																		
	1554+26.5		~~150~~																1	46																		
	1555+73		4	15						14.35 ~~11~~			★ ~~2~~						1	48																		
	1556+00									★ ~~40~~			★ ~~6~~						1	52																		
	1556+00																		1	50																		1 - Identification Sign (State Forces)
	Sub-Total (Baca Co.)		402 ~~160~~	45		21		7		70.45 ~~95~~			13.65 ~~22~~									40															
	Project Totals	5	605 ~~291~~	555		109		67		504.35 ~~458~~			147.45 ~~152~~									250		94		10											

★ Included in Roadway Quantities

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS—STATE OF COLORADO
DOH FORM 126
JULY, 1968

AS CONSTRUCTED
REVISED
JUL 1972

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	5	26

SURFACING PLAN

	STATION	SOURCE	QUANTITY ~ TONS: Emulsified Asphalt Treated Base Thickness	Emulsified Asphalt Treated Base CL. 7	Emulsified Asphalt Treated Base FINAL	Hot Bituminous Pavement Bottom Layer GR. F	Hot Bituminous Pavement Bottom Layer FINAL	Hot Bituminous Pavement Top Layer GR. F	Hot Bituminous Pavement Top Layer FINAL	HAUL ~ TON MILE: Emulsified Asph. Treated Base CL. 7	Emulsified Asph. Treated Base FINAL	Hot Bituminous Pavement Bottom Layer GR. F	Hot Bituminous Pavement Bottom Layer FINAL	Hot Bituminous Pavement Top Layer GR. F	Hot Bituminous Pavement Top Layer FINAL
Prowers County	1285+00 To 1348+85		4	4,023	4,012.70	1,660	1,982.70	1,213	1,137.30	62,777	62,630	25,903	30,946	18,928	17,751
	1348+85 To 1349+14.5 ~ BRIDGE						7.00	6	6.00				105	90	90
	1349+14.5 To 1459+47.5		4	6,951	7,014.90	2,869	2,839.85	2,096	1,830.35	96,963	97,878	40,021	39,624	29,238	25,539
	1459+47.5 To 1460+15 ~ BRIDGE						32.45	13	11.00				419	168	142
	1460+15 To 1470+00		4	621	788.20	256	236.75	187	162.90	7,948	10,091	3,276	3,031	2,393	2,085
	1470+00 To 1497+71		3	1,302	2,250.70	720	732.65	526	501.95	16,201	28,013	8,939	9,119	6,545	6,247
	ESTIMATED FOR: CORRECTING IRREGULARITIES	No. 1		1,290	★					18,393	★				
	WIDENING FOR GUARD RAIL			40	★			33	★	570	★			468	★
	FROM STRUCTURE QUANTITIES			363	433.90			130	133.80	5,176	6,345			1,845	1,931
	SUB TOTAL (PROWERS CO.) =			14,590	14,500.40	5,505	5,831.40	4,204	3,783.30	208,028	204,957	78,159	83,244	59,675	53,785
Baca County	1497+71 To 1510+00	PIT	3	578	684.10	320	345.00	234	181.65	6,973	8,255	3,861	4,163	2,323	2,192
	1510+00 To 1554+12		4	2,780	2,654.95	1,147	1,155.00	838	859.40	32,053	30,621	13,225	13,327	9,662	9,912
	1554+12 To 1554+41 ~ BRIDGE						4.00	6	6.00				44	67	67
	1554+41 To 1556+00	MUNDELL	4	100	174.65	42	25.35	30	41.55	1,109	1,938	466	281	333	461
	ESTIMATED FOR: CORRECTING IRREGULARITIES			346	★					4,014	★				
	WIDENING FOR GUARD RAIL			20	★			17	★	217	★			185	★
	FROM STRUCTURE QUANTITIES			95	70.45			22	13.65	1,031	804			240	156
	SUB TOTAL (BACA CO.) =			3,919	3,584.15	1,509	1,529.85	1,147	1,102.25	45,397	41,618	17,552	17,815	13,310	12,788
	PROJECT TOTALS =			18,509	18,084.55	7,014	7,361.25	5,351	4,885.55	253,425	246,575	95,711	101,059	72,985	66,573

★ Included in Roadway Quantities

STABILIZATION FOR THIS PROJECT IS BASED ON THE FOLLOWING:

1. E.D.L.A. 18 K 6
2. REGIONAL FACTOR 1.25
3. SERVICEABILITY INDEX . . 2.0
4. HOT BIT. PAVEMENT . . . 0.25 (Rt = 80)
5. EMUL. ASPH. TREAT BASE . . 0.23 (Rt = 99)

GUARD RAIL

STATION TO STATION	SIDE	GUARD RAIL TYPE 3 LIN. FT.		STATION TO STATION	SIDE	GUARD RAIL TYPE 3 LIN. FT.	
Prowers Co.				Baca Co.			
1347+33.25ø to 1348+83.25*	Rt.	150		1552+60.0ø to 1554+10.0*	Rt.	150	
1349+16.75* to 1349+91.75ø	Rt.	75		1554+43.0* to 1555+18.0ø	Rt.	75	
1348+08.25ø to 1348+83.25*	Lt.	75		1553+35.0ø to 1554+10.0*	~~Rt~~ Lt.	75	
1349+16.75* to 1350+66.75ø	Lt.	150		1554+43.0* to 1555+68.0ø	~~Rt~~ Lt.	125	
1458+56.5ø to 1459+31.5*	Lt.	75					
1460+06.5* to 1461+56.5ø	Lt.	150					
1458+06.5ø to 1459+56.5*	Rt.	150					
1460+31.5* to 1461+06.5ø	Rt.	75					
Sub Total Prowers Co.		900		Sub Total Baca Co.		425	
				Total		1,325	

* Attach to Bridge Guard Rail.
ø Type I Anchor 12 Required.

Note: See sheet Nos. 7, 8 and 9 for Guard Rail Type 3A Requirements.

SUMMARY OF EARTHWORK QUANTITIES

INDEX BOOK	PAGE	SHEET		PROWERS CO. Cu. Yd.		BACA CO. Cu. Yd.		PROJECT TOTALS Cu. Yd.	
			UNCLASSIFIED EXCAVATION						
Plans		20-25	Roadway (From Cross Sections)	~~3,440~~	2,822	~~72~~	0	~~3,512~~	2,822
Plans		4	Structure Quantities as Embankment	ø		ø		ø	
Plans		4	Structure Quantities as Excavation	~~131~~	203	~~160~~	402	~~291~~	605
			TOTAL	~~3,571~~	3,025	~~232~~	402	~~3,803~~	3,427
			ø To be made from Structure Quantities Excavation and Excess Excavation from Roadway.						
			COMPACTION (AASHO T99)						
Plans		20-25	Embankment (Net)	~~2,189~~	1,869			~~2,189~~	1,869
⊖	11		Base of Cuts and Fills	~~1,629~~	1,629	~~167~~	167	~~1,796~~	1,796
Plans		4	Structure Quantities as Embankment (Net)	~~510~~	510	~~45~~	45	~~555~~	555
			TOTAL	~~4,328~~	4,008	~~212~~	212	~~4,540~~	4,220
			HAUL	Yo. Mi.		Yo. Mi.		Yo. Mi.	
Mass 1	Diagram 6		~~Estimated for~~ Profile Quantities	~~1,200~~	1,052			~~1,200~~	1,052
			~~Estimated for~~ Road Approaches	~~1,100~~	1,026	~~100~~	39	~~1,200~~	1,065
			TOTAL	~~2,300~~	2,078	~~100~~	39	~~2,400~~	2,117
			ROADWAY QUANTITIES BALANCE (For Information Only)	Cu. Yo.		Cu. Yo.		Cu. Yo.	
			EXCAVATION						
			Unclassified	3,440		72		3,512	
			* Excess Excavation	-522		-72		-594	
			TOTAL	2,918		0		2,918	
			EXCAVATION X FACTOR						
			Unclassified	2,580		54		2,634	
			* Excess Excavation	-391		-54		-445	
			TOTAL	2,189		0		2,189	
			EMBANKMENT						
			Roadway from Cross Sections	2,189				2,189	
			TOTAL	2,189				2,189	
			* To be used for Road Approaches or Shoulder Widening as directed.						

⊖ DOH FORM # 266 ~ Quantity Book

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS - STATE OF COLORADO
D.O.H. FORM 126
JULY, 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	6	26

LOG OF PIT

Sample No 5015

TEST NO.	DEPTH IN FEET	DESCRIPTION OF MATERIAL
4	0.0 - 3.3	SILT: SANDY, CLAYEY
4A	3.3 -11.5+	SAND: WELL-GRADED, PEBBLY
6	0.0 - 1.4	SILT: SANDY, CLAYEY
6A	1.4 -11.3+	SAND: WELL-GRADED, PEBBLY
7	0.0 - 3.4	SILT: SANDY, CLAYEY
7A	3.4-11.0+	SAND: WELL-GRADED, PEBBLY
10	0.0 - 5.3	SILT: SANDY, CLAYEY
10A	5.3 - +	CLAYSTONE: LIGHT GRAY, HARD
11	0.0 - 1.3	SILT: SANDY, CLAYEY
11A	1.3 - 6.3	SAND: WELL-GRADED, PEBBLY
11B	6.3 - +	SILTSTONE: SANDY, SOFT
12	0.0 - 1.6	SILT: SANDY, CLAYEY
12A	1.6 - 5.3	SAND: WELL-GRADED, PEBBLY
12B	5.3 - +	SILTSTONE: SANDY, SOFT
13	0.0 - 3.0	SILT: SANDY, CLAYEY
13A	3.0 -10.0+	SAND: WELL-GRADED, PEBBLY
14	0.0 - 4.7	SILT: SANDY, CLAYEY
14A	4.7 -11.0+	SAND: WELL-GRADED, PEBBLY
15	0.0 - 4.6	SILT: SANDY, CLAYEY
15A	4.6 - 6.3+	SAND: WELL-GRADED, PEBBLY

Sample No. 1036

TEST NO.	DEPTH IN FEET	DESCRIPTION OF MATERIAL
20	0.0 - 1.0	SILT: SANDY, CLAYEY, TRACE OF GRAVEL
20A	1.0 - 2.4	SAND: MEDIUM, WITH GRAVEL
20B	2.4 -12.0	SAND: WELL-GRADED, GRAVELLY
21	0.0 - 1.3	SILT: SANDY, CLAYEY, TRACE OF GRAVEL
21A	1.3 - 6.6	SAND: MEDIUM TO COARSE, GRAVELLY
21B	6.6 -12.5+	SAND: WELL-GRADED, CLEAN
22	0.0 - 2.0	SILT: SANDY, CLAYEY, TRACE OF GRAVEL
22A	2.0 -12.4+	SAND: MEDIUM TO COARSE, WITH FINE GRAVEL
23	0.0 - 0.5	SILT: SANDY, CLAYEY, GRAVELLY
23A	0.5-12.0+	SAND: WELL-GRADED, TRACE OF FINE GRAVEL
24	0.0 - 0.5	SILT: SANDY, CLAYEY, GRAVELLY
24A	0.5 - 6.0	SAND: WITH TRACE OF GRAVEL
24B	6.0 - +	SANDSTONE: HARD
25	0.0 - 1.5	SILT: SANDY, CLAYEY, TRACE OF GRAVEL
25A	1.5 - 8.0	SAND: WELL-GRADED, TRACE OF FINE GRAVEL
25B	8.0 - +	SANDSTONE: WITH CLAYSTONE, SOFT TO HARD
26	0.0 - 1.0	SILT: SIMILAR TO TEST NO. 20
26A	1.0 - 4.5	SAND: SIMILAR TO TEST NO. 22A
26B	4.5 - +	SANDSTONE
27	0.0 - 1.3	SILT: SIMILAR TO TEST NO. 20
27A	1.3 - 7.0	SAND: WITH CLAY
27B	7.0 - +	SANDSTONE
28	0.0 - 1.0	SILT: SIMILAR TO TEST NO. 20
28A	1.0 - 6.0	SILT: SIMILAR TO TEST NO. 21
28B	6.0 - 8.2	SAND: CLAYEY
28C	8.2 - +	SAND: FINE
29	0.0 - 1.0	SILT: SANDY, CLAYEY
29A	1.0 - 2.0	SAND: SILTY
29B	2.0 -12.5+	SAND: MEDIUM TO COARSE, GRAVELLY
30	0.0 - 1.3	SILT: SANDY, CLAYEY
30A	1.3 - 5.0	SILT: CLAYEY, WHITE
30B	5.0 - 6.3	SAND: FINE, SLIGHTLY CLAYEY
30C	6.3 - 7.4	SAND: MEDIUM TO COARSE, CLEAN
30D	7.4 -12.0+	SAND: MEDIUM TO COARSE, TRACE OF GRAVEL AND SMALL CLAY BALLS
31	0.0 - 0.5	SILT: SIMILAR TO TEST NO. 20
31A	0.5 - 4.0	SAND: GRAVELLY
31B	4.0 - 9.5+	SAND: MEDIUM TO COARSE, CLEAN
32	0.0 - 1.0	SILT: SIMILAR TO TEST NO. 21
32A	1.0 - 5.0	SAND: GRAVELLY, CLAYEY
32B	5.0 -11.0+	SAND: WELL-GRADED, CLAYEY
33	0.0 - 1.2	SILT: SIMILAR TO TEST NO. 30
33A	1.2 - 4.0	SILT: SIMILAR TO TEST NO. 30A
33B	4.0 - 8.4	SAND: WITH TRACE OF GRAVEL, CLAYEY
33C	8.4 - +	CLAYSTONE: GRAY
34	0.0 - 1.0	SILT: SIMILAR TO TEST NO. 30
34A	1.0 - 7.0+	SILT: SIMILAR TO TEST NO. 30A
35	0.0 - 0.6	SILT: SIMILAR TO TEST NO. 20
35A	0.6 - 2.7	SAND: CLAYEY, GRAVELLY
35B	2.7 - 9.0	SAND: MEDIUM TO COARSE, GRAVELLY
35C	9.0 - +	GRAVEL, SANDSTONE & CLAY
36	0.0 - 0.6	SILT: SIMILAR TO TEST NO. 20
36A	0.6 - 9.5	SAND: MEDIUM TO COARSE, TRACE OF GRAVEL, CLAYEY
36B	9.5 - +	SANDSTONE: WITH CLAY, SOFT
37	0.0 - 0.7	SILT: SIMILAR TO TEST NO. 30
37A	0.7 - 2.3	SILT: SIMILAR TO TEST NO. 30A
37B	2.3 - 4.0	SAND: SIMILAR TO TEST NO. 36A
37C	4.0 - 9.4	SAND: WITH CLAY
37D	9.4 - +	SANDSTONE: CLAYEY
38	0.0 - 2.0	SILT: SIMILAR TO TEST NO. 30
38A	2.0 - 3.5	SAND: SILTY
38B	3.5 - 9.0	SAND: SIMILAR TO TEST NO. 36A
38C	9.0 - +	SANDSTONE & CLAY
39	0.0 - 0.8	SILT: SIMILAR TO TEST NO. 20
39A	0.8 - 3.5	SAND: SIMILAR TO TEST NO. 36A
39B	3.5 - +	SANDSTONE: CLAYEY

PIT NO. 1

Owner: Felix & Mamie Mundell, Walsh, Colorado

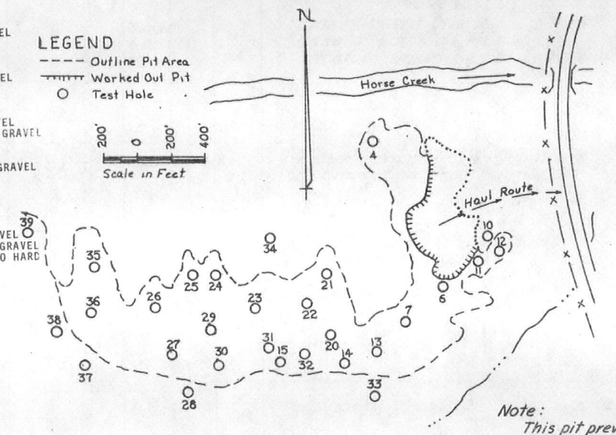
Location: Part of the Northeast 1/4 Sec. 3, T. 30 S., R. 42 W.

Use: Aggregate for Emulsified Asphalt Treated Base and Hot Bituminous Pavement

Quantity Available: 94,000 Cu. Yds.

Stripping: ~~5,000 Cu. Yds.~~ Remove Overburden 4,081 Cu. Yds.
~~5,000 Cu. Yds.~~ Replace Overburden 4,081 Cu. Yds.

Haul Distance: 11.08 Miles to Sta. 1556 +00
Haul distance was checked by odometer and found to be correct.



Note: Depth of water table unknown.
Sample No. 5015
Date: 9-5-68 & 2-5-71
Sample No. 1036
Date: 6-15-71

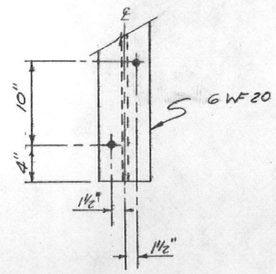
Note:
This pit previously used on Project Nos. S 0160(3); RS 0116(3); S 0002(29); S 0160(4).

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS — STATE OF COLORADO
DOH FORM NO. 117
JULY 1966

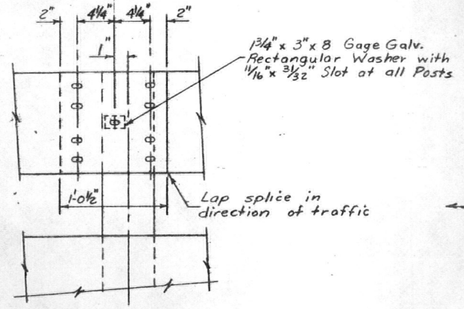
FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089 (5)	7	26

REVISIONS		

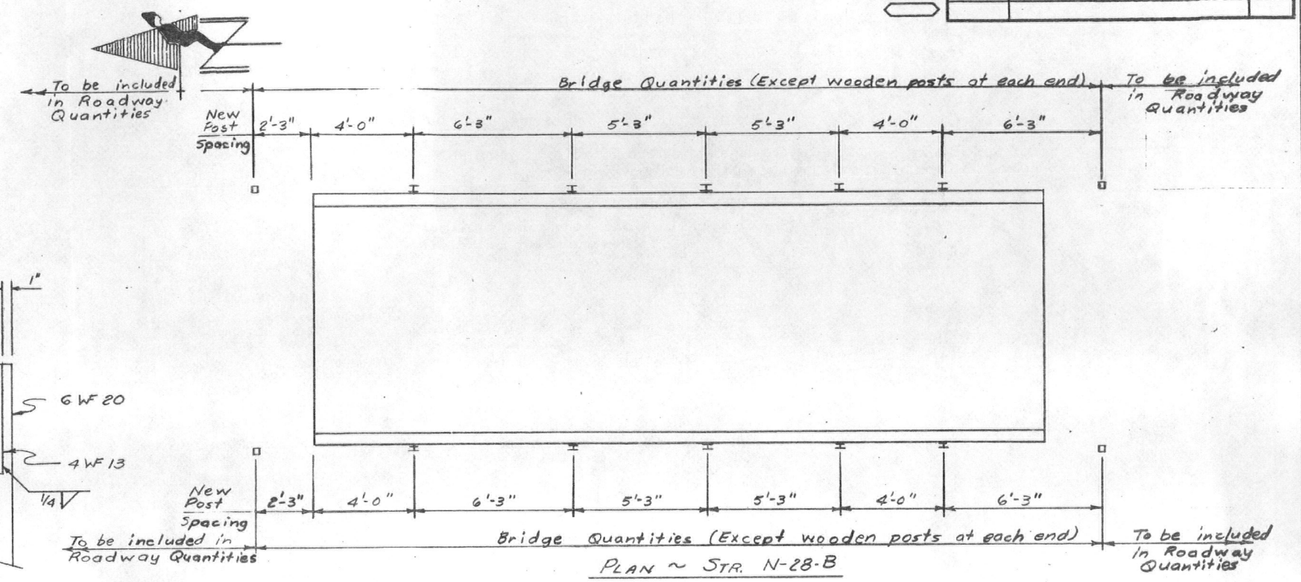
JUL 7 1972



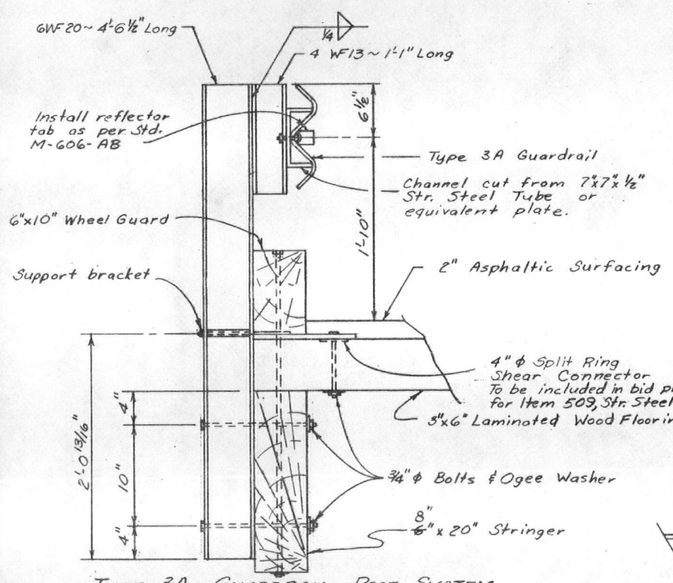
POST TO STRINGER BOLT ARRANGEMENT



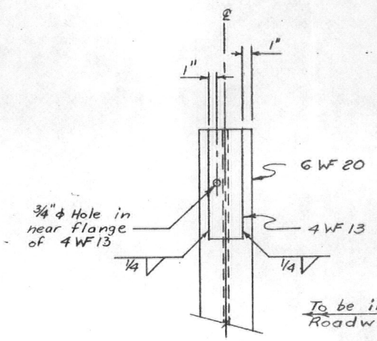
SPLICE DETAIL



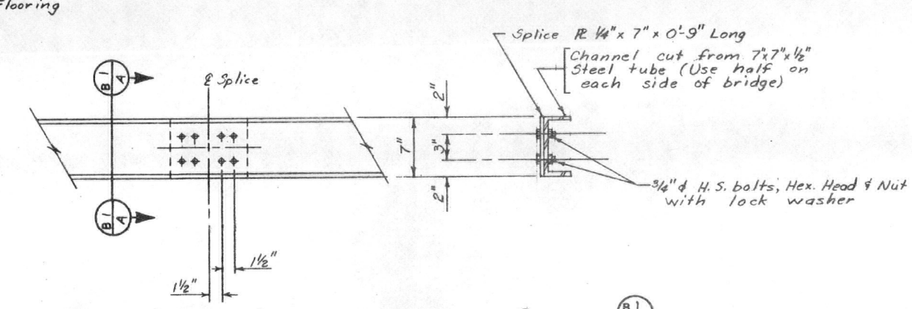
PLAN ~ STR. N-28-B



TYPE 3A GUARDRAIL POST SYSTEM

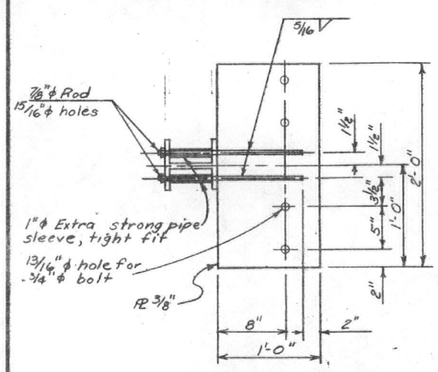


POST LOCATION OF 4WF13



TYPICAL CHANNEL SPLICE

SECTION B/A



SUPPORT BRACKET DETAIL

Item	Description	Unit	Str. N-28-B Super-structure	Str. N-28-B Totals
202	Removal of Portions of Present Str.	Ea.	1 ✓	1 ✓
509	Structural Steel (Galvanized)	Lb.	3025 ✓	3025 ✓
606	Guard Rail Type 3A	Lin. Ft.	~~67~~	~~67~~
			75 ✓	75 ✓

Included in Roadway Quantities.

General Notes
For additional details of guard rail and its installation not shown on these sheets see Std. M-606-AB.

All posts and steel elements shall be galvanized after fabrication. Field drilling of holes in existing timber stringers and laminated wood flooring to be included in the bid price of Item 509.

DIVISION OF HIGHWAYS

GUARD RAIL (TYPE 3A) CONNECTION TO EXISTING STRUCTURE

Approved: R. E. Kinnersley P.E.
Bridge Engineer
Date: Sept. 20, 1971

Designer: H. Henson
Detailer: D. Blocher
Structure Numbers: N-28-B
DWG. No. B 1 of 3

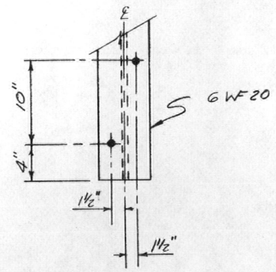
DESIGNED BY	INITIAL	DATE	CHECKED BY
CHECKED BY			QUANTITIES BY
DETAILED BY			CHECKED BY

KGE 10 7128 10-70

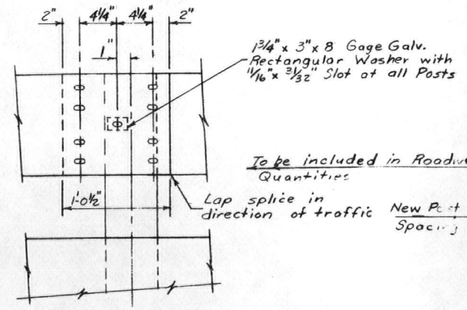
STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS — STATE OF COLORADO
DOH FORM NO. 117
JULY 1968

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	8	

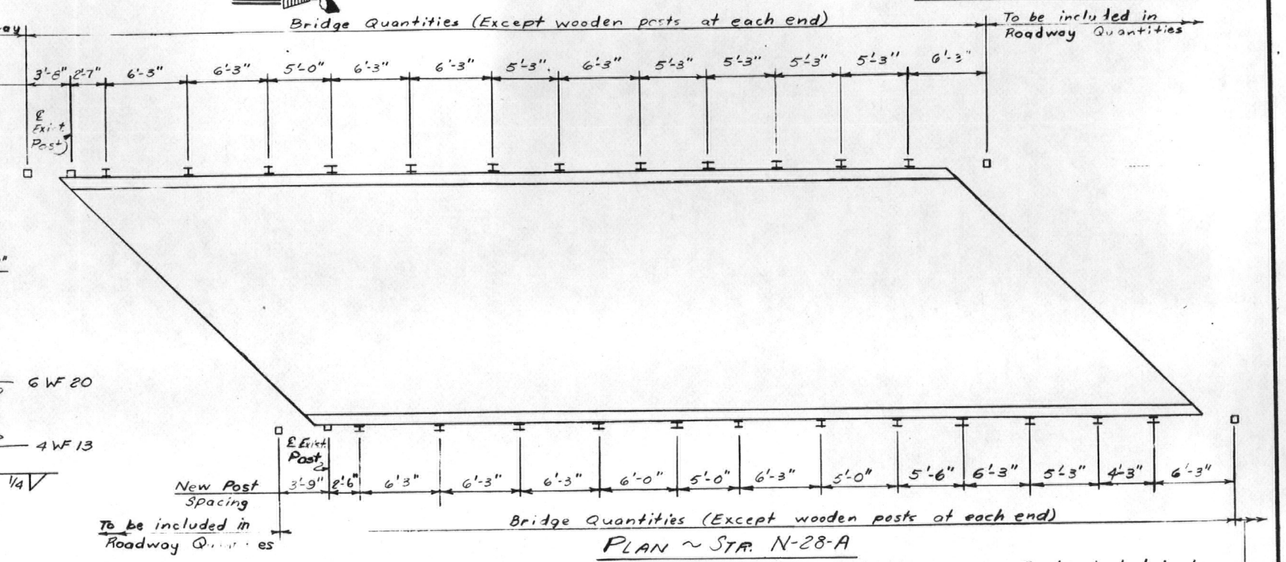
REVISIONS		



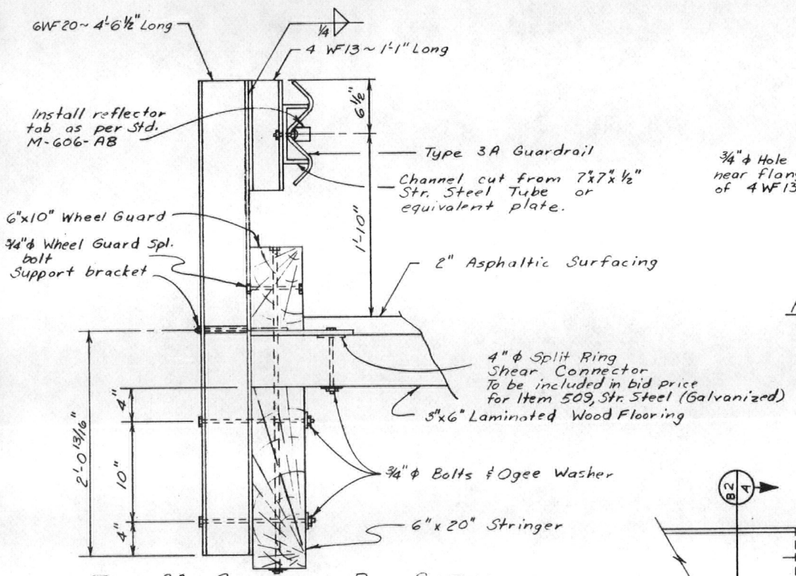
POST TO STRINGER BOLT ARRANGEMENT



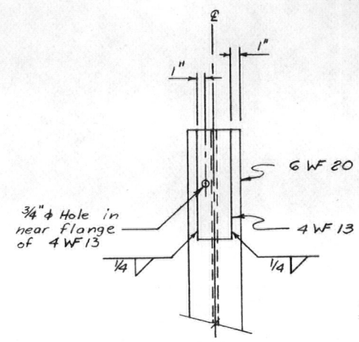
SPLICE DETAIL



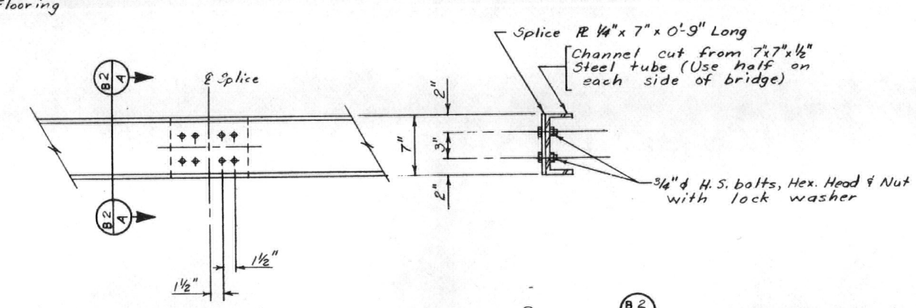
PLAN ~ STR. N-28-A



TYPE 3A GUARDRAIL POST SYSTEM



POST LOCATION OF 4WF13

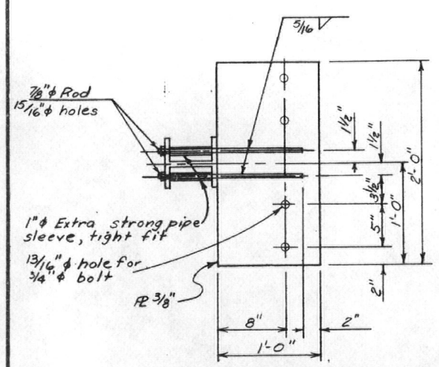


TYPICAL CHANNEL SPLICE

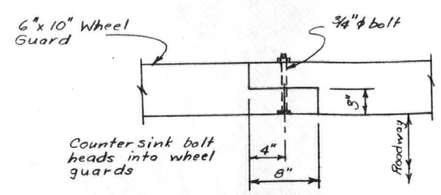
SECTION B2/A

Item	Description	Unit	Str. N-28-A Super-structure	Totals
202	Removal of Portions of Present Str.	Ea.	1	1
509	Structural Steel (Galvanized)	Lb.	7060	7060
606	Guard Rail Type 3A	Lin. Ft.	150	150

Included in Roadway Quantities.



SUPPORT BRACKET DETAIL



PLAN OF WHEEL GUARD SPLICE

General Notes
For additional details of guard rail and its installation not shown on these sheets see Std. M-606-AB.
8-¾"ϕ x 16" H.S. Bolts with Hex. Hd. and Hex. Nut is required at each stringer splice where post is removed.
All posts and steel elements shall be galvanized after fabrication.
Field drilling of holes in existing timber stringers and laminated flooring to be included in the bid price of Item 509.

INITIAL	DATE	
DESIGNED BY		CHECKED BY
CHECKED BY		QUANTITIES BY
DETAILED BY		CHECKED BY

DIVISION OF HIGHWAYS

GUARD RAIL (TYPE 3A) CONNECTION TO EXISTING STRUCTURE

Approved: P. E. Lewandy P.E.
Bridge Engineer
Date: Sept. 20, 1971

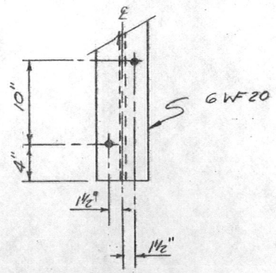
Designer: H. Henson
Detailer: D. Blacker
Structure Numbers: N-28-A
DWG. No. B 2 OF 3

K&E 10 7 1/2 X 10 7 1/2 10-70

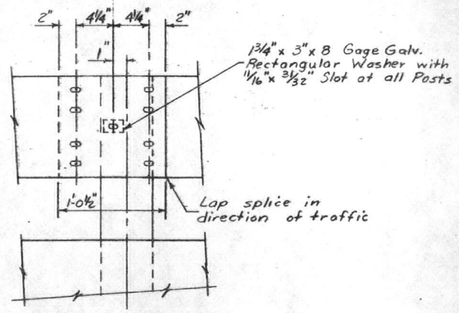
STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS — STATE OF COLORADO
DOH FORM NO. 117
JULY 1968

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	9	26

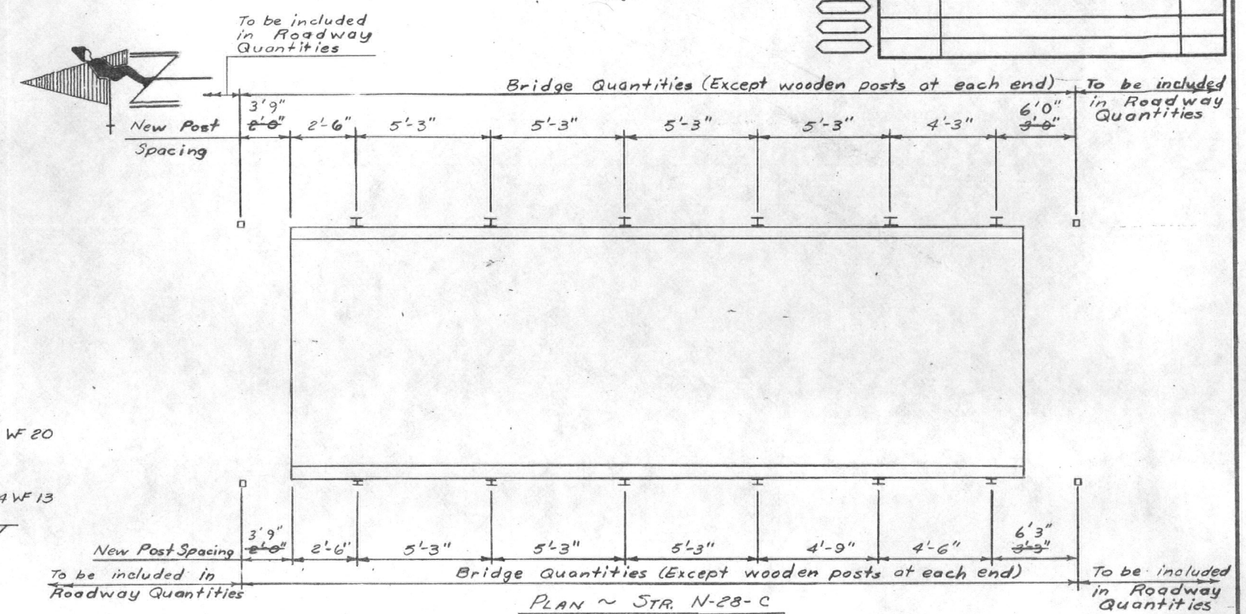
REVISIONS



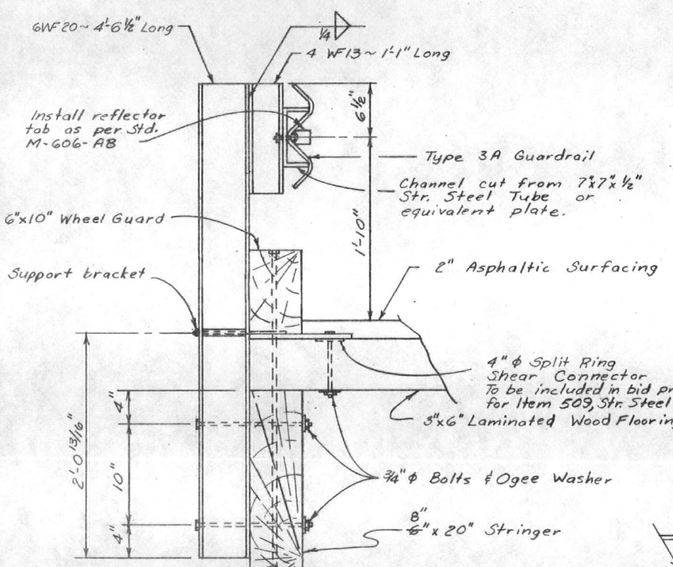
POST TO STRINGER BOLT ARRANGEMENT



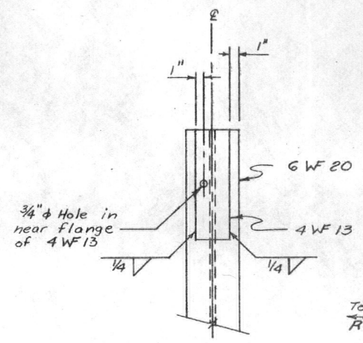
SPLICE DETAIL



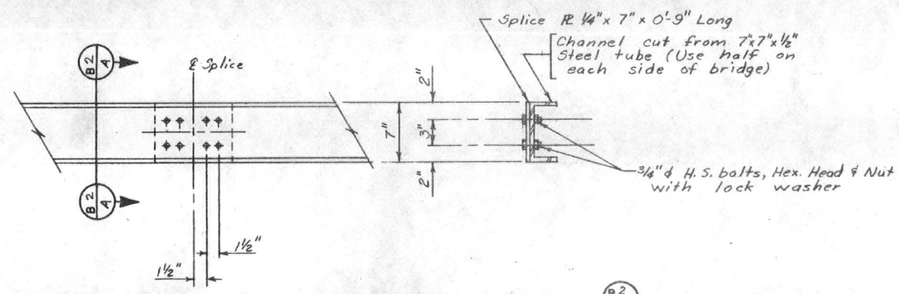
PLAN ~ STR. N-28-C



TYPE 3A GUARDRAIL POST SYSTEM



POST LOCATION OF 4WF13

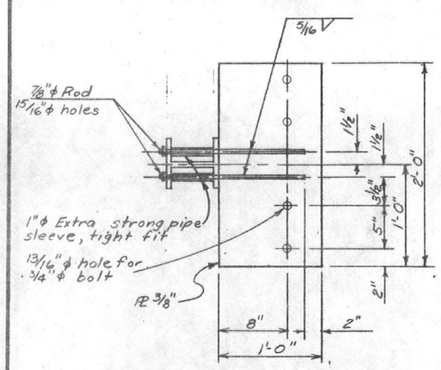


TYPICAL CHANNEL SPLICE

SECTION B2/A

Item	Description	Unit	Str. N-28-C Super-structure	Totals
202	Removal of Portions of Present Str.	Ea.	1	1
509	Structural Steel (Galvanized)	Lb.	332.0	332.0
606	Guard Rail Type 3A	Lin. Ft.	~~66~~	~~66~~
			75	75

Included in Roadway Quantities.



SUPPORT BRACKET DETAIL

General Notes
For additional details of guard rail and its installation not shown on these sheets see Std. M-606-AB.

All posts and steel elements shall be galvanized after fabrication.
Field drilling of holes in existing timber stringers and laminated wood flooring to be included in the bid price of Item 509.

DIVISION OF HIGHWAYS

GUARD RAIL (TYPE 3A) CONNECTION TO EXISTING STRUCTURE

Approved: R. L. Shwarsky P.E.
Bridge Engineer
Date: Sept 20, 1971

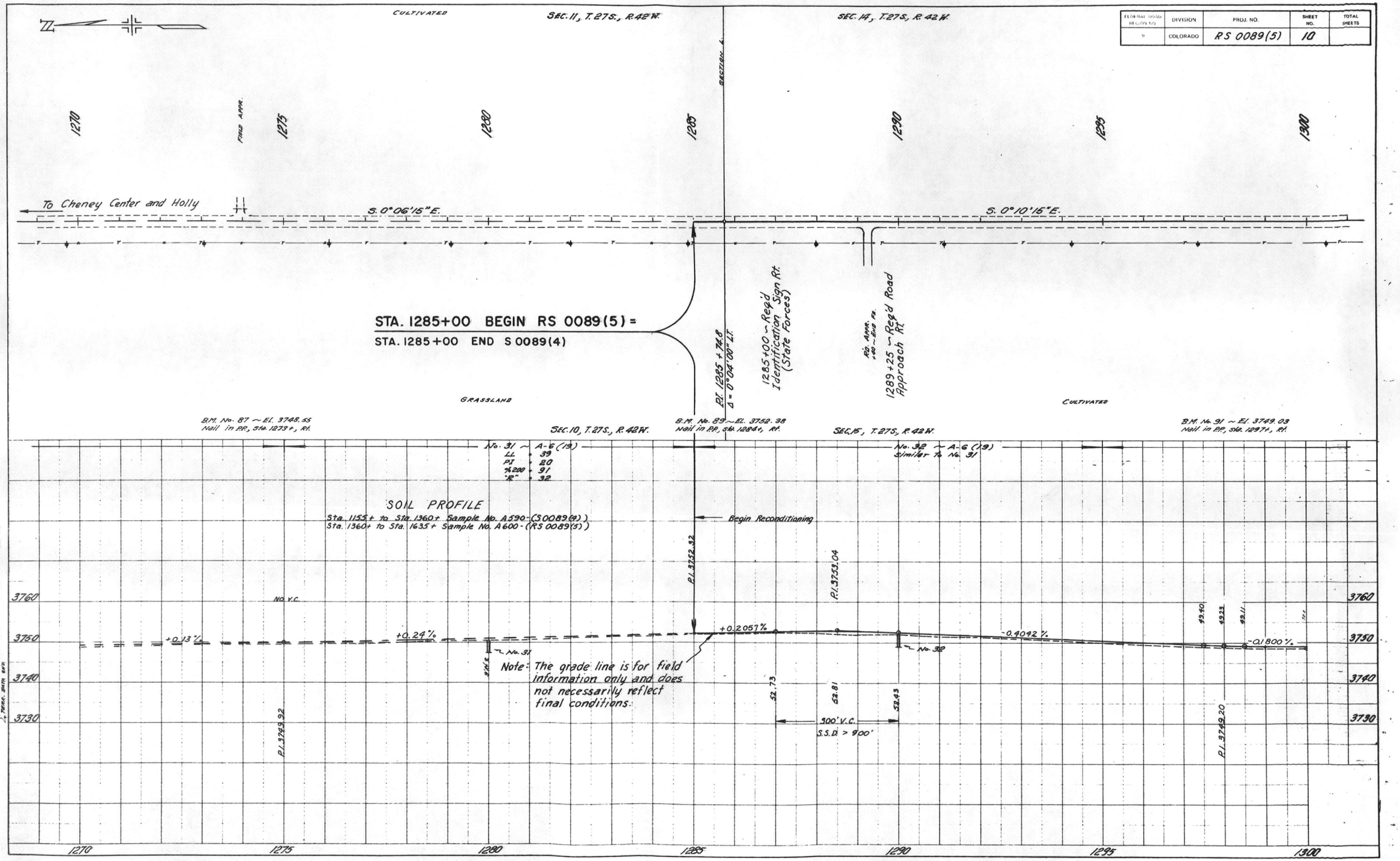
Designer: H. Henson | Detailer: D. Blacker
Structure Numbers: N-28-C
DWG. No. B 3 OF 3

INITIAL	DATE	
DESIGNED BY		CHECKED BY
CHECKED BY		QUANTITIES BY
DETAILED BY		CHECKED BY

K&E 10 7102 10-70

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS STATE OF COLORADO
D.O.H. FORM NO. 134
JULY 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	10	

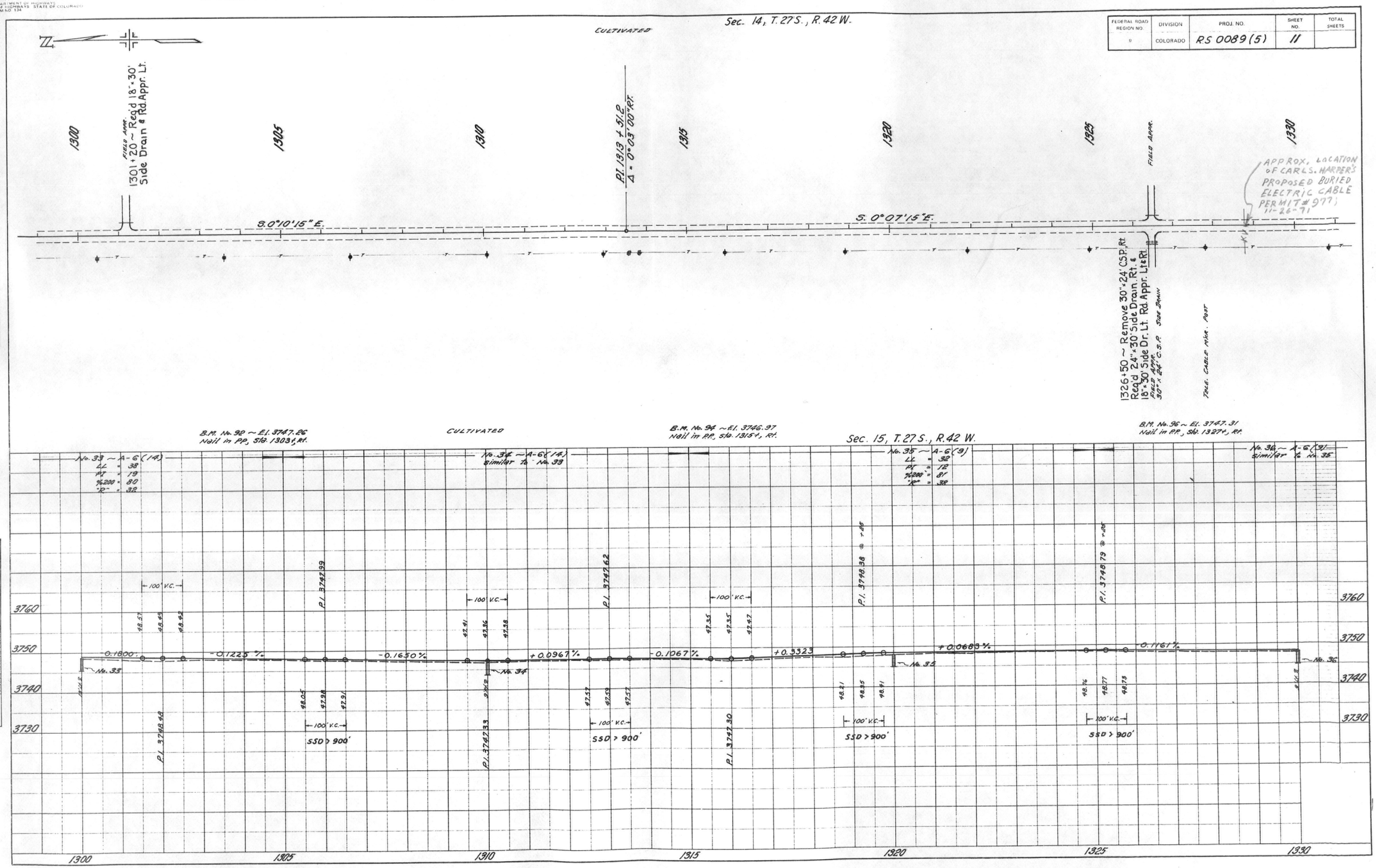


PLAN
NOTE BOOK
No. 3456
SURVEYED
PLOTTED
ALIGNMENT CHECKED
R. O. W. CHECKED
DATE
BY

PROFILE
NOTE BOOK
No.
SURVEYED
PLOTTED
GRADES CHECKED
R. R. X. NOTED
STRUCTURE NOTATIONS CHECKED
DATE
BY

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS STATE OF COLORADO
D.O.H. FORM NO. 134
JULY 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	R.S 0089(5)	11	

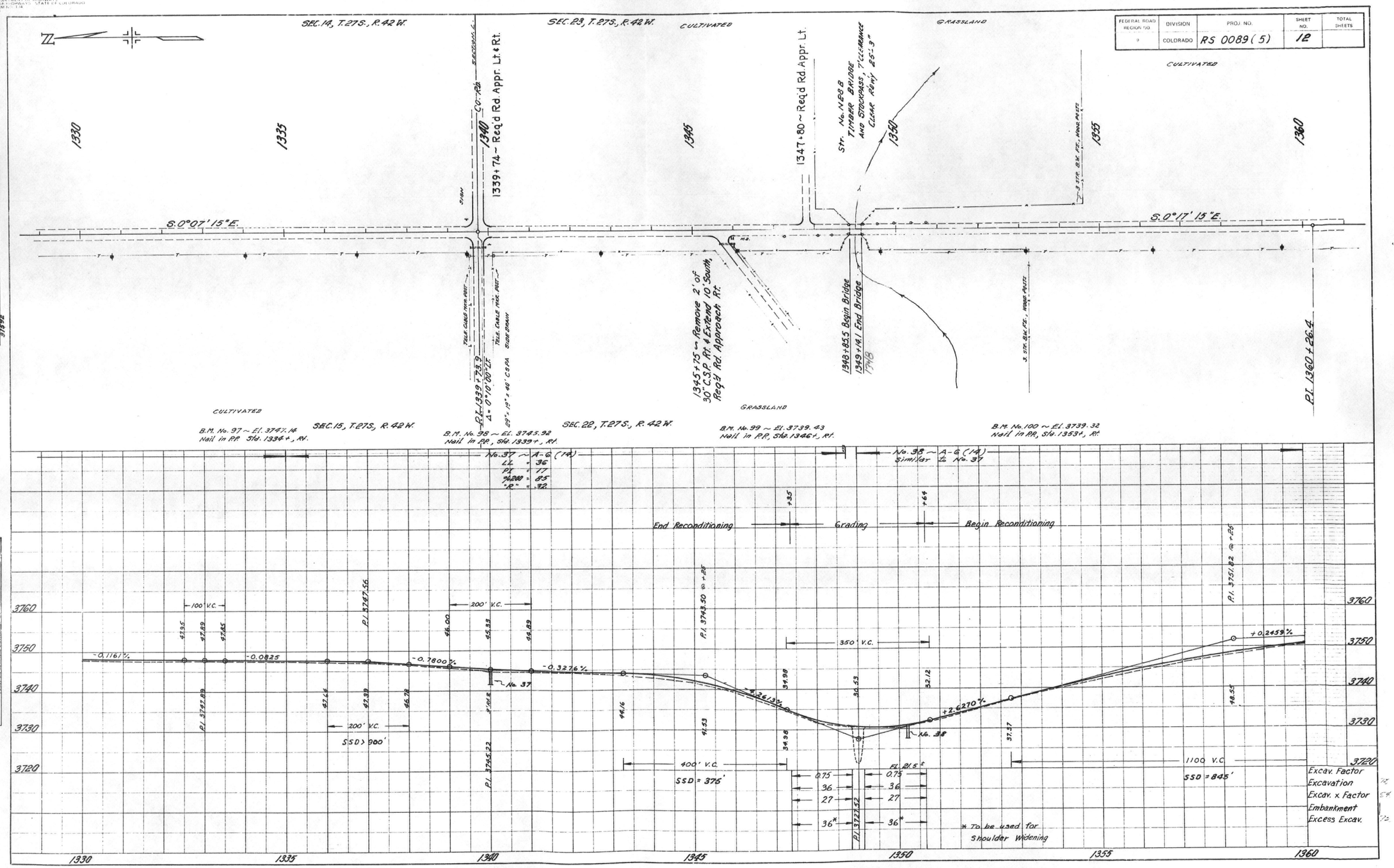


PLAN
NOTE BOOK No. 3438
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
DATE
BY

PROFILE
NOTE BOOK No.
SURVEYED
PLOTTED
GRADES CHECKED
R. W. NOTED
CURB/CURB NOTATIONS CHECKED
DATE
BY

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS, STATE OF COLORADO
D.O.H. FORM NO. 1-14
JULY, 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	12	

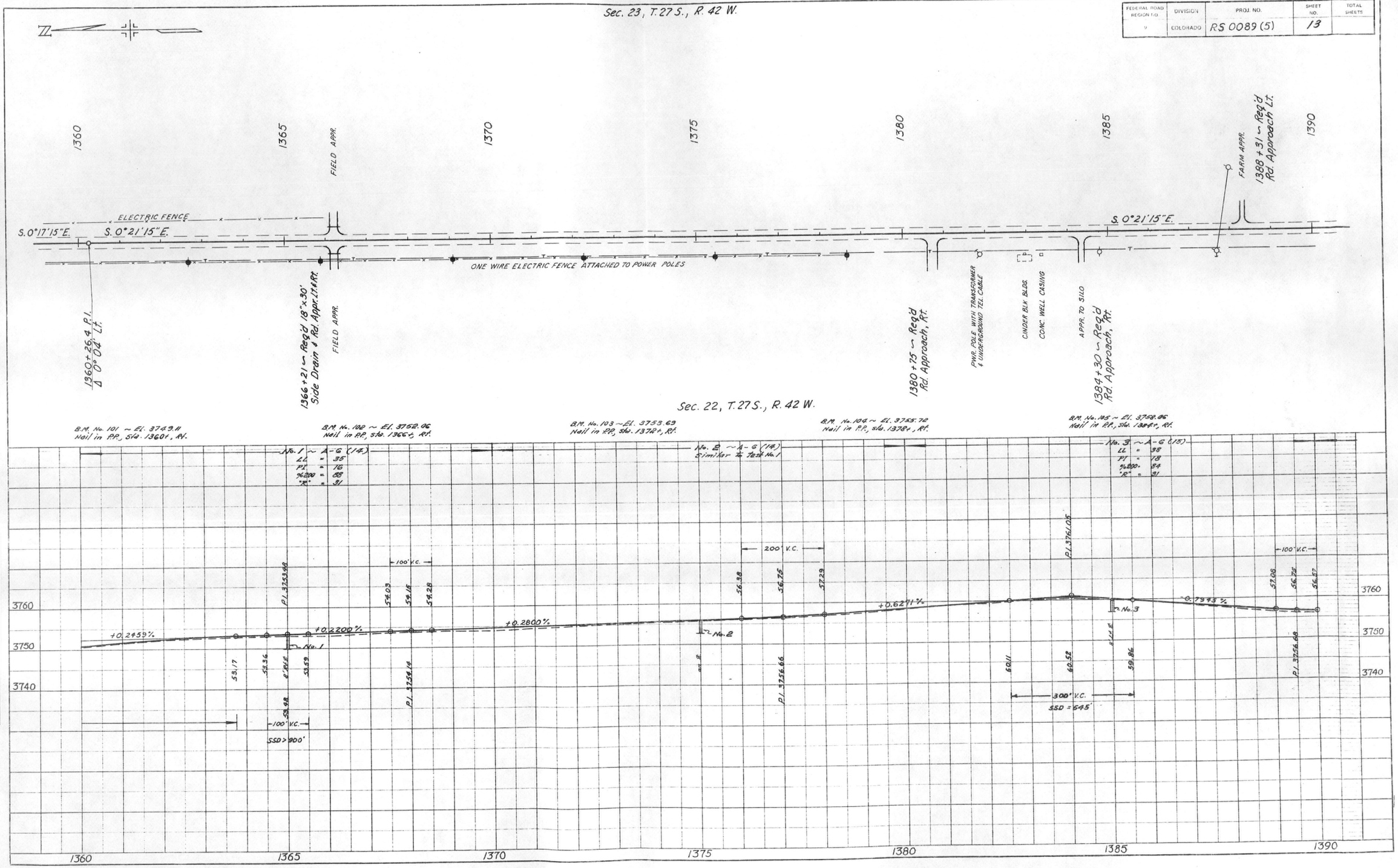


PLAN	SURVEYED:	BY	DATE
NOTE BOOK No. 3432 3798	PLOTTED:	G.E.D.	2-70
	ALIGNMENT CHECKED:		
	RT. OF WAY CHECKED:		

PROFILE	SURVEYED:	BY	DATE
NOTE BOOK No.	PLOTTED:		
	GRADES CHECKED:		
	B.M.'S NOTED:		
	STRUCTURE NOTATIONS CHECKED:		

STATE OF COLORADO
DIVISION OF HIGHWAYS
D.O.H. FORM NO. 134
JULY, 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089 (5)	13	



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PROFILE
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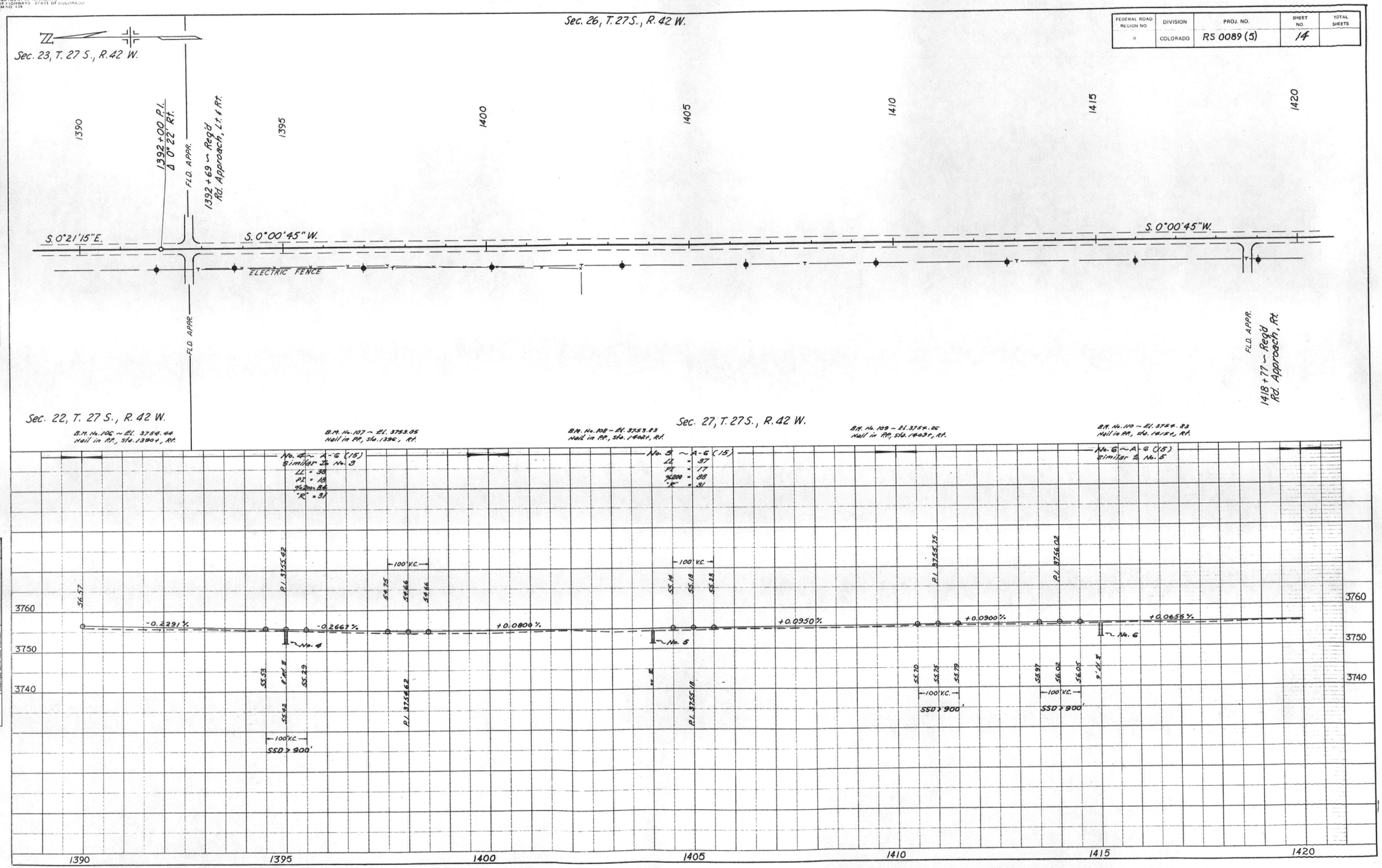
NOTE BOOK PROFILE CHECKED
B. M.'s NOTED
No. STRUCTURE NOTATIONS CHECKED

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS STATE OF COLORADO
D.O.H. FORM NO. 134
JULY, 1968

FEDERAL ROAD REGION NO	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089 (5)	14	



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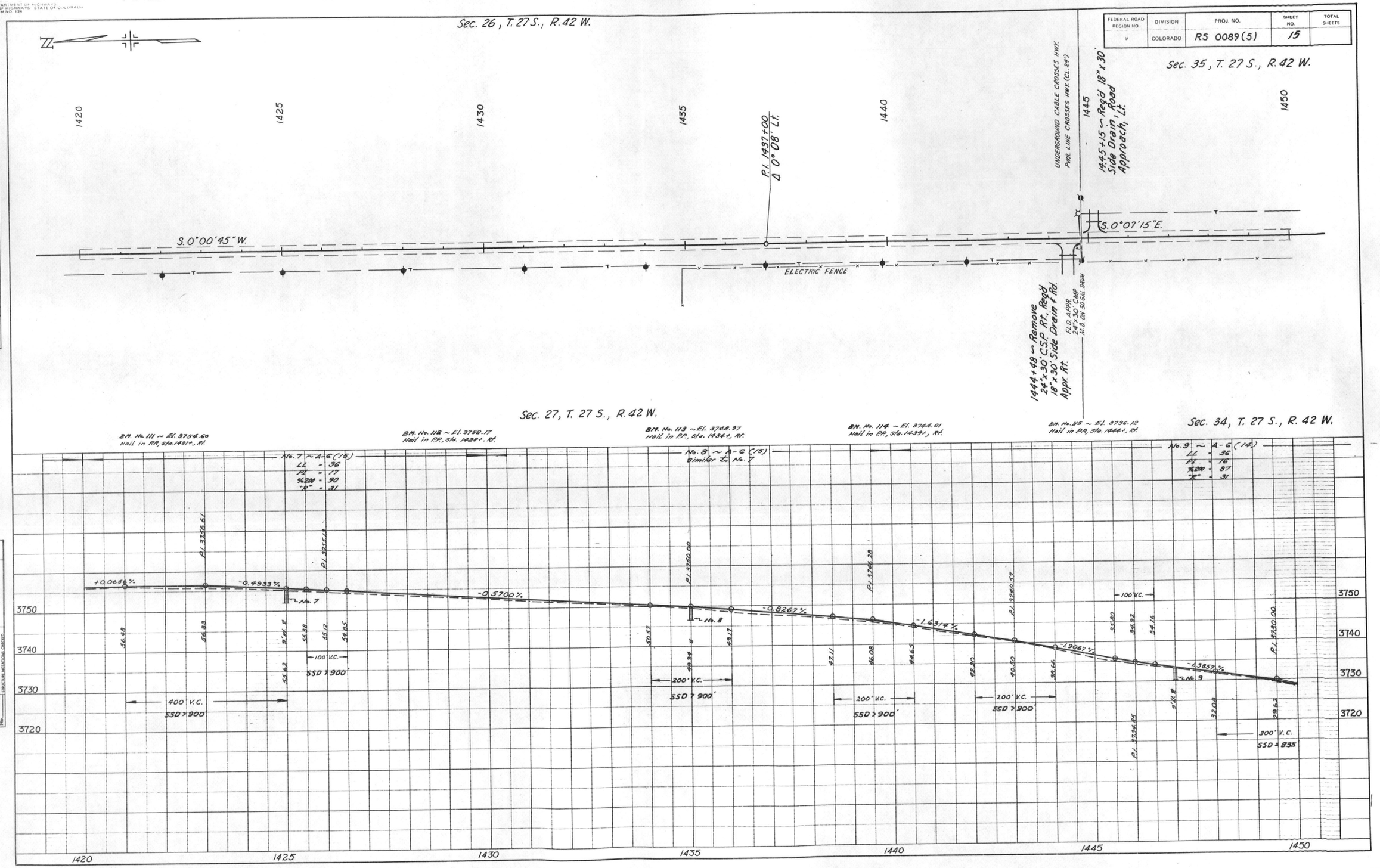
ALIGNMENT CHECKED
RT. OF WAY CHECKED
BY
DATE

PROFILE
NOTE BOOK No.
SURVEYED
PLOTTED
GRADES CHECKED
B.M.'s NOTED
STRUCTURE NOTATIONS CHECKED
BY
DATE

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS STATE OF COLORADO
U.D.M. FORM NO. 134
JULY, 1958

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	15	



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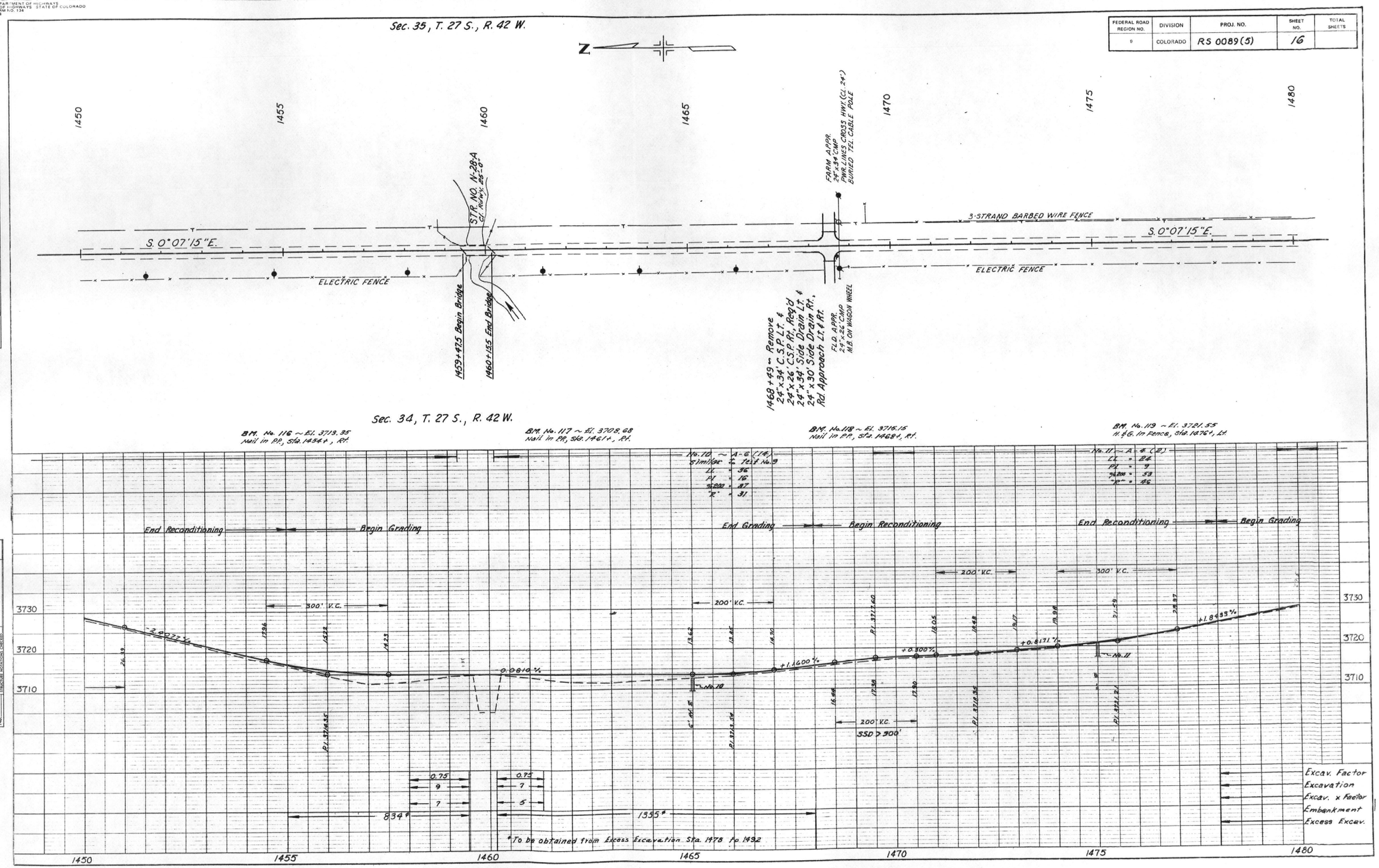
NOTE BOOK	PLOTTED.		
No. 1582	ALIGNMENT CHECKED.		
	RI. OF WAY CHECKED.		

PROFILE	SURVEYED.	BY	DATE
NOTE BOOK	PLOTTED.		
	GRADES CHECKED.		
No.	R.O.W. PLOTTED.		
	STRUCTURE NOTATIONS CHECKED.		

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS STATE OF COLORADO
D.O.H. FORM NO. 134
JULY, 1958

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	16	



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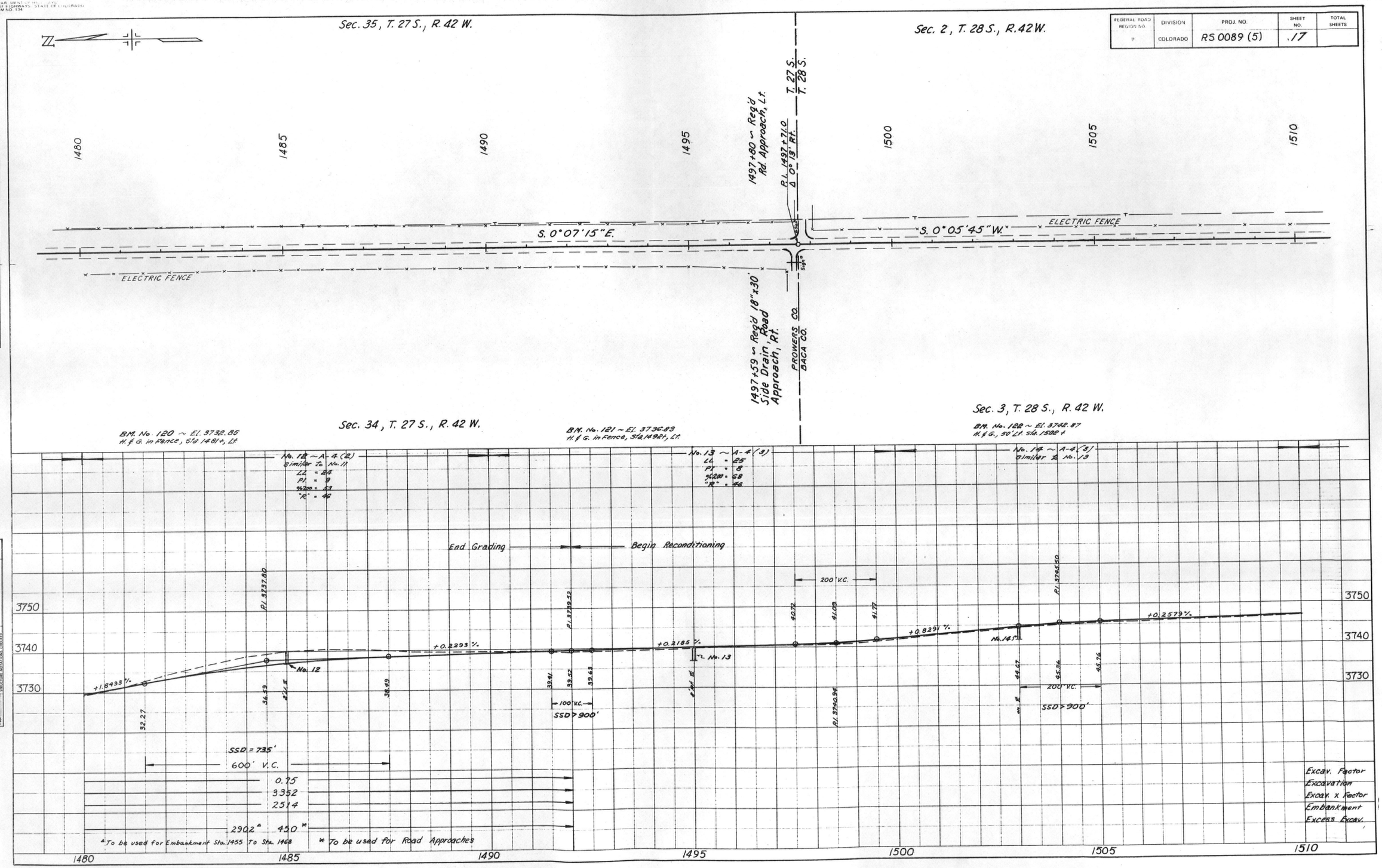
PLOTTED.
ALIGNMENT CHECKED.
RT. OF WAY CHECKED.
BY
DATE

PROFILE
NOTE BOOK No.
SURVEYED.
PLOTTED.
GRADES CHECKED.
R.O.W. CHECKED.
STRUCTURE NOTATIONS CHECKED.
BY
DATE

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS, STATE OF COLORADO
D.O.H. FORM NO. 134
JULY, 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089 (5)	17	



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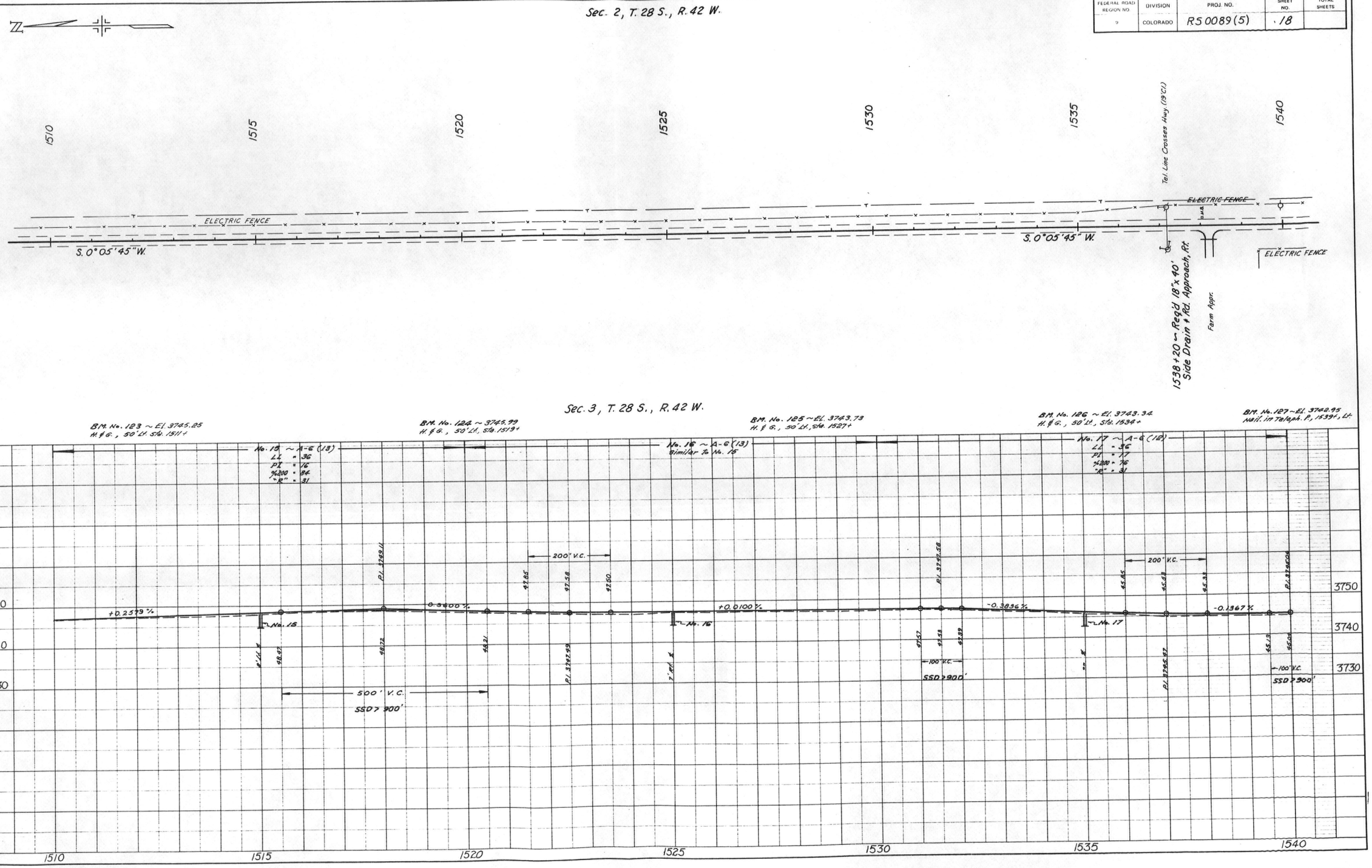
NOTE BOOK
No. 2998
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
BY
DATE

PROFILE
NOTE BOOK
No.
SURVEYED
GRADES CHECKED
PLOTTED
STRUCTURE NOTATIONS CHECKED
BY
DATE

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS STATE OF COLORADO
D.O.H. FORM NO. 134
JULY, 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	18	



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NOTE BOOK
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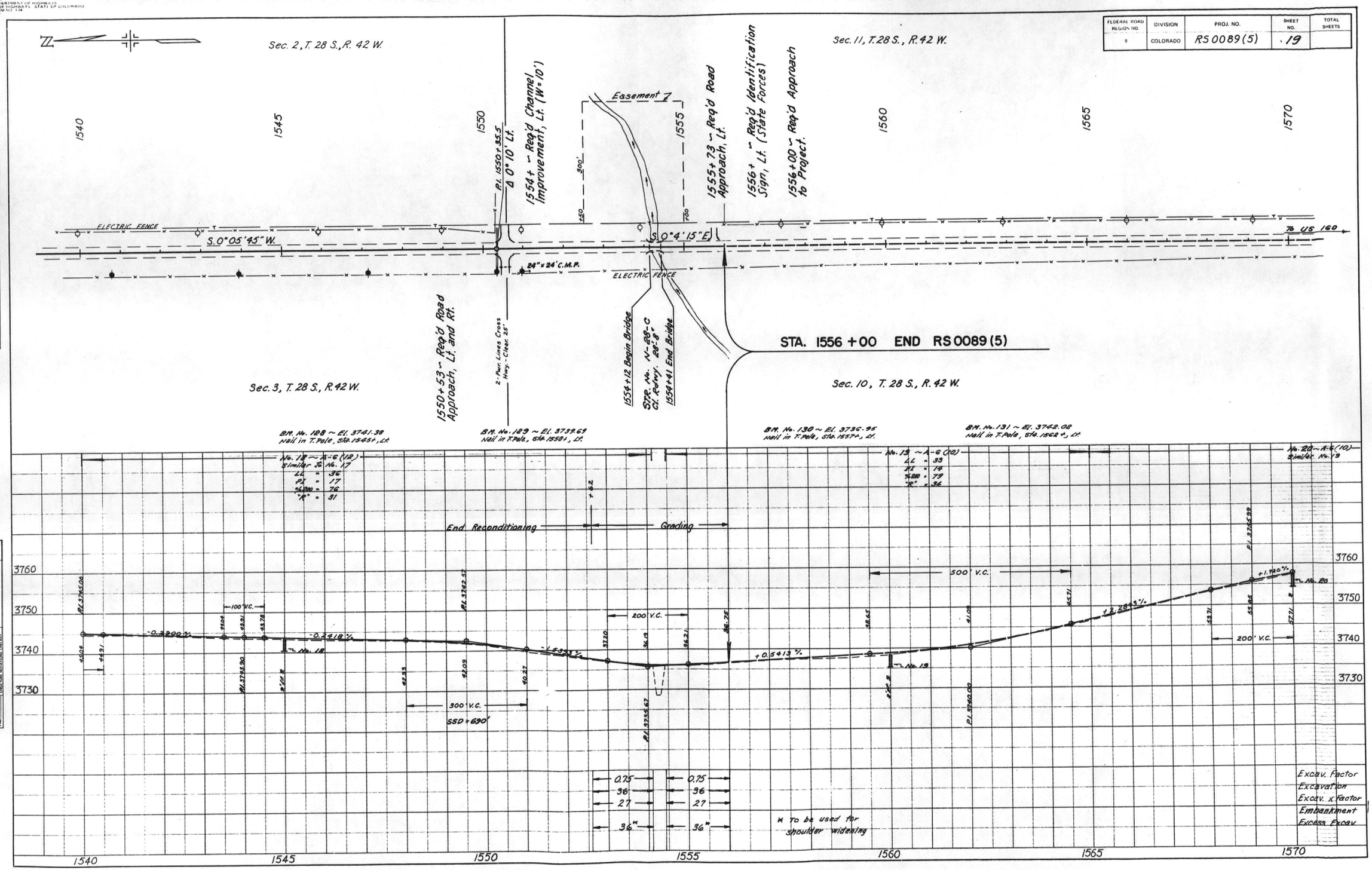
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
BY
DATE

PROFILE
NOTE BOOK
No.
SURVEYED
PLOTTED
GRADES CHECKED
R. W. V. NOTED
STRUCTURE NOTATIONS CHECKED
BY
DATE

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS STATE OF COLORADO
D.O.H. FORM NO. 136
JULY, 1968

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	RS 0089(5)	19	



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NOTE BOOK No. 1572
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
BY
DATE

PROFILE
NOTE BOOK No.
SURVEYED
PLOTTED
GRADES CHECKED
R.R. CROSSING
STRUCTURE NOTATIONS CHECKED
BY
DATE

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

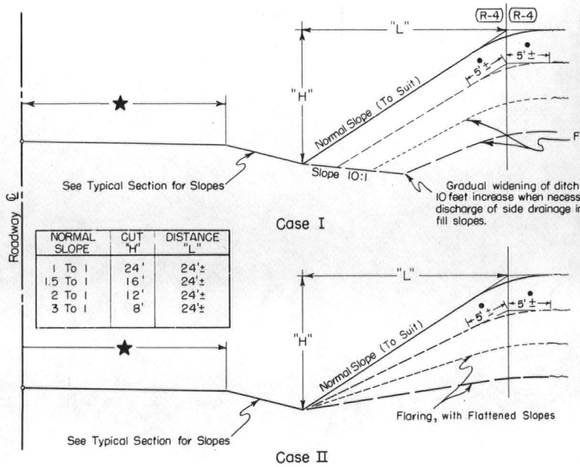
STANDARD M-203-B

(JULY 1, 1965)

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

REVISIONS			
(R-1)	2-6-68	Median Cross Over	MRH
(R-2)	7-30-68	Dept. Name	MRH
(R-3)	4-1-69	Widening for Guard Rail	M.R.H.
(R-4)	4-27-70	Cut Slope and Note	M.R.H.

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



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

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

Flaring, with widened ditch.

• CUT SLOPE TREATMENT IN EARTH CUTS: The intersection of cut slopes with the existing ground shall be rounded in earth cuts, beginning outside the slope stake and extending down the cut slope. The exact dimension will be determined by the Engineer based on the type of material encountered.

Quantities shall be included in "Unclassified Excavation".

★ WIDENING AT BRIDGE APPROACHES: Roadway embankment at bridge approaches shall be so constructed that base of surfacing at shoulder point is a minimum of 2 ft. beyond the edge of bridge deck. Where widening is necessary to achieve this result it shall take place gradually over a distance of 300 ft.

(R-4)

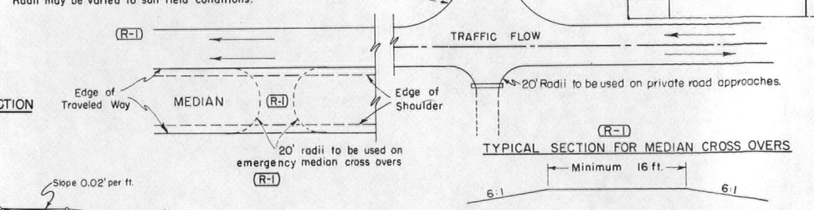
WIDENING FOR BITUMINOUS CURB (Only where Guard Rail is required); See appropriate M-Standard for Guard Rail. (R-3)

TYPICAL PLANS FOR SIDE APPROACH ROADS AND EMERGENCY MEDIAN CROSS OVERS

(R-1)

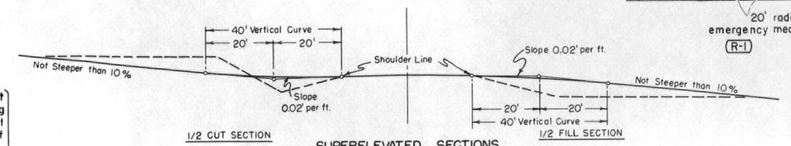
Where practical Side Drains are to be placed in line with the roadway ditches.

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

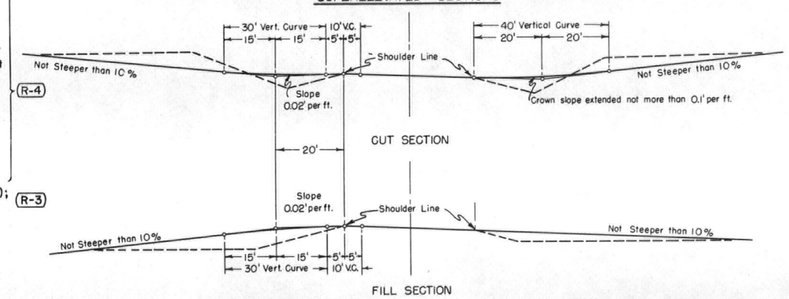


TYPICAL SECTION FOR MEDIAN CROSS OVERS (R-1)

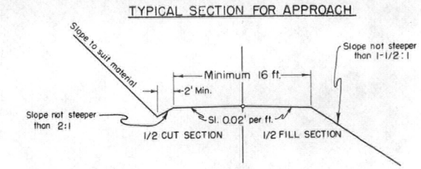
STANDARD CROWNED SECTION



SUPERELEVATED SECTIONS



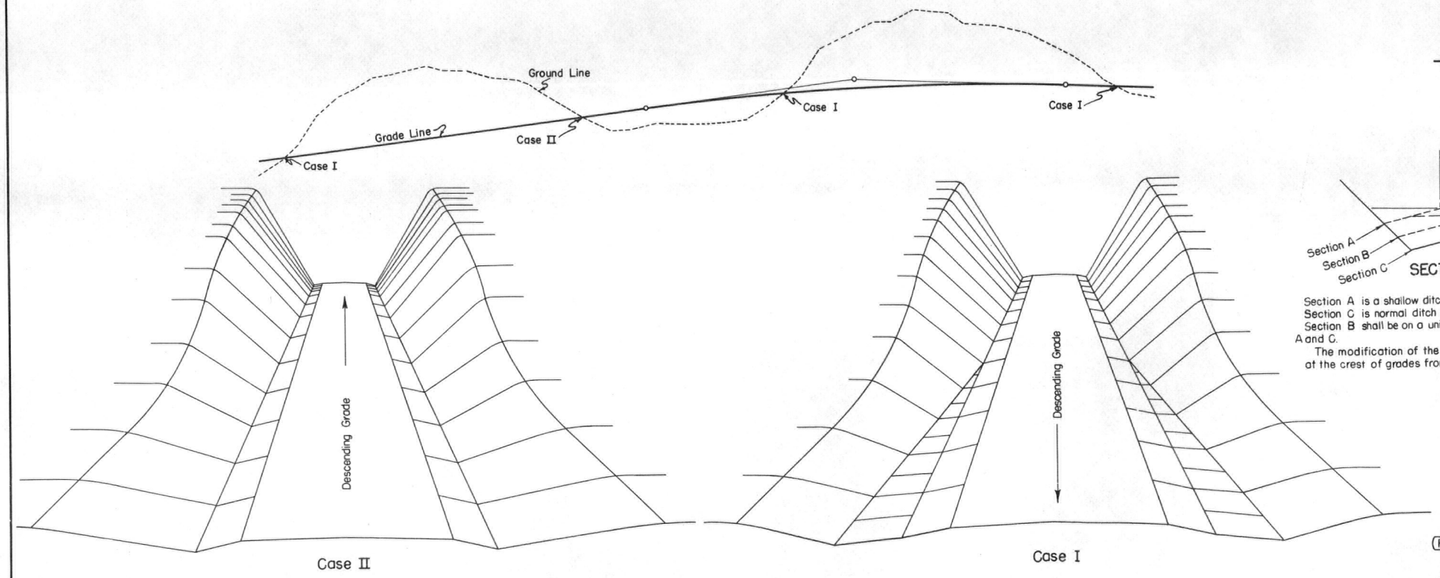
TYPICAL SECTION FOR APPROACH



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.

PLAN OF FLARING IN EARTH CUTS

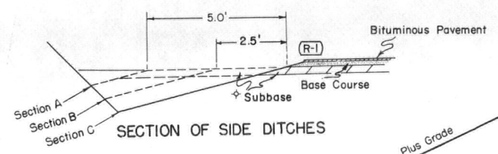
(R-4)



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)

✧ To be constructed thru widened sections when called for on plans for normal roadway section.



SECTION OF SIDE DITCHES

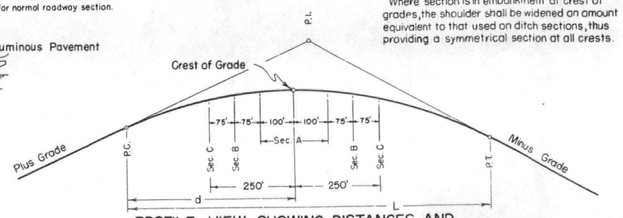
Section A is a shallow ditch section.
Section C is normal ditch section.
Section B shall be on a uniform transition between Sections A and C.
The modification of the ditch indicated shall be used only at the crest of grades from which drainage breaks both ways.

Formula for finding the Crest of Grade

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

NOTE

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



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

GENERAL NOTES

(R-2)

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 flatter than the maximum shown are to be used wherever feasible. (R-4)

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

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

Designed by A.Z.
Made by S.J.M. & A.B.H.
Checked by C.R.S.

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

STANDARD TYPES *of* DITCHES *and* CONSTRUCTION METHODS

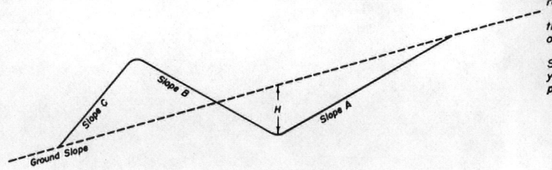
STANDARD M-203-C

(JULY 1, 1965)

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

DETAILS *for* CONTOUR INTERCEPTING DITCHES

Typical Section for Contour Intercepting Ditches



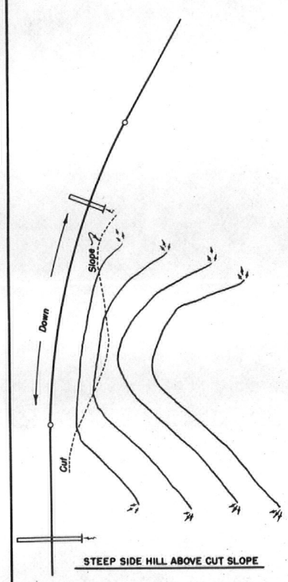
PURPOSE & USE OF THE TABLE

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

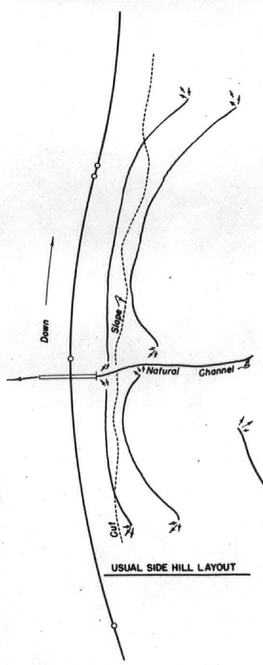
Foremost consideration in constructing these ditches is given first to the natural ground line slope confronted in construction, thence to the other values shown on the Typical Section.

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

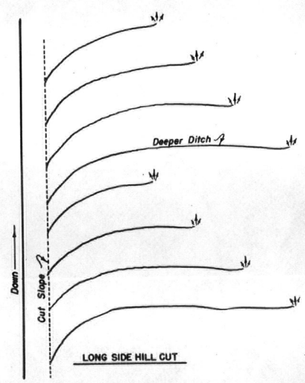
Typical Construction Layouts



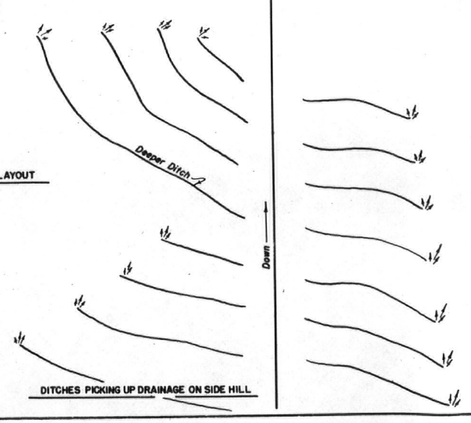
STEEP SIDE HILL ABOVE CUT SLOPE



USUAL SIDE HILL LAYOUT



LONG SIDE HILL CUT



DITCHES PICKING UP DRAINAGE ON SIDE HILL

Scale of Sketches in Feet

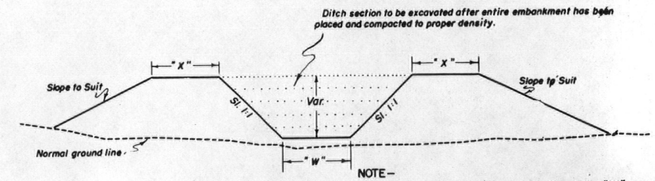
100 0 100 200 300 400

Table of Slopes and Yardages

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

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

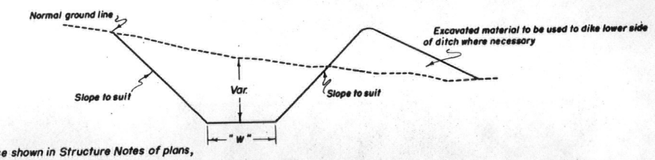
TYPICAL SECTIONS *for* DRAINAGE, IRRIGATION DITCHES *and* CHANNEL CHANGES



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

For Embankment Sections

(Generally for use in Irrigation Ditches & Channel Changes)



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

For Cut Sections

REVISIONS			
(R-1)	7-23-68	Dept. Name	M.R.H.

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 (R-1)

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
DIVISION OF HIGHWAYS

DITCH TYPES

Designed by C.G.M.	Approved by L. E. Olson
Made by C.G.M.	Staff Design Engr.
Checked by	Date: July 1, 1965

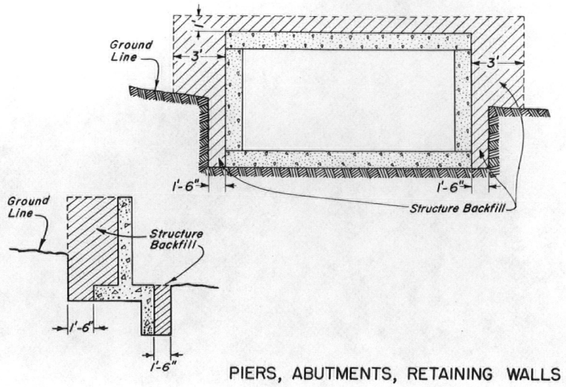
STANDARD M-206-AA

(MARCH 1, 1971)
(SHEET 1 OF 2)

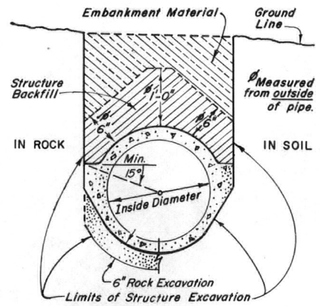
FED. ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLO.		

REVISION		

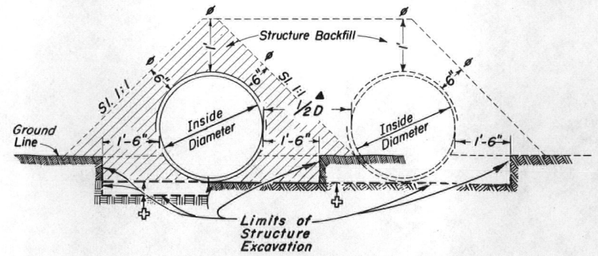
CONCRETE BOX CULVERTS & WINGWALLS



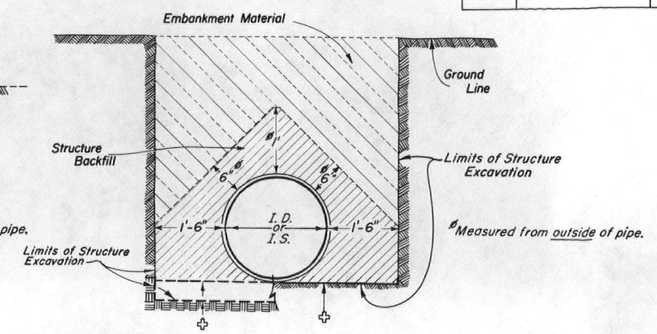
CAST IN PLACE CONDUIT



CIRCULAR CONDUIT

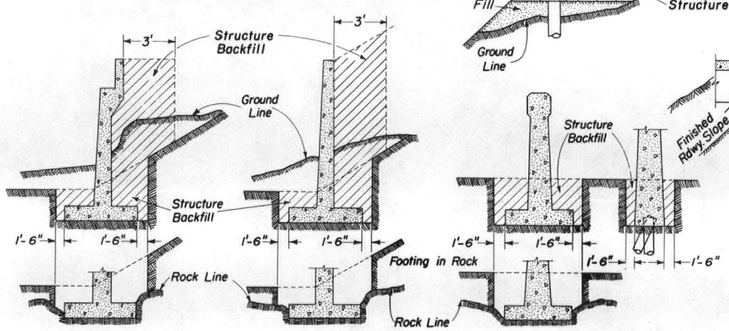


SIPHONS OR CONDUIT IN TRENCH

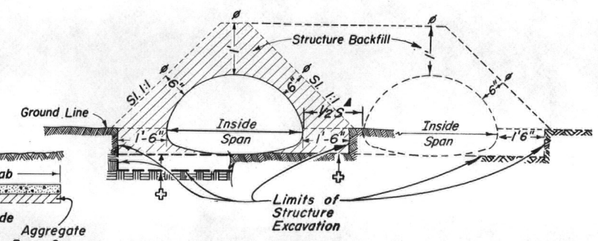


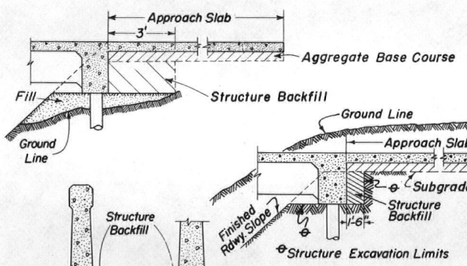
PIERS, ABUTMENTS, RETAINING WALLS ETC.

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.

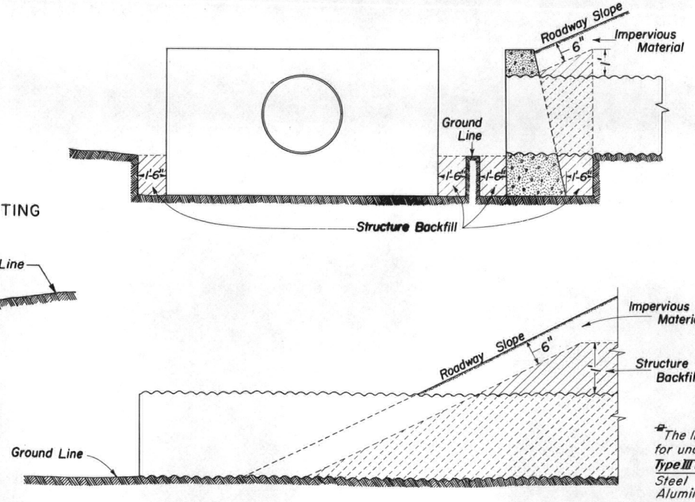


ELLIPTICAL OR ARCH CONDUIT

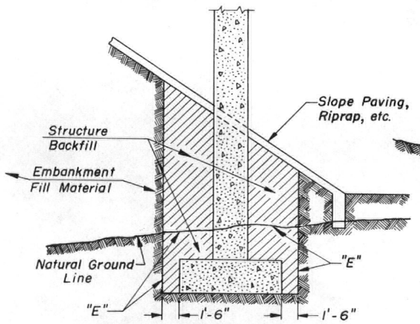




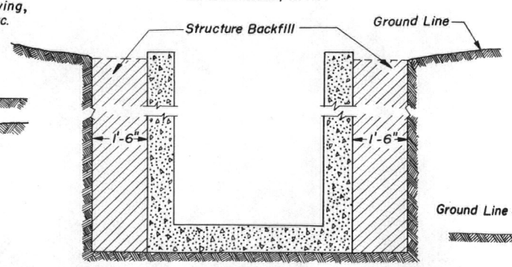
HEADWALLS AND END OF CULVERTS



DROP INLETS, DIVISION BOXES, INTERCEPTING HEADWALLS, ETC.



Note:
"E" = Limits of Structure Excavation



NOTES:

▲ *When two or more conduits are laid side by side they shall be spaced so that the adjacent pipes will be ½I.D., ½I.S. or 3 feet apart (including wall thickness), whichever is less. Minimum spacing shall be not less than 1 foot between outside walls of pipe.*

For additional culvert installation details see M Standards for metal, concrete, or structural plate pipe culverts.

✠ *Bottom of trench as excavated. For applicable limits of Structure Excavation, see bedding details on standards for culverts.*

GENERAL NOTES

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

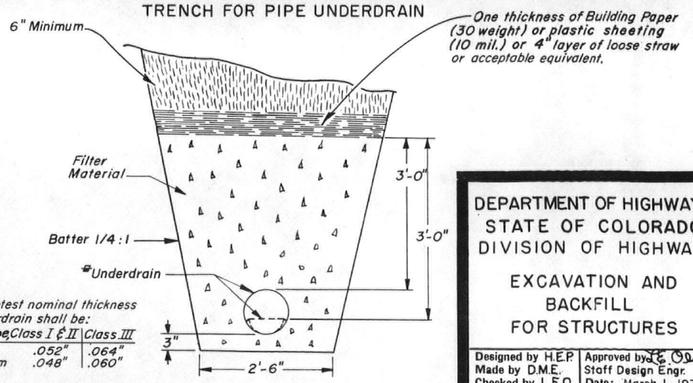
Where the roadway cross section is in fill, excavation for concrete footings (except those in rock or those on piles) and for box culverts shall be done according to the following:

Embankment shall be built up and compacted to a point one foot above the bottom of the box or one foot above the bottom 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.*

TRENCH FOR PIPE UNDERDRAIN



*The lightest nominal thickness for underdrain shall be:

Type III Pipe	Class I & II	Class III
Steel	.052"	.064"
Aluminum	.048"	.060"

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

EXCAVATION AND BACKFILL FOR STRUCTURES

Designed by H.E.P.	Approved by J. E. Olsen
Made by D.M.E.	Staff Design Engr.
Checked by L.E.O.	Date: March 1, 1971

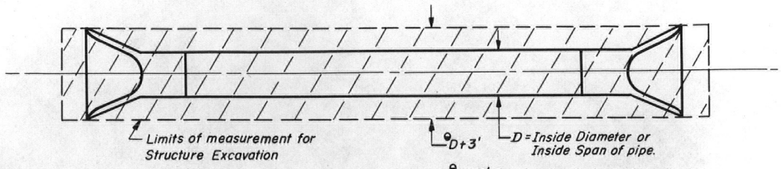
STANDARD M-206-AA

(MARCH 1, 1971)
(SHEET 2)

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

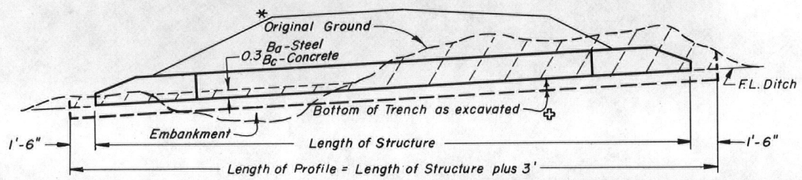
	REVISIONS:	

STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS



PLAN

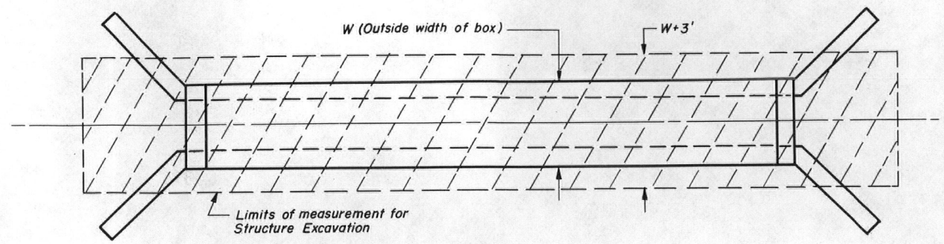
*D+6' for structural plate pipe culverts.



PROFILE

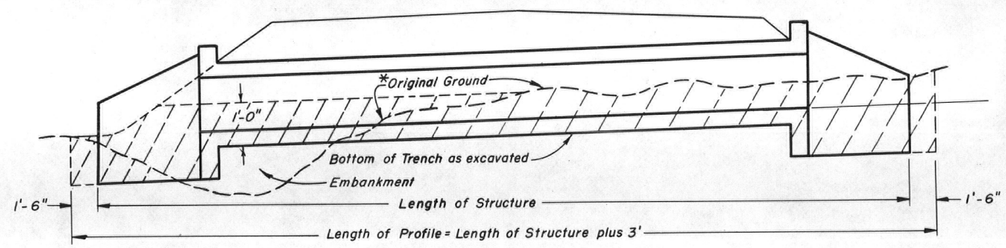
✠ For applicable limits of Structure Excavation, see bedding details on standards for metal, reinforced concrete and structural plate pipe culverts.

STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS



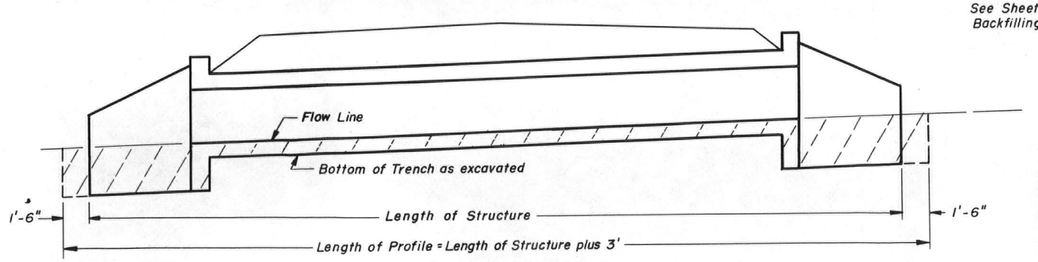
PLAN

Without Channel Change or Channel Improvement



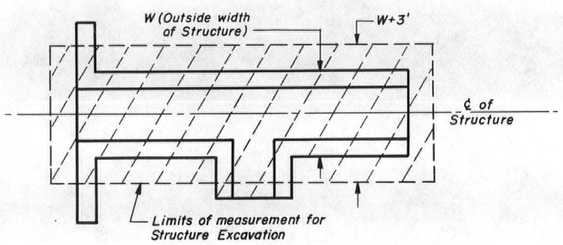
PROFILE

With Channel Change or Channel Improvement

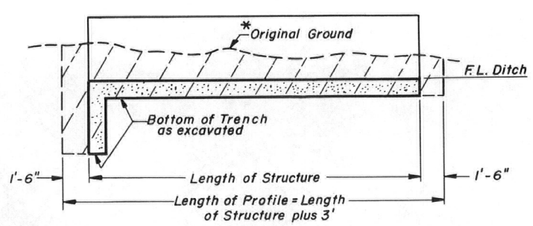


PROFILE

STRUCTURE EXCAVATION MEASUREMENT FOR DIVERSION OR DIVISION BOXES



PLAN



PROFILE

* Along ℄ 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
DIVISION OF HIGHWAYS

EXCAVATION AND BACKFILL FOR STRUCTURES

Designed by: M.R.H. Made by: H.P.B. Checked by:	Approved by: J.E. Olson Staff Design Engr. Date: March 1, 1971

STANDARD M-603-M

(MARCH 20, 1967)

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

REVISIONS			
R-1	4-5-68	Added notes.	M.R.H.
R-2	7-23-68	Dept. Name. & Ø Note	M.R.H.
R-3	2-11-71	Thickness Tables, General Notes.	M.R.H.

FILL HEIGHT & THICKNESS TABLES FOR METAL CULVERT PIPE (RIVETED, WELDED OR HELICAL FABRICATION) (R-3)

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

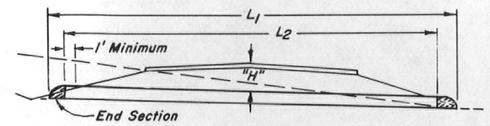
PIPE SIZE (B_d) Inches	AREA (Sq.Ft.)	HEIGHT OF FILL OVER TOP OF PIPE IN FEET														
		1 to 10	10+ to 15	15+ to 20	20+ to 25	25+ to 30	30+ to 35	35+ to 40	40+ to 45	45+ to 50	50+ to 55	55+ to 60	60+ to 70	70+ to 80	80+ to 90	90+ to 100
		THICKNESS IN INCHES														
12	0.8	.064	.064	.064	.064	.064	.064	.064	.064	.064	.064	.064	.064	.079	.109	
15	1.2	.064	.064	.064	.064	.064	.064	.064	.064	.064	.064	.064	.079	.109	.109	.138
18	1.8	.064	.064	.064	.064	.064	.064	.064	.064	.079	.079	.109	.109	.138	.168	
24	3.1	.064	.064	.064	.064	.064	.079	.109	.138	.138	.168					
30	4.9	.064	.064	.064	.064	.079	.079	.109	.109	.138	.168					
36	7.1	.064	.064	.064	.064	.079	.109	.138	.168							
42	9.6	.064	.064	.064	.064	.064	.079	.079	.109							
48	12.6	.064	.064	.064	.064	.079	.079	.109	.168							
54	15.9	.079	.079	.079	.079	.079	.109	.109								
60	19.6	.109	.109	.109	.109	.109	.109	.138								
66	23.8	.109	.109	.109	.109	.138	.138	.168								
72	28.3	.138	.138	.138	.138	.168										
78	33.0	.168	.168	.168	.168											
84	38.0	.168	.168	.168												

----See General Note.

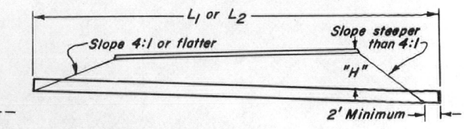
TABLE II
CORRUGATED STEEL PIPE ARCH ▼
(2" x 1/2") OR (2·2/3" x 1/2") CORRUGATIONS

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
			THICKNESS IN INCHES					
18 x 11	1.1	3 1/2	.064	.064	.064	.064	.064	.064
22 x 13	1.6	4	.064	.064	.064	.064	.064	
25 x 16	2.2	4	.064	.064	.064	.064		
29 x 18	2.8	4 1/2	.064	.064	.064			
36 x 22	4.4	5	.064	.064	.064			
43 x 27	6.4	5 1/2	.064					
50 x 31	8.7	6	.079					
58 x 36	11.4	7	.109					
65 x 40	14.3	8	.109					
72 x 44	17.6	9	.138					

METAL CULVERT WITH END SECTIONS



METAL CULVERT WITHOUT END SECTIONS



"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.

(R-1) Length of extension, when placed in accordance with Section 617, shall be the actual number of feet of new culvert required.

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

PIPE SIZE (B_d) 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
		THICKNESS IN INCHES												
36	7.1	.064	.064	.064	.064	.064	.079	.079	.109	.109	.109	.109	.138	.168
42	9.6	.064	.064	.064	.064	.079	.079	.079	.109	.109	.109	.109	.168	
48	12.6	.064	.064	.064	.079	.079	.079	.109	.109	.109	.138	.168		
54	15.9	.064	.064	.064	.079	.079	.109	.109	.138	.168				
60	19.6	.064	.064	.064	.079	.109	.109	.109	.138					
66	23.8	.064	.064	.079	.079	.109	.109	.138						
72	28.3	.064	.064	.079	.109	.109	.109	.138						
78	33.0	.064	.064	.079	.109	.138	.168							
84	38.0	.079	.079	.079	.109	.109								
90	44.0	.079	.079	.109	.109	.109								
96	50.3	.109	.109	.109	.109	.138								
102	57.0	.109	.109	.109	.109									
108	64.0	.109	.109	.109	.138									
114	70.9	.138	.138	.138	.168									
120	78.6	.138	.138	.138	.168									

----See General Note.

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

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

TABLE IV
CORRUGATED STEEL PIPE
3" x 1" CORRUGATIONS

* SPOT WELDED OR BOLTED (1/2" ASTM A 325 BOLTS) FABRICATION

PIPE SIZE (B_d) 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
		THICKNESS IN INCHES														
36	7.1	.064	.064	.064	.064	.064	.064	.064	.079	.079	.109	.109	.109	.109	.109	.138
42	9.6	.064	.064	.064	.064	.064	.064	.064	.079	.079	.109	.109	.109	.138	.168	
48	12.6	.064	.064	.064	.064	.064	.079	.079	.079	.109	.109	.109	.138	.168		
54	15.9	.064	.064	.064	.064	.064	.079	.079	.109	.109	.138	.138				
60	19.6	.064	.064	.064	.064	.079	.079	.109	.109	.138	.168					
66	23.8	.064	.064	.064	.079	.079	.109	.109	.138	.168						
72	28.3	.064	.064	.064	.079	.079	.109	.109	.138							
78	33.0	.064	.064	.064	.079	.109	.109	.138	.168							
84	38.0	.079	.079	.079	.079	.109	.109	.138								
90	44.0	.079	.079	.079	.079	.109	.109	.138								
96	50.3	.109	.109	.109	.109	.109	.138	.168								
102	57.0	.109	.109	.109	.109	.109	.138	.168								
108	64.0	.109	.109	.109	.109	.109	.138									
114	70.9	.138	.138	.138	.138	.138	.168									
120	78.6	.138	.138	.138	.138	.138										

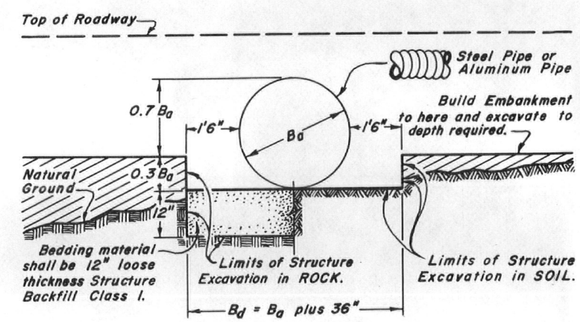
----See General Note.

* 3/8" rivets may be used on pipes with thickness to left of or above the heavy solid line.
7/16" rivets may be used on pipes with thickness to right of or below the heavy solid line.

TABLE V
CORRUGATED STEEL PIPE ARCH ▼
(R-2) 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
				THICKNESS IN INCHES				
	43 x 27	6.4	7 3/4	.064	.064	.064		
	50 x 31	8.7	9	.064	.064	.064		
	58 x 36	11.4	10 1/2	.064	.064	.064		
	65 x 40	14.3	12	.064	.064	.064		
	72 x 44	17.6	13 1/4	.064	.064	.064		
	73 x 55	22.0	18	.064	.064	.064	.064	.064
	81 x 59	26.0	18	.079	.079	.079	.079	.079
Ø	87 x 63	31.0	18	.079	.079	.079	.079	
Ø	95 x 67	35.0	18	.109	.109	.109		
Ø	103 x 71	41.0	18	.109	.109			

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.

TABLE VI
CORRUGATED ALUMINUM PIPE
2·2/3" x 1/2" CORRUGATIONS

PIPE SIZE (B_d) 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
		THICKNESS IN INCHES												
12	0.8	.060	.060	.060	.060	.060	.060	.060	.075	.105	.105	.105	.105	.105
18	1.8	.060	.060	.060	.060	.075	.105	.135	.164	.164				
24	3.1	.060	.060	.060	.075	.135								
30	4.9	.060	.060	.060	.105	.105	.164							
36	7.1	.060	.060	.075	.105	.164								
42	9.6	.075	.075	.105	.075	.105	.105	.164						
48	12.6	.105	.105	.105	.105	.135	.164	.164						
54	15.9	.105	.105	.135	.164	.164								
60	19.6	.135	.135	.164										
66	23.8	.135	.164											
72	28.3	.164												

----See General Note.

TABLE VII
CORRUGATED ALUMINUM PIPE ARCH ▼
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 9	9+ to 11	11+ to 13	13+ to 14	14+ to 15
			THICKNESS IN INCHES					
18 x 11	1.1	4 3/4	.060	.060	.060	.060	.060	.060
22 x 13	1.6	4 3/4	.060	.060	.060	.060	.060	
25 x 16	2.2	4 1/2	.060	.060	.060	.060		
29 x 18	2.8	4 1/2	.060	.060	.060			
36 x 22	4.4	5	.060	.060				
43 x 27	6.4	5 1/2	.075					
50 x 31	8.7	6	.105					
58 x 36	11.4	7	.135					
65 x 40	14.3	8	.135					
72 x 44	17.6	9	.164					

GENERAL NOTES (R-3)

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 metal and/or protective coatings shall be used where site investigations indicate corrosive and/or abrasive conditions.

▼ Pipe arch with equal periphery and with span and rise dimensions approximately equal to those required by plans will be permitted. During construction, adequate cover (4') shall be provided to protect the structure from damage.

Pipe shall be placed with longitudinal seams at the sides or quarter points but not along top of vertical axis.

The minimum depth of fill excluding pavement over corrugated metal pipe culverts shall be as staked by the Engineer but in no case shall it be less than shown in the following tabulation:

Diameter of Culvert (B_d)	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 thickness to 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 it's designated fill height. (Tables II, V, and VII)

GENERAL NOTES (Continued) (R-1)

When a culvert is to be extended with pipe of different material, the connection shall conform to the detail on plans or be approved.

Ø May not be available. The designer should contact supplier before calling for the sizes denoted by this symbol. (R-2)

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

METAL CULVERT PIPE
H-20 LOADING (R-2)

Designed by M.R.H.	Approved by [illegible]
Made by J.R.B.	Staff Design Engineer
Checked by R.S.M.	Date: March 20, 1967

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

REVISIONS			
(R-1)	4-19-68	Added Arch and Elliptical Pipe. Gen. Notes.	M.R.H.
(R-2)	7-23-68	Dept. Name.	M.R.H.
(R-3)	3-1-71	GN's for B bed and NRCP. Cl. 2 bed mat'l.	M.R.H.

STANDARD M-603-RC

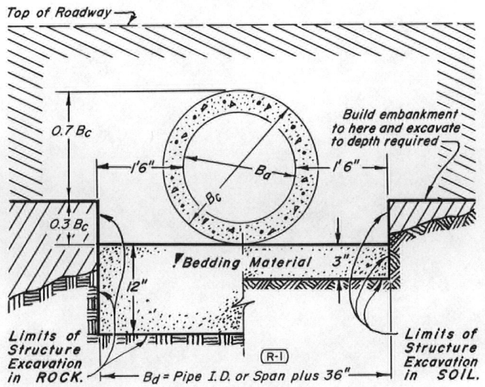
(MARCH 20, 1967)

(R-1)

NOTE: B_c Is the outside dimension for diameter, span or rise.

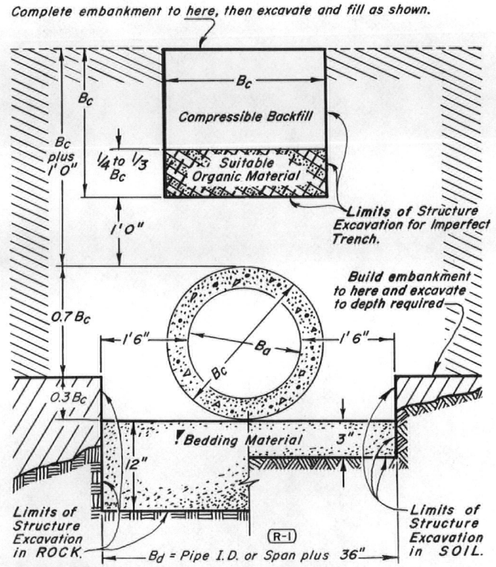
PIPE INSTALLATION

(WITH 0.7 PROJECTION RATIO)



IMPERFECT TRENCH PIPE INSTALLATION

(WITH 0.7 PROJECTION RATIO)



Bedding Material for SOIL shall be 3" loose thickness Structure Backfill Class 2. (R-3)
Bedding Material for ROCK shall be 12" loose thickness Structure Backfill Class 1.

(R-1)

DIMENSIONS FOR REINFORCED CONCRETE PIPE

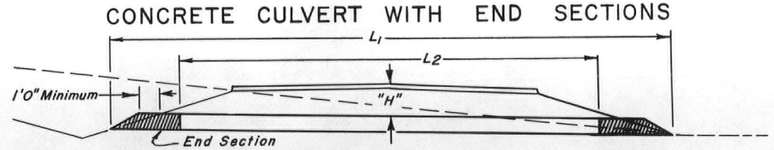
(For Information Only)

CIRCULAR			ARCH				(VE) VERTICAL ELLIPTICAL				(HE) HORIZONTAL ELLIPTICAL			
▲ PIPE SIZE-B_d (In. I.D.)	Wall Thickness (Inches)	0.3 B_c (Outside Dia.) (Feet)	ϕ Span (Inches)	ϕ Rise (Inches)	Wall Thickness (Inches)	0.3 Outside Rise (Feet)	Span (Inches)	Rise (Inches)	Wall Thickness (Inches)	0.3 Outside Rise (Feet)	Span (Inches)	Rise (Inches)	Wall Thickness (Inches)	0.3 Outside Rise (Feet)
12	2	0.40												
15	2-1/4	0.49	18	11	2-1/4	0.39								
18	2-1/2	0.58	22	13	2-1/2	0.45					23	14	2-3/4	0.49
21	2-3/4	0.66	25	16	2-3/4	0.54								
24	3	0.75	29	18	3	0.60					30	19	3-1/4	0.66
27	3-1/4	0.84									34	22	3-1/2	0.73
30	3-1/2	0.92	36	22	3-1/2	0.73					38	24	3-3/4	0.79
33	3-3/4	1.01									42	27	3-3/4	0.86
36	4	1.10	43	27	4	0.88	29	45	4-1/2	1.35	45	29	4-1/2	0.95
39							32	49	4-3/4	1.46	49	32	4-3/4	1.04
42	4-1/2	1.28	50	31	4-1/2	1.00	34	53	5	1.58	53	34	5	1.10
48	5	1.45	58	36	5	1.15	38	60	5-1/2	1.78	60	38	5-1/2	1.23
54	5-1/2	1.62	65	40	5-1/2	1.28	43	68	6	2.00	68	43	6	1.38
60	6	1.80	72	44	6	1.40	48	76	6-1/2	2.23	76	48	6-1/2	1.53
66	6-1/2	1.97					53	83	7	2.43	83	53	7	1.68
72	7	2.15	88	54	7	1.70	58	91	7-1/2	2.65	91	58	7-1/2	1.83
78	7-1/2	2.32					63	98	8	2.85	98	63	8	1.98
84	8	2.50	102	62	8	1.95	68	106	8-1/2	3.08	106	68	8-1/2	2.13
90	8-1/2	2.68	115	72	8-1/2	2.23	72	113	9	3.28	113	72	9	2.25
96	9	2.85	122	77	9	2.38	77	121	9-1/2	3.50	121	77	9-1/2	2.40
102	9-1/2	3.02					82	128	9-3/4	3.69	128	82	9-3/4	2.54
108	10	3.20	138	87	10	2.68	87	136	10	3.90	136	87	10	2.68

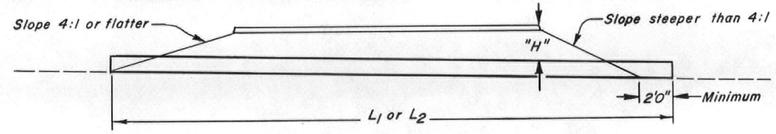
▲ Also equivalent round dimension for Arch and Elliptical pipe.

ϕ Sizes shown are for identification purposes only. Actual sizes shall conform to those listed in Fig. 1 of ASTM Spec. C506.

CONCRETE CULVERT WITH END SECTIONS



CONCRETE CULVERT WITHOUT END SECTIONS



"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.

(R-1) Length of extension, when placed in accordance with Section 617, shall be the actual number of feet of new culvert required.

(R-1)

HEIGHTS OF FILL OVER REINFORCED CONCRETE PIPE

— ALL SIZES —

TYPE OF PIPE	HEIGHT OF FILL OVER TOP OF PIPE IN FEET — CLASS OF PIPE (0.01" Crack D-Load)				
	Class II / Class VE II / Class HE II — 1000 D	Class III / Class VE III / Class HE III — 1350 D	Class IV / Class VE IV / Class HE IV — 2000 D	Class V / Class VE V — 3000 D	Class VE VI — 4000 D
PIPE INSTALLATION WITH 0.7 PROJECTION RATIO					
CIRCULAR	Min. to 18	Min. to 25	25+ to 37	37+ to 45	45+ to 62
ARCH	Min. to 18	Min. to 25	25+ to 37	37+ to 45	
VERTICAL ELLIPTICAL	Min. to 18	Min. to 25	25+ to 37		
HORIZONTAL ELLIPTICAL	Min. to 18	Min. to 25	25+ to 37		
PIPE INSTALLATION WITH IMPERFECT TRENCH					
ALL TYPES	up to 35	up to 48	48+ to 75	75+ to 96	

(R-3)

GENERAL NOTES

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

Minimum cover excluding pavement shall be 1 foot.

Fill heights greater than maximum allowed in the Heights of Fill Table on this sheet will require special design of structure.

Pipe design is based on safety factor of 1.33 on ultimate strength.

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

Pipe Class is determined from .01 inch crack D-load.

Bedding is Class B (Modified) with Settlement Ratio R_{sd} = 0.0 (Yielding Bed).

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

Minimum wall thickness dimensions are based on AASHO Designation M 170 (Wall B) for Circular Pipe, AASHO Designation M 206 for Arch Pipe and AASHO Designation M 207 for Elliptical Pipe.

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

When a culvert is to be extended with pipe of different material, the connection shall conform to the detail on plans or be approved.

NONREINFORCED CONCRETE PIPE

Nonreinforced Concrete Pipe is required to meet the same D-Load to produce the ultimate load under the three-edge-bearing method as specified for Reinforced Concrete Pipe in accordance with AASHO M-170. Wall thickness of pipe may be increased as required to meet D-Load requirement.

All requirements for Reinforced Concrete Pipe, except those referring to reinforcement shall apply to Nonreinforced Concrete Pipe.

(R-2)

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

REINFORCED CONCRETE PIPE

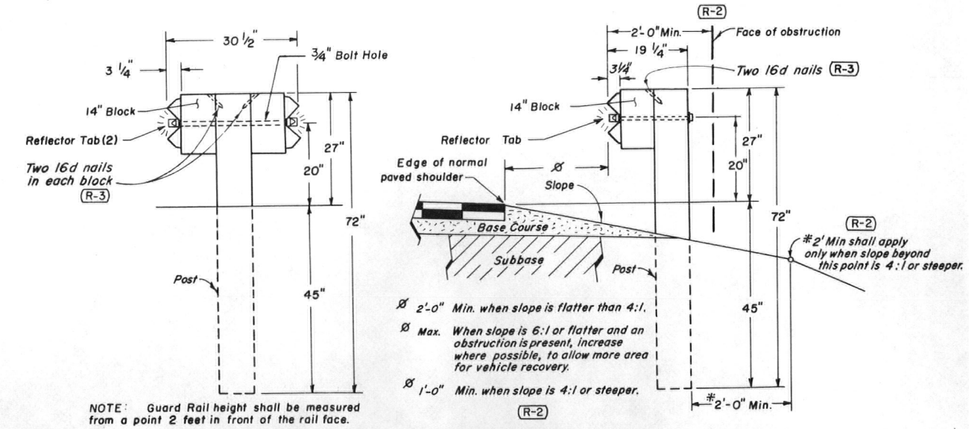
Designed by M.R.H.	Approved by [illegible]
Made by J.R.B.	Staff Design Eng'r.
Checked by R.S.M.	Date: 4-19-68

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

STANDARD M-606-AB

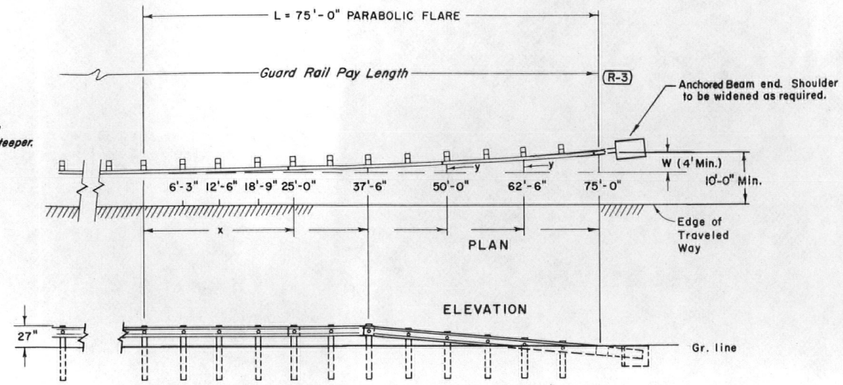
(MARCH 1, 1968)
(SHEET 1 OF 3)

	REVISIONS		
R-1	7-10-68	Add typical post & obstr.	M.R.H.
R-2	4-1-69	Widening. Bevel. Gen. notes.	M.R.H.
R-3	2-18-70	Pay length. Blocks. Gen. Notes.	M.R.H.
R-4	11-25-70	Timber, Hole and Gen. Notes.	M.R.H.
R-5	6-15-71	Timber table, post spacing G.N.'s.	M.R.H.
R-6	6-25-71	Shoulder treatment detail.	M.R.H.



TYPICAL POST INSTALLATIONS (R-4)

(See Table for Post & Block Cross Section)



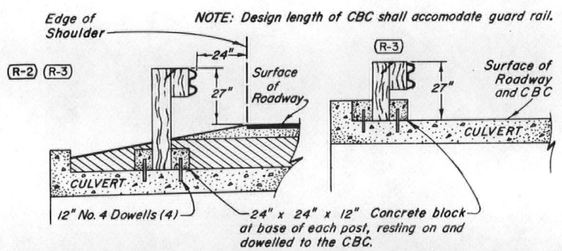
PARABOLIC TRANSITION & END TREATMENT

TABLE OF OFFSETS FOR 75' PARABOLIC FLARES

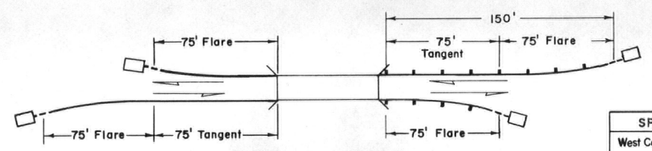
x	y W=4'	W=5'	W=10'	W=12'	W=14'	W=16'
12'-6"	0.11	0.14	0.28	0.33	0.39	0.44
25'-0"	0.44	0.55	1.11	1.33	1.56	1.78
37'-6"	1.00	1.25	2.50	3.00	3.50	4.00
50'-0"	1.78	2.22	4.44	5.33	6.23	7.11
62'-6"	2.78	3.48	6.95	8.34	9.73	11.11
75'-0"	4.00	5.00	10.00	12.00	14.00	16.00

LEGEND

W = Full parabolic offset.
L = Length of parabolic transition.
x = Longitudinal dist. from beginning of flare.
y = Offset = $W \cdot x^2/L^2$.



GUARD RAIL ACROSS CONCRETE BOX CULVERT



2-LANE HIGHWAY
BRIDGE APPROACH GUARD RAIL

NOTE: For divided highways see Sheet No. 2.

(R-5)

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, Lodgepole Pine, Ponderosa Pine, Western Hemlock, or Larch, and shall conform to the following grading specifications and requirements:

SPECIES	SIZE	FOHC	GRADING RULES		
West Coast Douglas Fir	6"x8"	Yes	WCLB #16	Par.	131 b
West Coast Hemlock	6"x8"	Yes	WCLB #16	Par.	131 a
Larch	6"x8"	Yes	WWP 1970	Par.	80.11
Southern Pine	6"x8"	No	SPIB 1970	Par.	285
Lodgepole Pine	6"x8"	No	WWP 1970	Par.	80.10
Ponderosa Pine	6"x8"	No	WWP 1970	Par.	80.10

Post and block cross section

WCLB # 16 — "Standard Grading Rules #16 for West Coast Lumber" Published by the West Coast Lumber Inspection Bureau. Effective Sept. 1, 1970.

WWP 1970 — "1970 Standard Grading Rules for Southern Pine Lumber" Published by the Western Wood Products Association. Effective Sept. 1, 1970.

SPIB 1970 — "1970 Standard Grading Rules for Southern Pine Lumber" Published by the Southern Pine Inspection Bureau. Effective Sept. 1, 1970.

FOHC — Free of Heart Centers. See paragraph 714 c of WCLB.

NOTE — 6"x 8" Posts and Blocks shall be installed with the 6" dimension parallel to the roadway.

All timber shall be rough, square cut and full sawn.

At the time the post or block is installed, any seasoning check which extends the full length of the piece shall not exceed one-quarter inch in width at its' maximum width.

Blocks shall be cut from timber of the same cross section and species as the posts.

Timber shall be incised and pressure treated in accordance with AASHO Designation M133, except that blocks need not be incised. Post bolt holes are to be drilled before treatment is applied.

The preservative shall be either (a) Creosote or (b) Pentachlorophenol in a petroleum carrier (liquid or L.P. gas).

Posts shall be spaced at 6'-3" center-to-center except as otherwise designated on the plans. Posts shall be spaced at 6'-3" center-to-center when the radius of guardrail curvature is 200 ft. or less.

Where pedestrian hazard exists and sidewalk is 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' length of rail panels will be permitted.

Metal plate guard rail shall be painted in accordance with standard specifications or shall be galvanized in accordance with AASHO Designation M-111 or with ASTM Designation A 525, Coating Class 2.50.

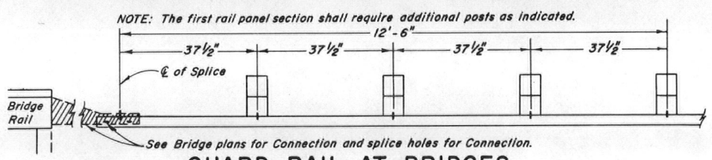
Posts used for vertical transition shall be adjusted in length so that a minimum of 45" will be buried.

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

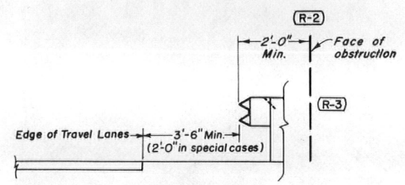
Concrete shall be Class A, B or D.

Blocks shall be toenailed to posts with two 16 penny galvanized nails in the top of each block.

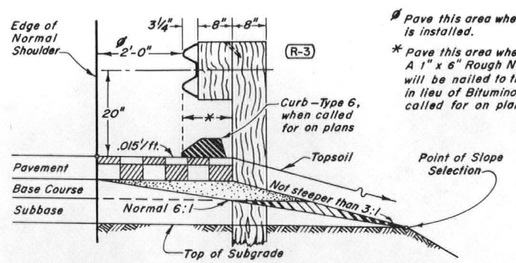
If posts are cut in the field, cut ends shall receive 2 coats of hot creosote.



GUARD RAIL AT BRIDGES

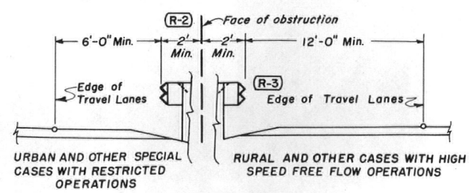


FOR NON-DEPRESSED MEDIAN AND CONTINUOUS GUARD RAIL



GUARD RAIL SHOULDER TREATMENT (R-6)

(Showing Typical Shoulder Widening)



(R-1) **GUARD RAIL FOR OBSTRUCTIONS IN MEDIAN**

(See Sheet No. 3)

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

GUARD RAIL TYPE 3

Designed by M.R.H.
Made by J.R.B. by
Checked by R.S.M.
Approved by
Staff Design Engineer
Date: March 1, 1968

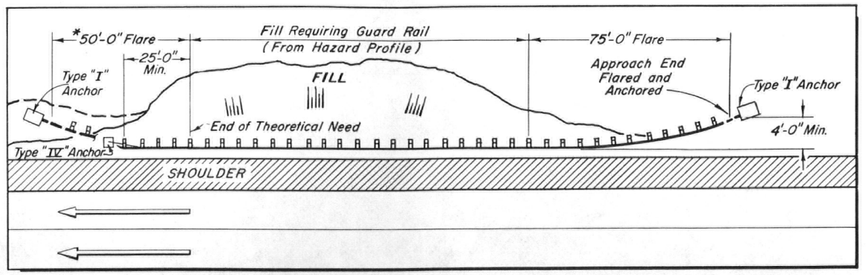
STANDARD M-606-AB

(MARCH 1, 1968)

(SHEET 2)

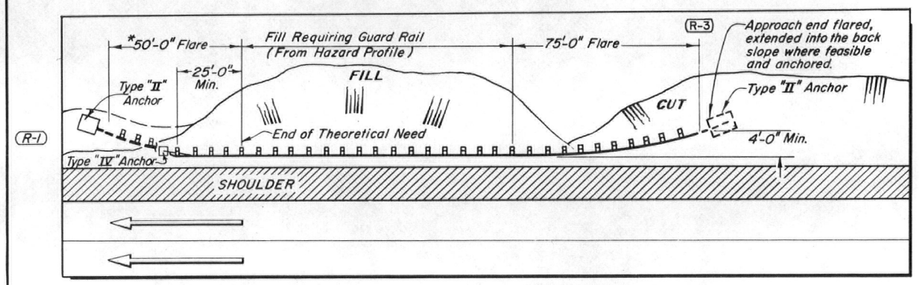
FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
8	COLORADO			

REVISIONS			
R-1	7-10-68	Add end anchorage	M.R.H.
R-2	4-1-69	Bridge exit guard rail note	M.R.H.
R-3	2-18-70	Pay length	M.R.H.
R-4	11-25-70	Timber dimension.	M.R.H.
R-5	6-15-71	Lengthen bridge approach g.r. in 60'+med.	M.R.H.
R-6	6-25-71	Revision date only.	M.R.H.

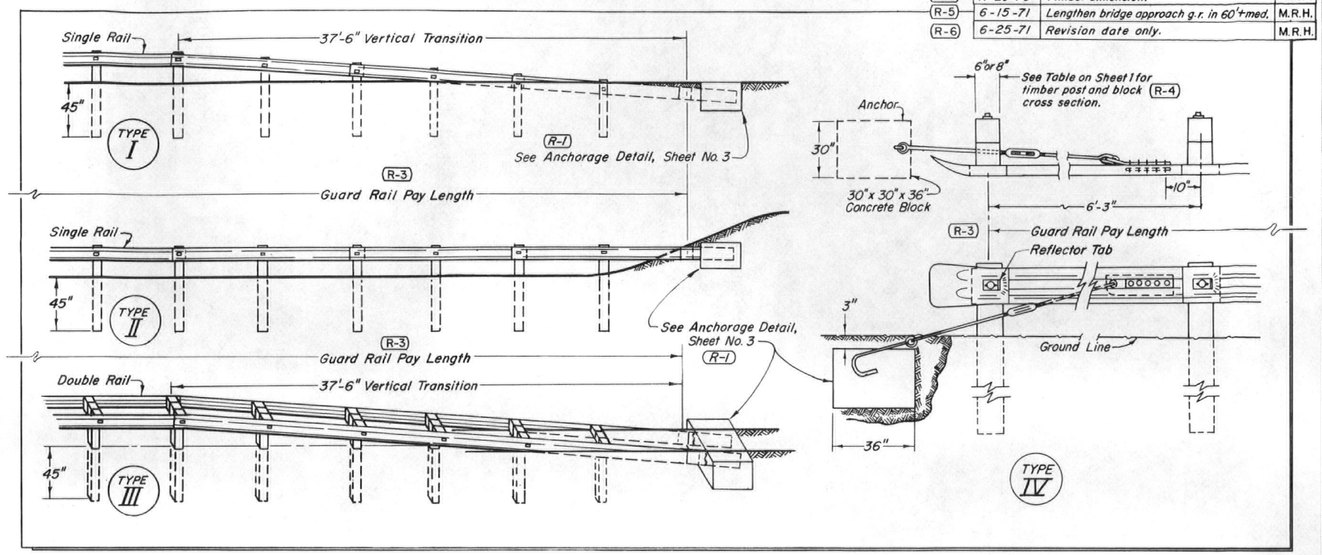


GUARD RAIL INSTALLATION — ROADSIDE FILL CONDITION

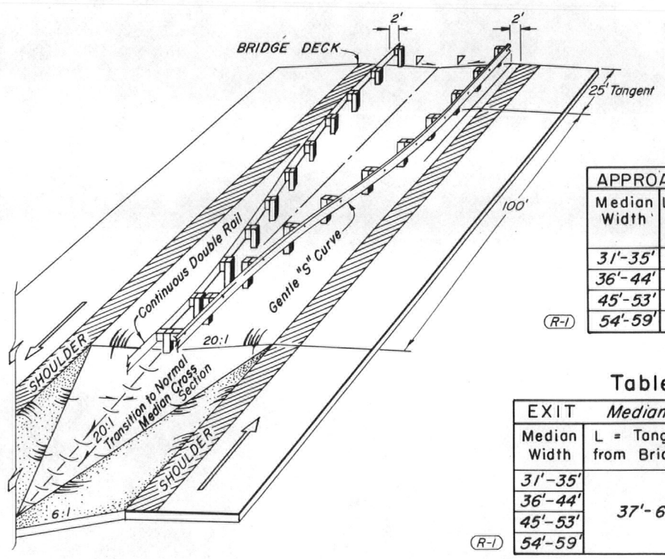
NOTES:
* 2-Lane Highways — The exit end of Guard Rail shall extend 50 feet past the end of theoretical need and shall be flared and anchored.



GUARD RAIL INSTALLATION — ROADSIDE CUT TO FILL CONDITION



TYPICAL END ANCHORAGE



21' to 30' MEDIAN

R-2 ∇Not steeper than 20:1.

Table 1

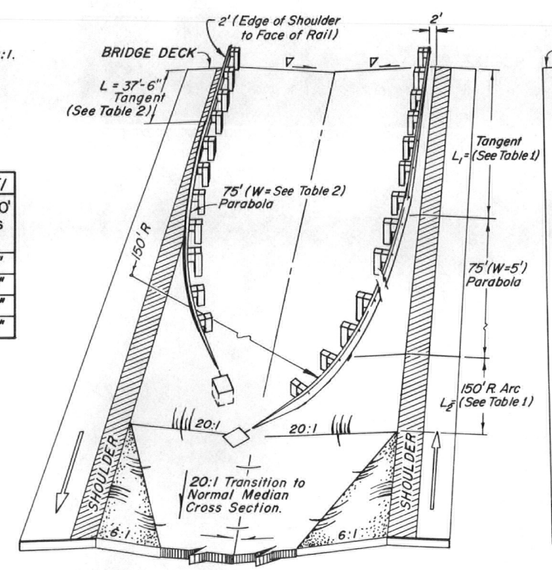
APPROACH Median Guard Rail			
Median Width	L_1=Tangent from Bridge	75' Parabolic Flare (then)	L_2 = 150' Radius Arc (then)
31'-35'	50'-0"	W = 5'	25'-0"
36'-44'	25'-0"		50'-0"
45'-53'	12'-6"		62'-6"
54'-59'	0'-0"		75'-0"

R-1

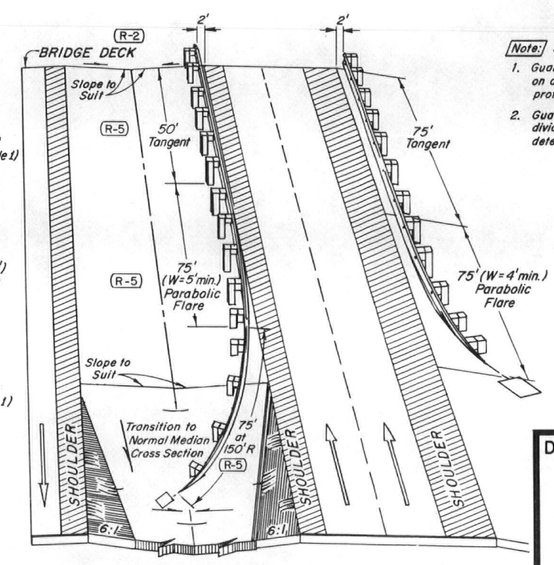
Table 2

EXIT Median Guard Rail		
Median Width	L = Tangent from Bridge (then)	75' Parabolic Flare, W=
31'-35'	37'-6"	10'
36'-44'		12'
45'-53'		14'
54'-59'		16'

R-1



R-1 31' to 59' MEDIAN



R-1 MEDIAN 60' AND OVER

R-2

Note: EXIT FROM BRIDGES:

1. Guard rail for OUTSIDE shoulders at exit end of bridges on divided highways to be determined from hazard profile.
2. Guard rail for INSIDE shoulders at exit end of bridges on divided highways with medians 60' and over to be determined from hazard profile.

GUARD RAIL AT BRIDGE APPROACH

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

GUARD RAIL
TYPE 3

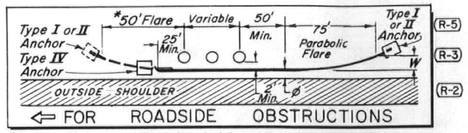
Designed by M.R.H.	Approved by
Made by J.R.B.	Staff Design Engineer
Checked by R.S.M.	Date: March 1, 1968

STANDARD M-606-AB

(MARCH 1, 1968)
(SHEET 3)
(R-1)

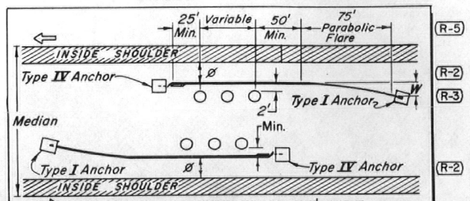
FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO			

REVISIONS			
R-1	7-10-68	Entire sheet redone.	M.R.H.
R-2	4-1-69	Recovery area. Delete timber bevel. Refl. tab.	M.R.H.
R-3	2-18-70	Pay Length.	M.R.H.
R-4	11-25-70	Block at pier.	M.R.H.
R-5	6-15-71	Non-cont. rail. Obst. approach post spacing	M.R.H.
R-6	6-25-71	Revision date only.	M.R.H.

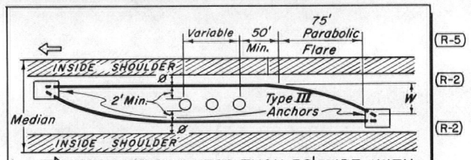


⇦ FOR ROADSIDE OBSTRUCTIONS

*2-Lane Highways — The exit end of Guard Rail shall extend 50 ft. past the end of theoretical need and shall be flared and anchored.

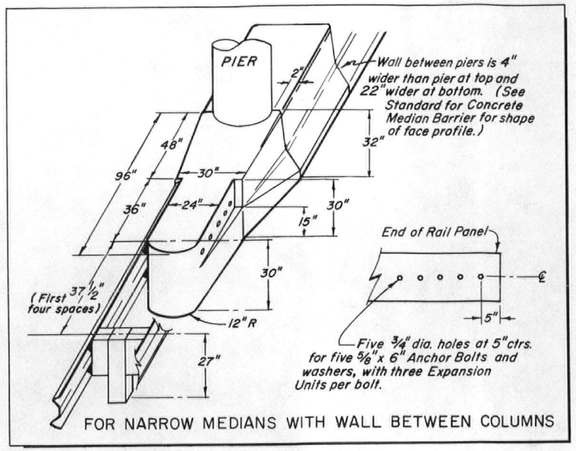


⇨ FOR MEDIANS MORE THAN 30' WIDE (NORMAL INSTALLATION)

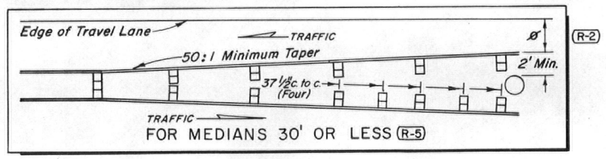


⇨ FOR MEDIANS LESS THAN 30' WIDE WITH ROADWAY DESIGN SPEED LESS THAN 50 M.P.H. AND FOR SPECIAL CASES

NON-CONTINUOUS RAIL



FOR NARROW MEDIANS WITH WALL BETWEEN COLUMNS

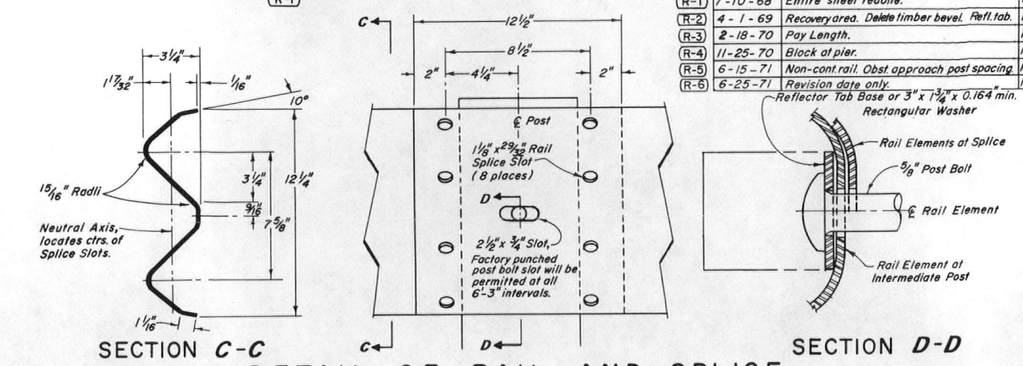


FOR MEDIANS 30' OR LESS (R-5)

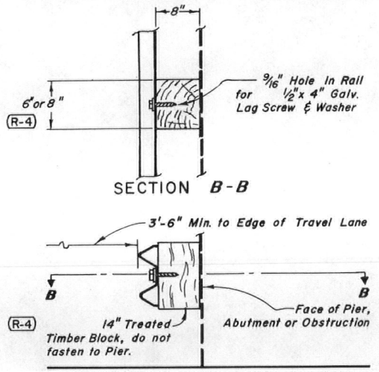
CONTINUOUS RAIL

Ø When slope is 6:1 or flatter and an obstruction is present, increase where possible, to allow more area for vehicle recovery. (R-2)

TYPICAL GUARD RAIL FOR OBSTRUCTIONS



DETAIL OF RAIL AND SPLICE

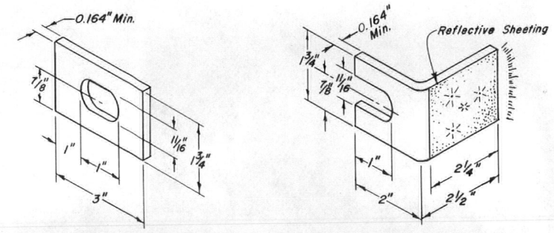


FOR NARROW MEDIANS

(To be used only when 2' min. clearance cannot be obtained.)

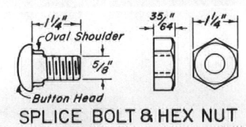
(R-4) SEE TABLE ON SHEET 1 FOR TIMBER CROSS SECTION

(R-5) NOTE: Four 37 1/2" post spaces shall be used at obstruction approach. Posts between piers shall be evenly spaced at 37 1/2" c. to c. or less. Timber blocks fastened to abutments or obstructions shall be spaced 37 1/2" c. to c. or less.

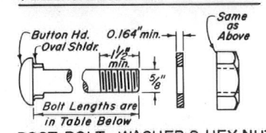


RECTANGULAR WASHER DETAIL

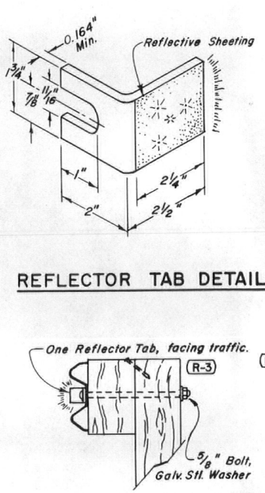
REFLECTOR TAB DETAIL



SPLICE BOLT & HEX NUT
(NEED 8 PER SPLICE, 4 PER TERMINAL)



POST BOLT, WASHER & HEX NUT



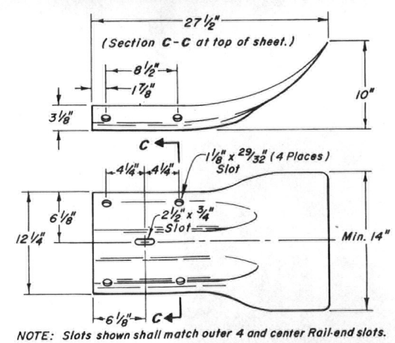
NOTE: Reflector Tab shall be installed on alternate posts or at max. 12'-6" spacing, beginning at the 3rd post from the buried anchor. (R-2)

INSTALLATION DETAIL OF REFLECTOR TAB

TABLE OF POST BOLT SIZES

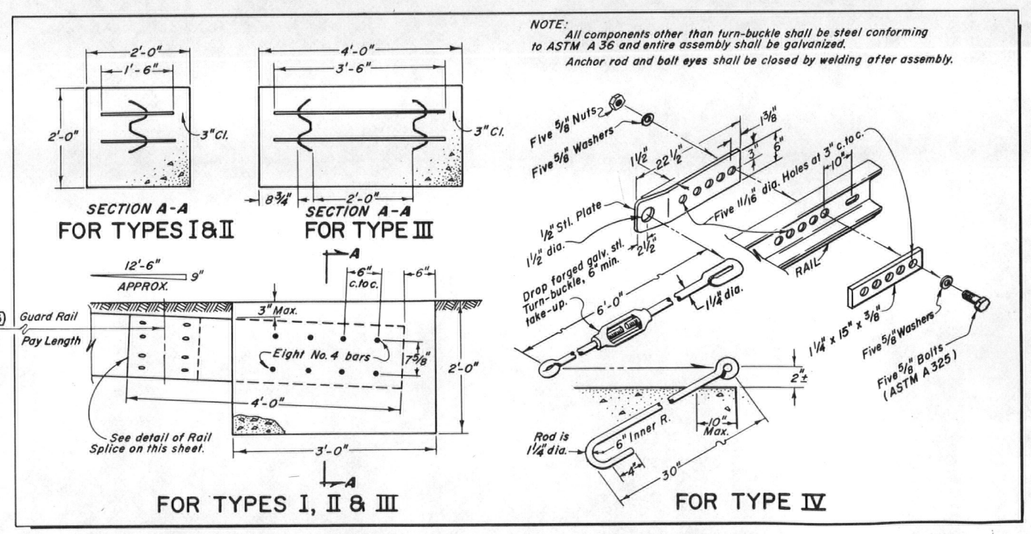
Block / Post	RAIL	BOLT SIZE
8" / 8"	Double	5/8" x 25 3/4"
8" / 8"	Single	5/8" x 17 1/2"

(R-4) NOTE: When 6" x 8" timber is used, the 8" dimension shall be perpendicular to the roadway.



NOTE: Slots shown shall match outer 4 and center Rail-end slots.

DETAIL OF TERMINAL SECTION



DETAILS FOR TYPICAL END ANCHORAGE

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

GUARD RAIL
TYPE 3

Designed by M.R.H.	Approved by [illegible]
Made by J.R.B.	Staff Design Engineer
Checked by R.S.M.	Date: March 1, 1968

STANDARD M-614-A

(JULY 1, 1965)

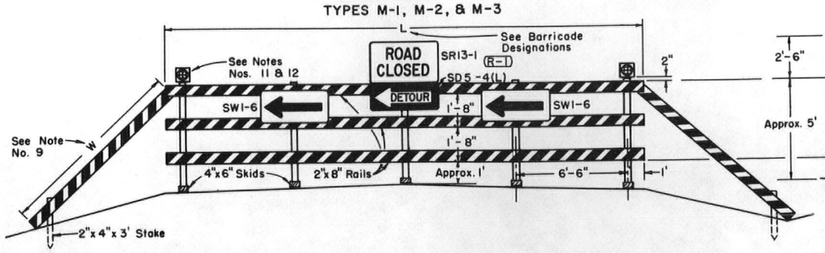
FEDERAL ROAD REGION NO.	DISTRICT	PROJECT NO.	SHEET NO.
9	COLORADO	[redacted]	

REVISIONS			
(R-1)	11-15-68	Rev. Dept. Name & Code Nos.	JLS
(R-2)	4-23-69	Rev. Code No. & Notes	JLS

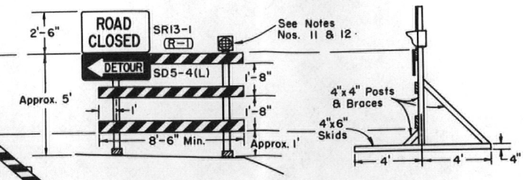
CLASS I BARRICADES
(3 RAILS)

MOVABLE

TYPES M-1, M-2, & M-3

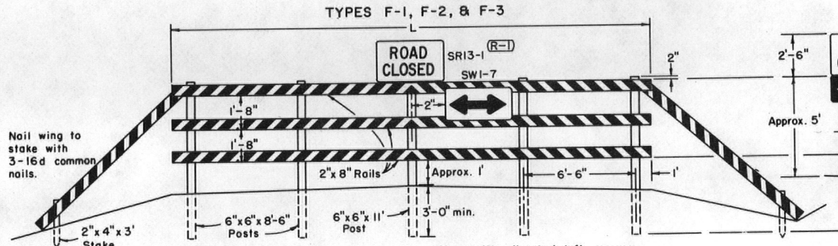


TYPE M-4



FIXED

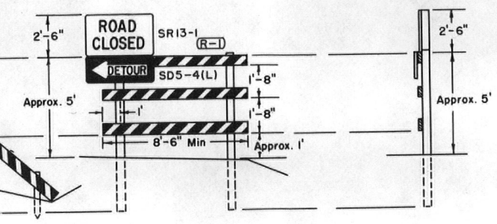
TYPES F-1, F-2, & F-3



For traffic diverted right, reverse angle of stripes this side and in lieu of sign SW1-7 use sign SW1-6. See Note No. 5.

For traffic diverted left, reverse angle of stripes this side and in lieu of sign SW1-7 use sign SW1-6. See Note No. 5.

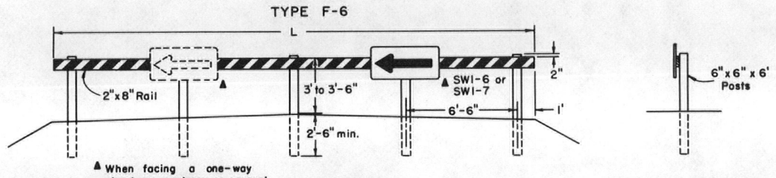
TYPE F-4



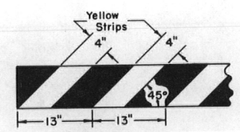
CLASS II BARRICADE
(1 RAIL)

FIXED

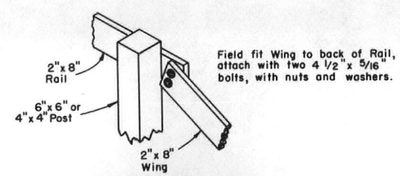
TYPE F-6



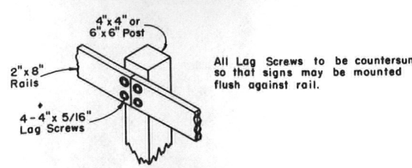
▲ When facing a one-way street or roadway a second SW1-6 or SW1-7 may be required. See Note No. 3.



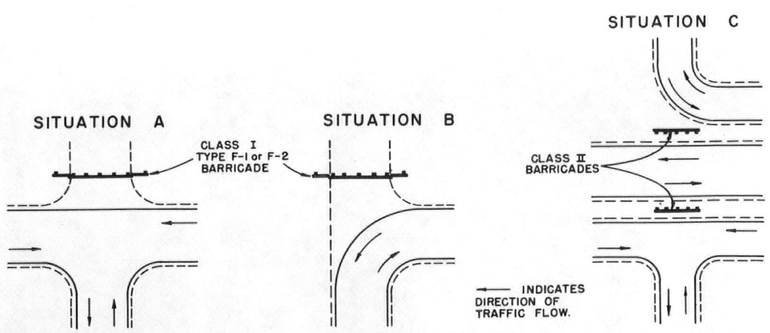
DETAIL OF RAIL AND WING STRIPING



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



METHOD OF ATTACHING PLANKING TO POSTS AT JOINTS



GENERAL NOTES

1. All work shall be done in accordance with the Standard Specifications applicable to the Project.
2. (R-2) 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 Division of Highways and this standard.
3. 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.
4. (R-2) 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 Division.
5. 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."
6. 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."
7. 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.
8. (R-2) All timber shall be Standard Grade or better, S4S, Douglas Fir or Larch, as described in the 1965 Standard Grading Rules published by the Western Wood Products Association, and shall conform to paragraph 123c for the rails and paragraphs 122c and 125c for the posts.
9. 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.
10. (R-2) Alternate materials or other reflective elements on Traffic signs or Barricades will be permitted only after approval of such material by the Division in writing.
11. 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. 3G 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).
12. 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.
13. Flashing Beacons and Flashers, when used, shall be positioned above the top rail of the barricades to produce the most effective results.
14. Barricades used as "Traffic Controls for Highway Construction" are not to be paid for separately.
15. Barricades will be paid for separately when designated on plans as bid items.
16. 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: Movable	Type: Fixed	Roadway Width	L	Description
(R-1)	I	M-1	F-1	26'-34'	28'	Barricade complete with SR13-1 sign and SW1-6 or SW1-7 signs as required.
(R-2)	I	M-2	F-2	35'-44'	41'	Barricade complete with SR13-1 sign and SW1-6 or SW1-7 signs as required.
(R-1)	I	M-3	F-3	Variable	28'	Barricade (without extension wings) complete with SR13-1 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.

(R-1)

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

TIMBER BARRICADES

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

Approved By: [signature]
Date: JULY 1, 1965

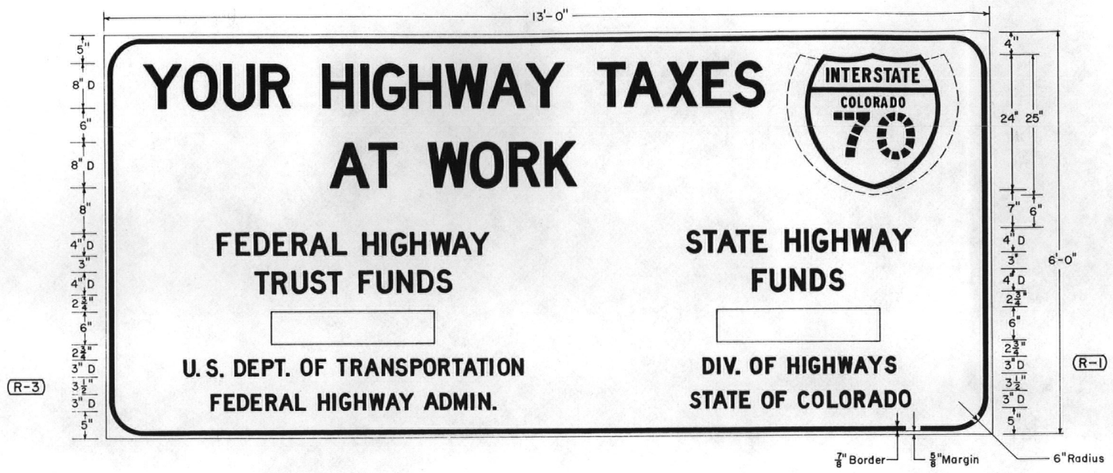
STANDARD M-614-IC

JULY 5, 1968

(SHEET 1 OF 2 SHEETS)

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

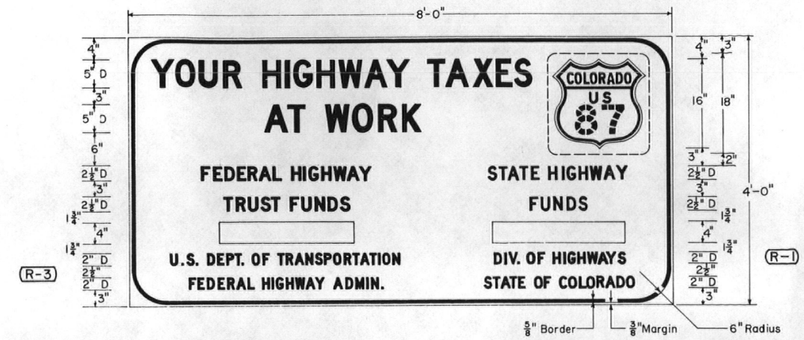
REVISIONS			
R-1	7-26-68	Rev. Legend and Notes	G.W.F.
R-2	5-20-69	Rev. Lateral Placement	J. J. B.
R-3	9-25-70	Rev. Legend	J. J. B.



ALTERNATE LEGEND

4" D FEDERAL

4" D FUNDS

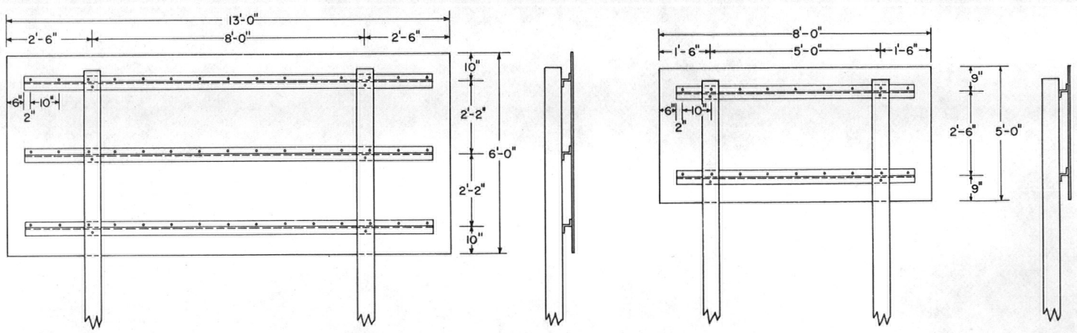


ALTERNATE LEGEND

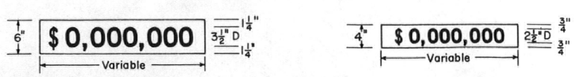
2 1/2" D FEDERAL

2 1/2" D FUNDS

FABRICATION DETAILS



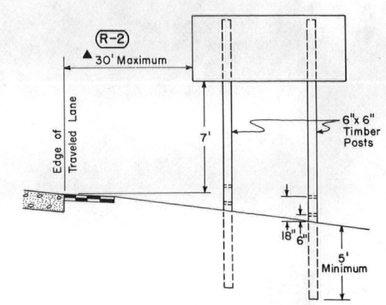
"AMOUNT OF FUNDS" PLAQUE DETAILS



GENERAL NOTES

1. These signs shall be furnished and installed by state forces.
2. All work shall be done in accordance with Standard Specifications applicable to the Project.
3. Signs are to be placed facing traffic approaching the Project. They shall be installed at a location where they will not obscure or detract from the effectiveness of other official signs.
4. ▲ The lateral placement may be reduced to a minimum of 2 ft. outside of the shoulder edge where necessary to fit field conditions.
5. When these signs are used on Beautification Projects, the words "HIGHWAY" and "TRUST" in lines 3 and 4 shall be deleted and the words "FEDERAL" and "FUNDS" shall be used in accordance with the spacing as shown under "Alternate Legend".
6. Sign panel shall be fabricated with 3/4" plywood.
7. Route Marker plaques and "Amount of Funds" plaques shall be sheet aluminum 0.080" min. thickness.
8. Signs shall have a screen processed black legend and border on a plain white background. "Amount of Funds" plaques shall have a screen processed black legend on a plain white background.
9. Route Marker plaques shall be plain as indicated on the applicable standards.
10. Backing zees shall be 3" x 2 3/4" x 1/4". Steel zees shall weigh 6.7 lbs. per ft. and aluminum zees shall be of 6061-T6 alloy weighing 2.33 lbs. per ft.
11. Posts shall be 6" x 6", S4S timber, painted white.
12. Each timber post shall be provided with two 2" diameter holes through the neutral axis, one at 6" and one at 18" above the ground level. The inside portion of each 2" diameter hole shall be painted white.
13. Panels shall be fastened to backing zees with 1/4" thrust head lockbolt fasteners.
14. Backing zees shall be fastened to posts with 3/8" machine bolts.
15. Route Marker plaques and "Amount of Funds" plaques shall be fastened to the sign panels with 5/8" #9 round head wood screws.
16. Exposed lockbolt fastener heads and wood screw heads on the face of the sign shall be dipped or painted to match the surrounding color.
17. The underground portion of each timber post shall be treated with creosote.
18. Where a third governmental agency is shown as participating, its official name should be included centrally in lines 6, 7, and 8.
19. (R-1) It will not be necessary to change DEPT. to DIV. on any existing signs.

INSTALLATION DETAIL



DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

STANDARD CONSTRUCTION IDENTIFICATION SIGNS

Designed By:	J.L.S.	Approved By:	
Made By:	F.J.B.	Traffic Engineer	
Checked By:	G.W.F.	Date: July 5	,19 68

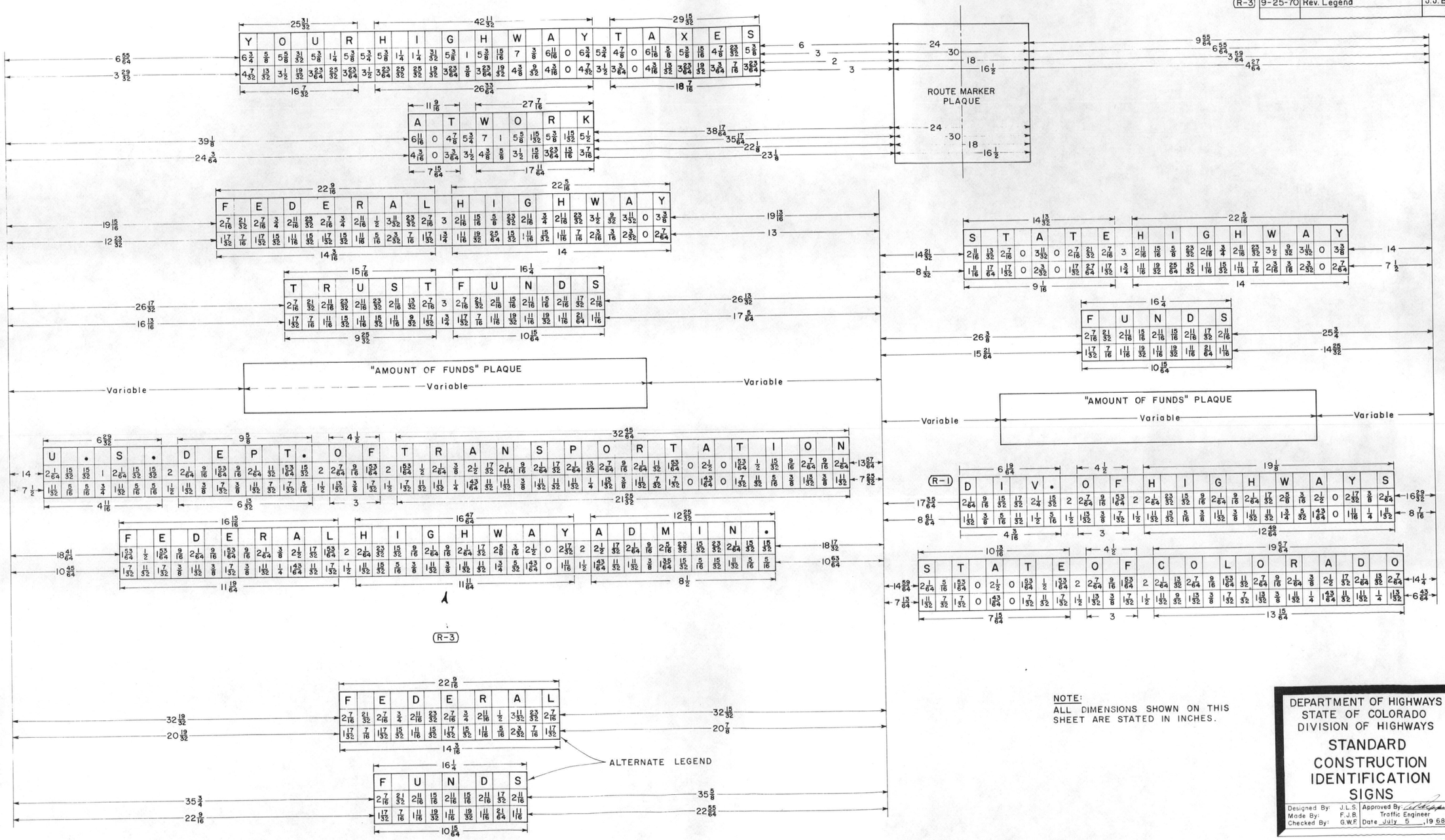
STANDARD M-614-IC

JULY 5, 1968

(SHEET 2 OF 2 SHEETS)

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

REVISIONS			
R-1	7-26-68	Rev. Legend	G.W.F.
R-2	5-20-69	Rev. Lateral Placement	J.J.B.
R-3	9-25-70	Rev. Legend	J.J.B.



NOTE:
ALL DIMENSIONS SHOWN ON THIS SHEET ARE STATED IN INCHES.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

STANDARD CONSTRUCTION IDENTIFICATION SIGNS

Designed By: J.L.S.
Made By: F.J.B.
Checked By: G.W.F.
Approved By: [signature] Traffic Engineer
Date July 5, 1968

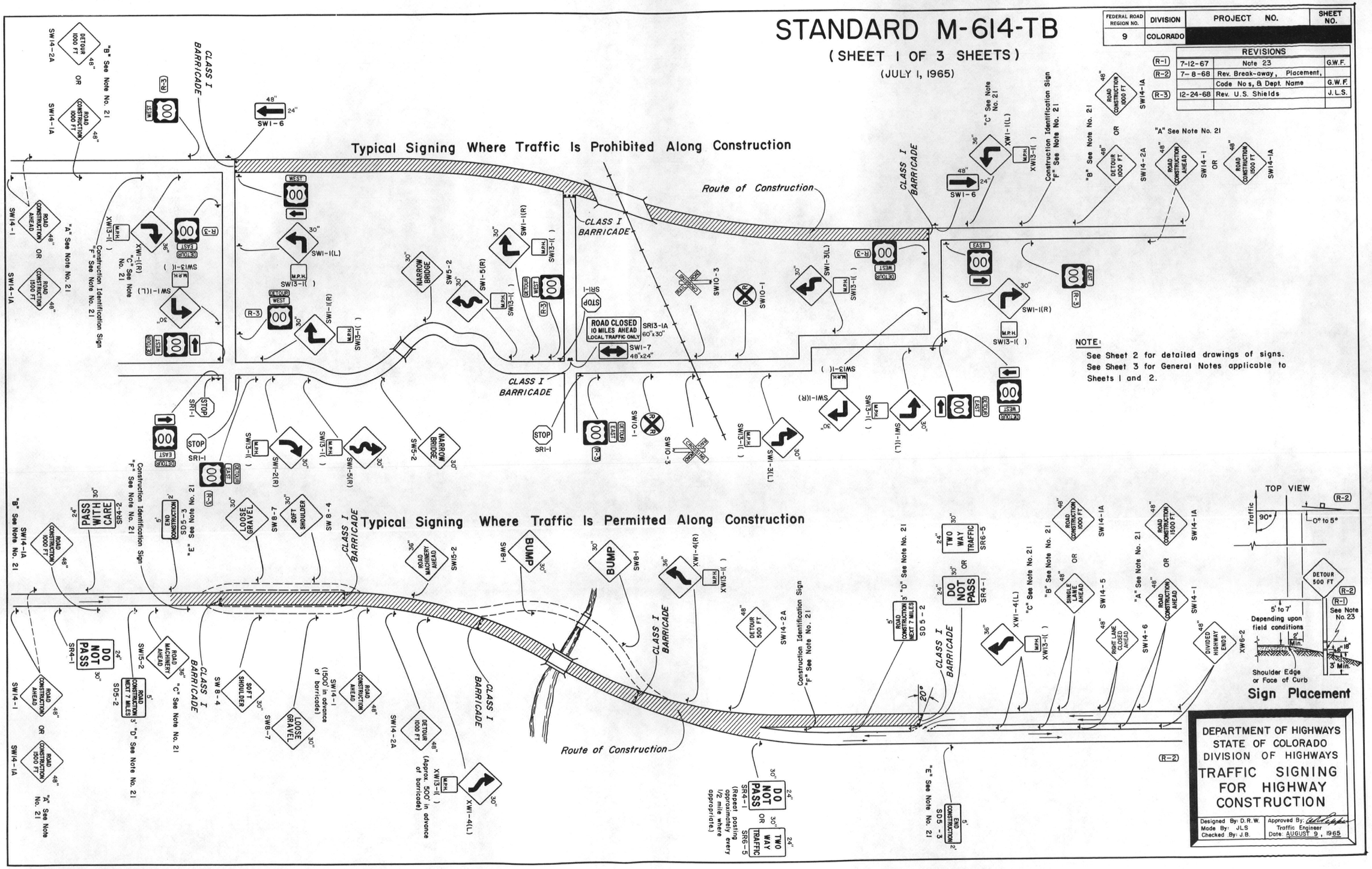
STANDARD M-614-TB

(SHEET 1 OF 3 SHEETS)

(JULY 1, 1965)

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

REVISIONS			
R-1	7-12-67	Note 23	G.W.F.
R-2	7-8-68	Rev. Break-away, Placement,	
		Code Nos, & Dept. Name	G.W.F.
R-3	12-24-68	Rev. U.S. Shields	J.L.S.



STANDARD M-614-TB (SHEET 1)

STANDARD M-614-TB

(SHEET 2 OF 3 SHEETS)

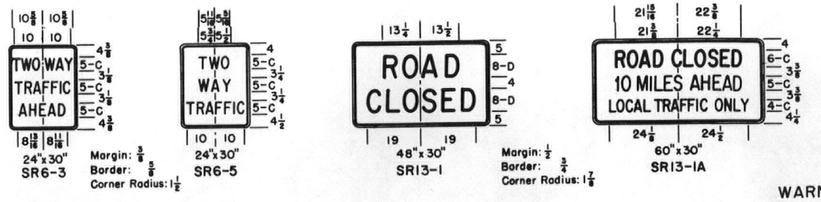
(JULY 1, 1965)

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

REVISIONS			
R-1	7-12-67		M.R.H.
R-2	7-8-68	Rev. Code No. & Dept. Name	G.W.F.
R-3	12-24-68	Added Notes	J.L.S.

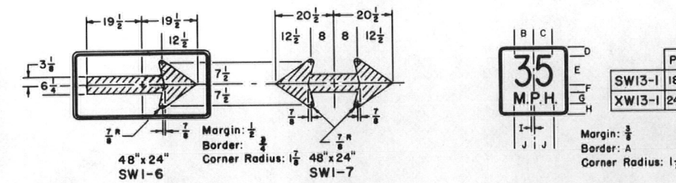
REGULATORY SIGNS

See Note No. 9



WARNING SIGNS

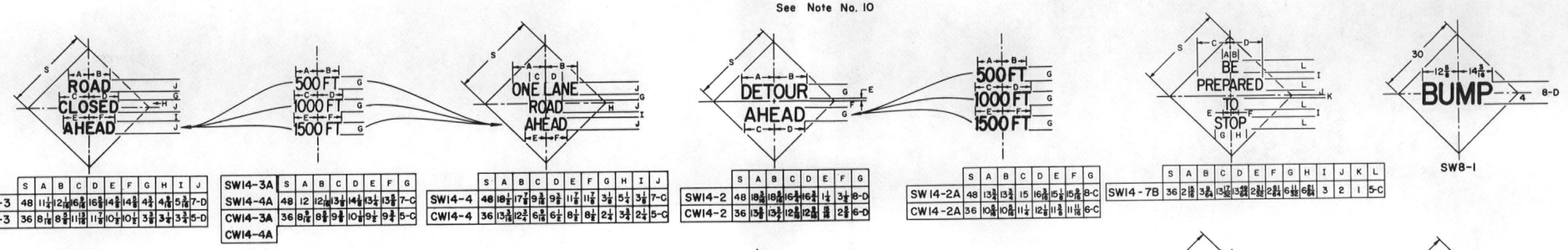
See Note No. 10



	Panel	A	B	C	D	E	F	G	H	I	J
SW13-1	18"x18"	3/8	5 1/8	5 5/16	2 1/4	8-C	2	3-E	2 3/4	3/4	5 3/16
XW13-1	24"x24"	5/8	6 5/8	6 5/16	3 1/4	10-C	2 3/4	4-E	4	15/16	6 7/8

WARNING SIGNS

See Note No. 10



	S	A	B	C	D	E	F	G	H	I	J
SW14-3	48	11 1/4	12 1/16	6 3/16	16 3/4	4 3/8	14 3/8	4 3/4	4 3/16	5 3/16	7-D
CW14-3	36	8 1/16	8 3/4	11 13/16	11 1/2	10 1/2	10 1/2	3 3/8	3 1/4	3 3/4	5-D

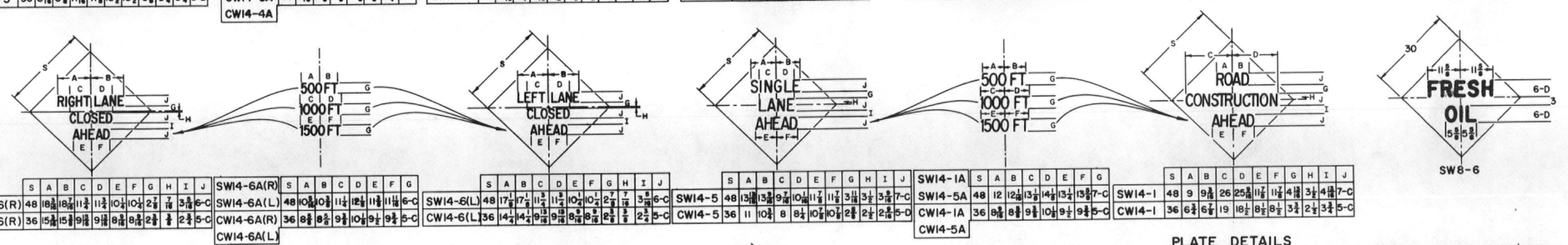
	S	A	B	C	D	E	F	G
SW14-3A								
SW14-4A	48	12	12 1/16	3 1/4	14 1/8	13 1/4	13 3/8	7-C
CW14-3A	36	8 3/16	8 3/8	9 3/8	10 1/8	9 1/2	9 3/8	5-C
CW14-4A								

	S	A	B	C	D	E	F	G	H	I	J
SW14-4	48	18 1/4	17 7/8	9 3/8	11 7/8	3 1/8	5 1/2	3 1/8	7-C		
CW14-4	36	13 3/16	12 3/4	6 3/8	8 1/2	8 1/2	2 1/4	3 3/4	2 1/4	5-C	

	S	A	B	C	D	E	F	G	H	I	J
SW14-2	48	18 3/16	18 3/16	16 3/4	16 3/4	1 1/4	3 1/4	8-D			
CW14-2	36	13 3/8	13 3/8	12 3/8	12 3/8	3/8	2 3/8	6-D			

	S	A	B	C	D	E	F	G
SW14-2A	48	13 3/4	13 3/4	15	16 3/16	15 1/8	15 3/16	8-C
CW14-2A	36	10 3/16	10 3/16	11 1/4	12 1/8	11 3/8	11 1/16	6-C

	S	A	B	C	D	E	F	G	H	I	J	K	L
SW14-7B	36	2 1/16	3 3/16	13 17/32	13 23/32	2 21/32	2 21/64	6 11/32	6 21/64	3	2	1	5-C



	S	A	B	C	D	E	F	G	H	I	J
SW14-6(R)	48	18 3/8	18 3/16	11 3/4	11 3/4	10 1/4	10 1/4	2 3/8	3/16	3 5/16	6-C
CW14-6(R)	36	15 3/16	15 3/8	9 1/16	9 1/16	8 3/8	8 3/8	2 3/8	3/8	2 3/4	5-C

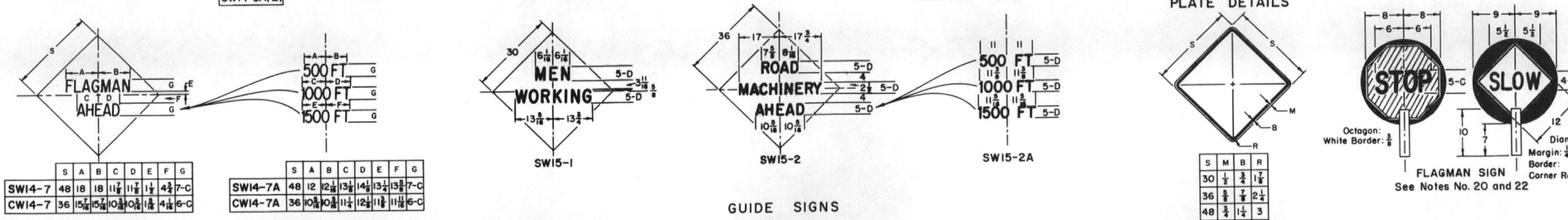
	S	A	B	C	D	E	F	G
SW14-6A(R)								
SW14-6A(L)	48	10 3/8	10 3/8	11 1/2	12 1/8	11 1/8	11 11/16	6-C
CW14-6A(R)	36	8 3/8	8 3/8	9 3/8	10 1/8	9 1/2	9 3/8	5-C
CW14-6A(L)								

	S	A	B	C	D	E	F	G	H	I	J
SW14-6(L)	48	17 1/8	17 1/8	11 3/4	11 3/4	10 1/4	10 1/4	2 7/8	3/16	3 5/16	6-C
CW14-6(L)	36	14 1/4	14 1/4	9 13/16	9 13/16	8 5/16	8 5/16	2 3/8	3/8	2 3/4	5-C

	S	A	B	C	D	E	F	G	H	I	J
SW14-5	48	13 3/16	13 3/8	9 7/16	10 1/16	11 7/8	3 1/16	3 1/2	3 3/16	7-C	
CW14-5	36	11	10 1/2	8	8 1/2	10 1/8	10 1/8	2 3/8	2 1/2	2 13/16	5-D

	S	A	B	C	D	E	F	G
SW14-1A								
SW14-5A	48	12	12 1/16	13 1/4	14 1/8	13 1/4	13 3/8	7-C
CW14-1A	36	9 3/8	9 3/8	9 1/8	10 1/8	9 1/2	9 3/8	5-C
CW14-5A								

	S	A	B	C	D	E	F	G	H	I	J
SW14-1	48	9	9 3/8	26	25 3/8	11 7/8	11 7/8	4 13/16	3 1/4	4 13/16	7-C
CW14-1	36	6 3/4	6 7/8	19	18 1/2	8 1/2	8 1/2	3 3/4	2 1/2	3 3/4	5-C



	S	A	B	C	D	E	F	G
SW14-7	48	18	18	11 7/8	11 7/8	1 1/2	4 3/4	7-C
CW14-7	36	15 7/16	15 7/16	10 3/16	10 3/16	1 3/8	4 1/16	6-C

	S	A	B	C	D	E	F	G
SW14-7A	48	12	12 1/16	13 1/8	14 1/8	13 1/4	13 3/8	7-C
CW14-7A	36	10 3/16	10 3/16	11 1/4	12 1/8	11 3/8	11 1/16	6-C

S	M	B	R
30	1/2	3/4	1 7/8
36	5/8	7/8	2 1/4
48	3/4	1 1/8	3

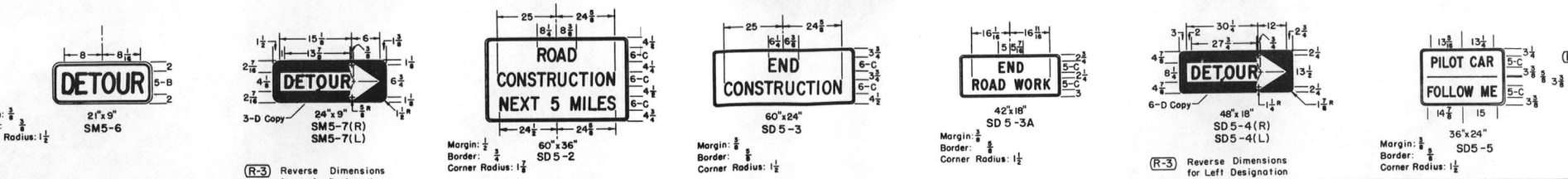
NOTES:

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
DIVISION OF HIGHWAYS

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

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

STANDARD M-614-TB

(SHEET 3 OF 3 SHEETS)

(JULY 1, 1965)

	REVISIONS		
R-1	7-12-67	Added Note 23	G.W.F.
R-2	7-8-68	Rev. Note 23 & Dept. Name –	
		Deleted Note	G.W.F.
R-3	12-24-68	Rev. Note No. 18	J.L.S.

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. (R-1) (R-2)

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 58 and LL Structural 58 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. Lanterns and Torches – Lanterns, with red globes, shall be used only in low speed urban areas. Open-flame torches shall not be used under any circumstances. (R-3)

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": SD5-2 – 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": SD5-3 – 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 6"x6" timber sign post shall be provided with two 2" diameter holes through the neutral axis normal to the roadway, one hole at 6" and one hole at 18" above the ground level. The 4"x4" timber posts shall not be provided with any type of break-away device. The inside portion of each 2" diameter hole shall be painted white. The underground portion of each timber post shall be treated with creosote. (R-1) (R-2)

(R-2)

(R-2)

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

TRAFFIC SIGNING FOR HIGHWAY CONSTRUCTION

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

STANDARD S-614-29 B

(SHEET 1 OF 2 SHEETS)

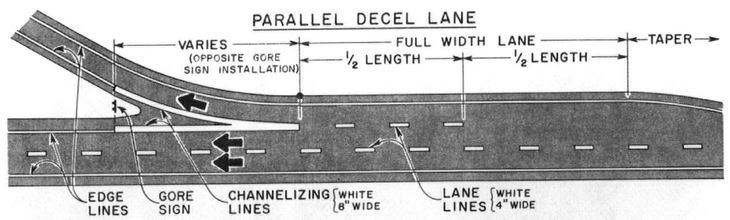
AUGUST 18, 1971

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHT.
9	COLORADO			

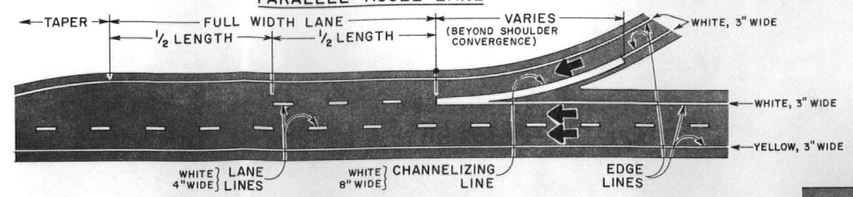
REVISIONS		

TYPICAL ENTRANCE AND EXIT RAMP MARKINGS

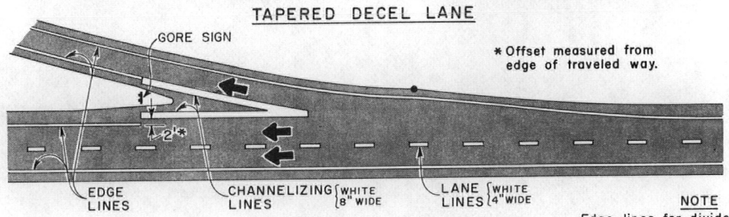
PARALLEL DECEL LANE



PARALLEL ACCEL LANE

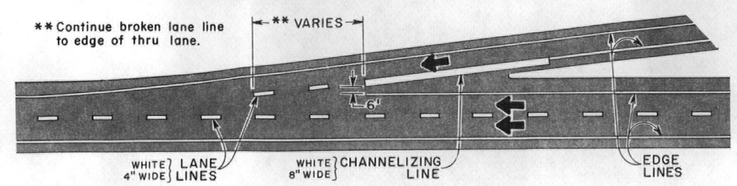


TAPERED DECEL LANE



* Offset measured from edge of traveled way.

TAPERED ACCEL LANE – CASE 1



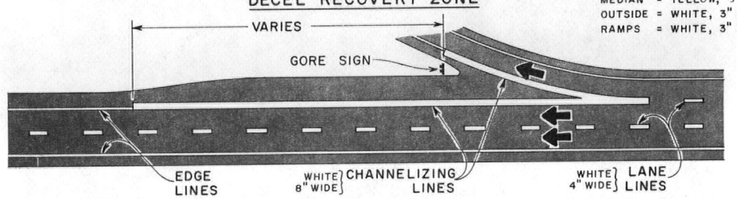
** Continue broken lane line to edge of thru lane.

NOTE

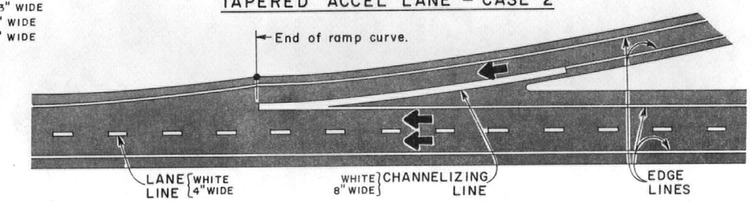
Edge lines for divided roadways:

MEDIAN = YELLOW, 3" WIDE
OUTSIDE = WHITE, 3" WIDE
RAMPS = WHITE, 3" WIDE

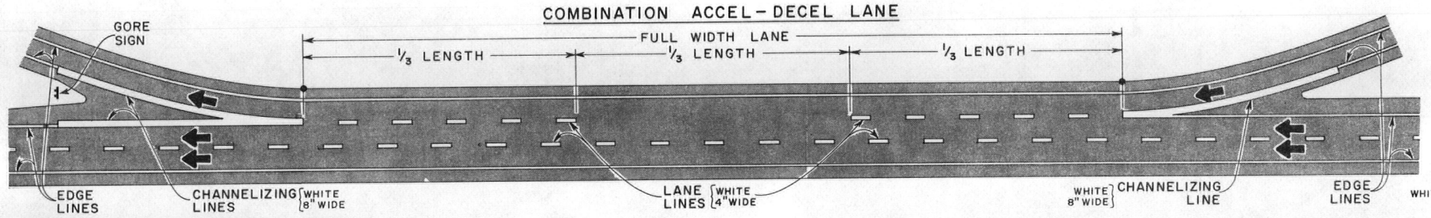
DECEL RECOVERY ZONE



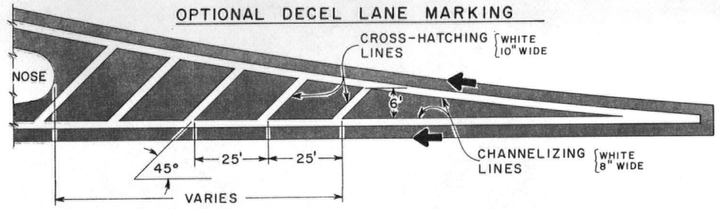
TAPERED ACCEL LANE – CASE 2



COMBINATION ACCEL-DECEL LANE

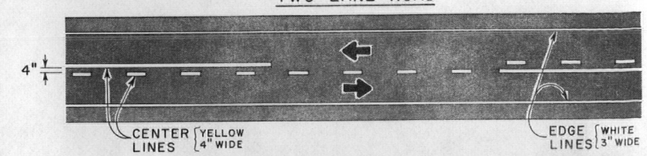


OPTIONAL DECEL LANE MARKING

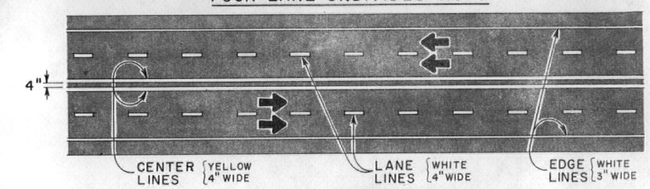


TYPICAL ROADWAY MARKINGS

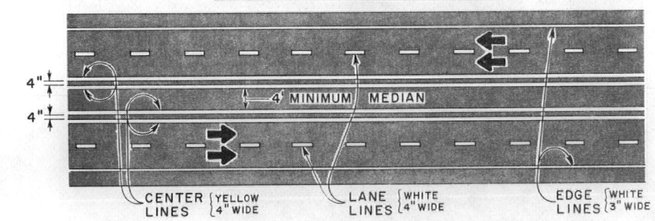
TWO LANE ROAD



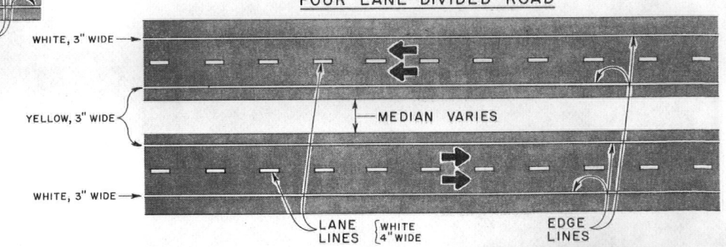
FOUR LANE UNDIVIDED ROAD



FOUR LANE UNDIVIDED ROAD



FOUR LANE DIVIDED ROAD



GENERAL NOTES

ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS APPLICABLE TO THE PROJECT.

CENTER LINES
1. Broken yellow, 4 inches wide – 15 foot segments with 25 foot gaps.
2. Solid yellow, 4 inches wide.

These lines separate adjacent-opposite direction traffic lanes. Double lines shall be spaced 4 inches apart.

LANE LINES
1. Broken white, 4 inches wide – 15 foot segments with 25 foot gaps.
2. Solid white, 4 inches wide.

These lines separate adjacent-same direction traffic lanes. A solid line may be used to discourage lane changing.

EDGE LINES
1. Parallel – Solid white or yellow, 3 inches wide.
2. Diagonal – Solid white, 10 inches wide, spaced at intervals of 20 feet minimum to 100 feet maximum.

Yellow edge lines shall be used only for the left edge of freeway or expressway mainline roadways separated by other than a painted median. Edge lines are not continued through intersections and are not broken for driveways. Care must be taken to avoid edge line appearing as lane line along roadways with wide shoulders and / or closely spaced driveways.

CHANNELIZING LINES
Solid white, 8 inches wide. These lines are used with acceleration – deceleration lanes, pavement width transitions, and left-right turn slots or islands.

CROSS-HATCHING LINES
Solid white or yellow, 10 inches wide – 45 degree Diagonal, spaced at 25 foot intervals. These lines are optional and may be placed at locations indicated on the plans or determined by the Engineer. Yellow shall be used for painted median – undivided road only.

PARKING LINES
Solid white, 3 inches wide – diagonal or parallel as shown on the plans.

STOP LINES
Solid white, 24 inches wide – extend parallel to intersected roadway across all approach lanes or as indicated at locations on the plans. Locate at the desired stopping point, not more than 30 feet nor less than 4 feet from the nearest edge of the intersected traffic lane.

CROSSWALK LINES (see note on sheet 2)

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

TYPICAL PAVEMENT MARKINGS

Designed By: F.J.B.	Approved By: [signature]	
Made By: F.J.B.	Traffic Engineer	
Checked By: J.J.S.	Date: August 18, 1971	

STANDARD S-614-29 B

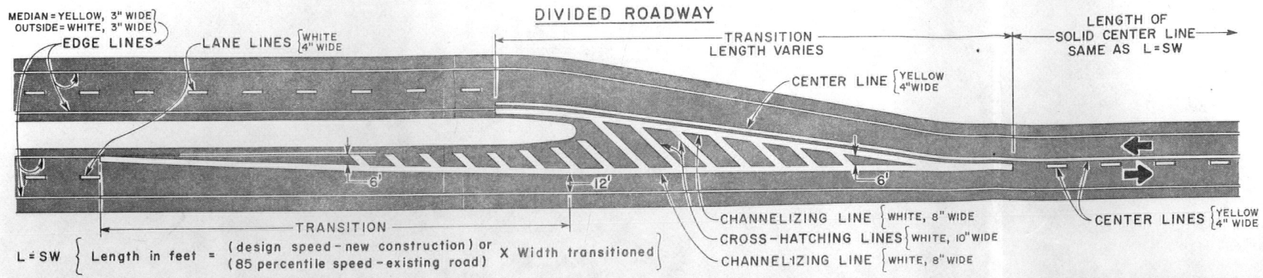
(SHEET 2 OF 2 SHEETS)

AUGUST 18, 1971

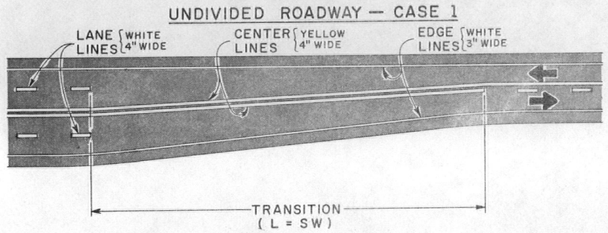
FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO			

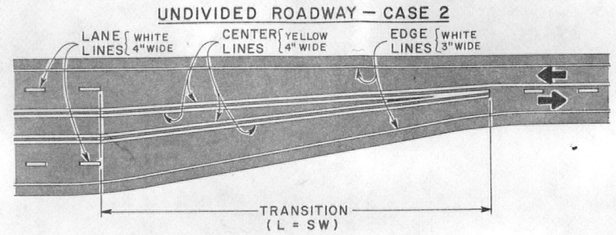
REVISIONS		

TYPICAL PAVEMENT WIDTH TRANSITION MARKINGS



L = SW { Length in feet = (design speed - new construction) or (85 percentile speed - existing road) X Width transitioned }

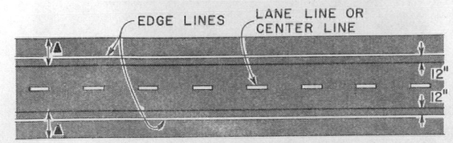




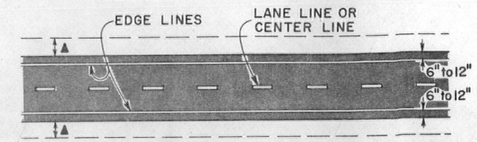
TYPICAL PAVEMENT EDGE MARKINGS

NOTE: ▲ = SHOULDER WIDTH

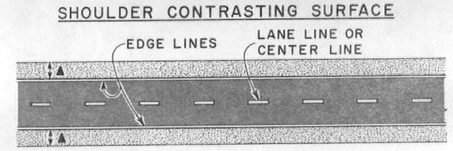
SHOULDERS SAME SURFACE



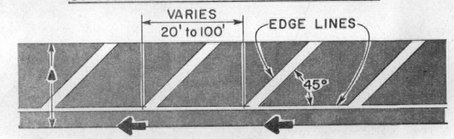
NO SHOULDER OR UNSURFACED SHOULDER



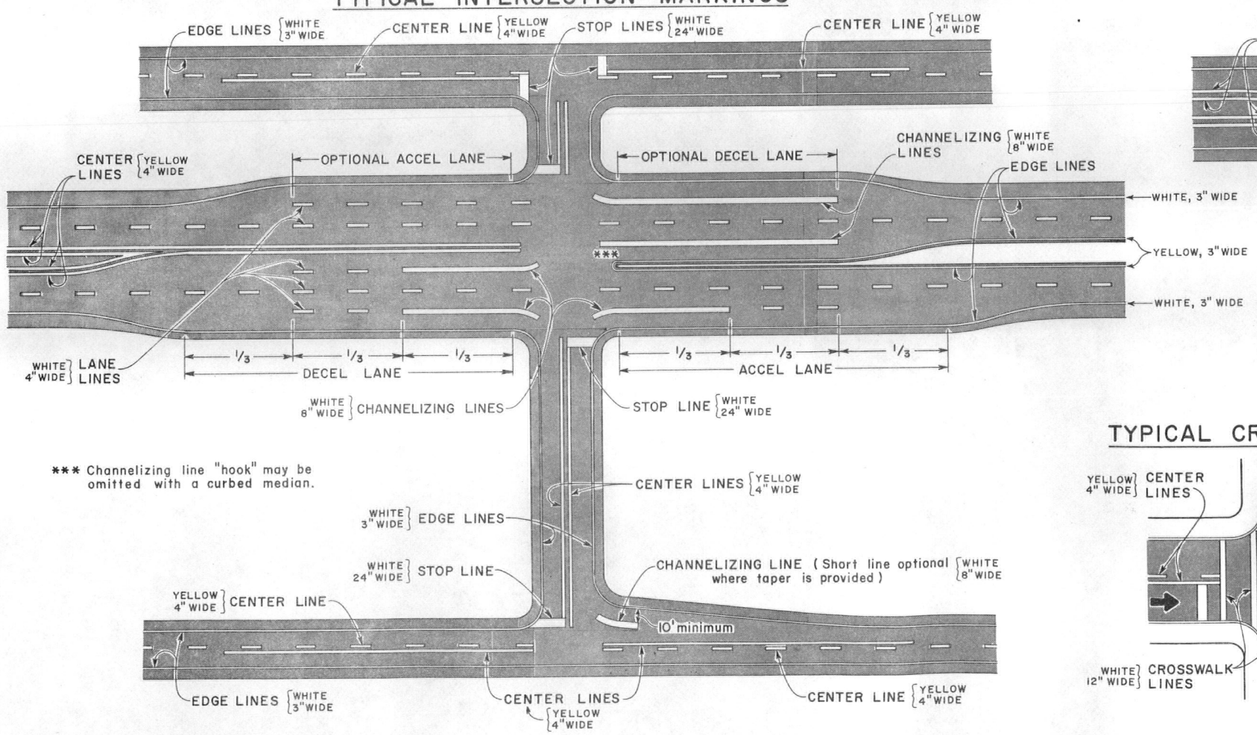
SHOULDER CONTRASTING SURFACE



OPTIONAL DIAGONAL EDGE LINE

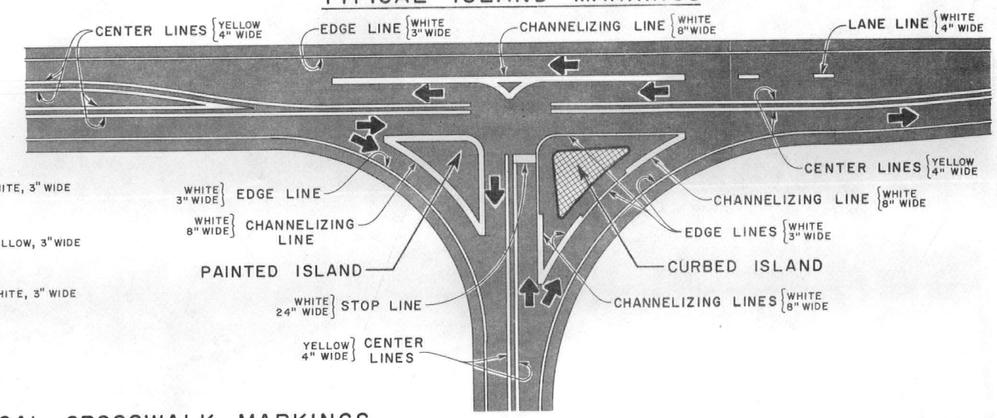


TYPICAL INTERSECTION MARKINGS

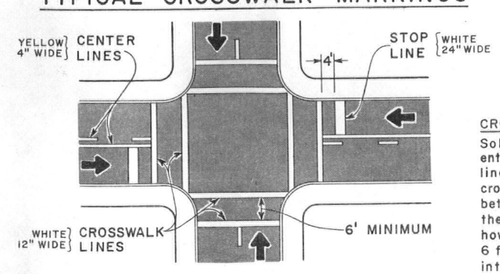


*** Channelizing line "hook" may be omitted with a curbed median.

TYPICAL ISLAND MARKINGS



TYPICAL CROSSWALK MARKINGS



CROSSWALK LINE APPLICATION

Solid white, 12 inches wide — extend across entire width of pavement. If no advance stop line is provided, increase the width of the crosswalk lines to 24 inches. The distance between the lines is usually determined by the width of the sidewalks so connected, however, in no case shall this be less than 6 feet. Complicated and/or channelized intersections and mid-block crosswalks shall be as detailed in the plans or as directed by the Engineer.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

TYPICAL PAVEMENT MARKINGS

Designed By:	F.J.B.	Approved By:	[signature]
Made By:	F.J.B.	Traffic Engineer	
Checked By:	J.J.S.	Date:	August 12, 1971