INACTIVE

APR 2 1971

FEDERAL ROAD REGION NO	DIVISION	PROJECT NO	SHEET NO
9	COLORADO	S 0004 (6)	1

STATE DEPARTMENT OF HIGHWAYS
DIVISION OF HIGHWAYS — STATE OF COLORADO

AS CONSTRUCTED
REVISED DATE

~~AS CONSTRUCTED~~
~~NO REVISIONS~~ ~~DATE~~

PLAN AND PROFILE OF ~~PROPOSED~~ COMPLETED

FEDERAL AID PROJECT NO. S0004(6)

STATE HIGHWAY NO. 116

BACA COUNTY

TITLE SHEET

CONVENTIONAL SIGNS

PLAN SHEET — BEGIN PROJECT — TITLE SHEET — END PROJECT

CENTER LINE
COUNTY LINE
TOWNSHIP OR RANGE LINE
LAND LINES — SECTION LINE — ¼ SECTION LINE — ⅛ SECTION LINE
CITY LIMITS — PLAN SHEET — TITLE SHEET
RAILROAD
BARBED WIRE FENCE
WOVEN WIRE - COMBINATION FENCE
TELE & TELEG LINE
POWER LINE
PRESENT ROAD (PLAN SHEETS)
RIGHT OF WAY LINE — R.O.W. MARKER
ACCESS POINTS (FREEWAYS)
C OF A LINE (CONTROL OF ACCESS) — OP OP — OP-OPENINGS — OP OP
ACCESS DENIED BY DEED
TOP OF CUTS
TOE OF FILLS
DETOUR
BURIED TELE. CABLE
ELECTRIC FENCE

SCALES OF ORIGINAL DRAWINGS

ON PLAN: 1 IN = 100 FT
ON PROFILE: 1 IN = 100 FT HORIZONTAL; 1 IN = 10 FT VERTICAL

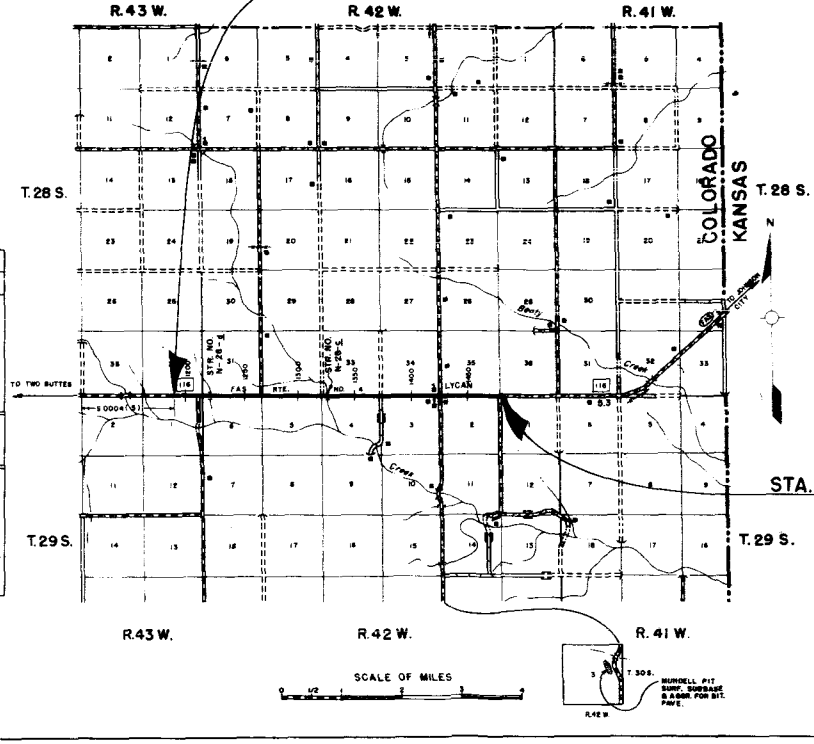
INDEX OF SHEETS

~~AS CONSTRUCTED~~
~~NO REVISIONS~~ ~~DATE~~

SHEET NO		
1	SKETCH MAP, TITLE PAGE AND TABULATION OF LENGTH AND DESIGN DATA.	
2	TYPICAL SECTION AND GENERAL NOTES.	
3-4	SUMMARY OF APPROXIMATE QUANTITIES.	
5	BASE COURSE AND SURFACE COURSE PLAN, SUBBASE PLAN AND SUMMARY OF EARTHWORK QUANTITIES.	
6	PIT SKETCH.	
7	STRUCTURE QUANTITIES.	
8-17	ALIGNMENT PLAN AND PROFILE.	
18-32	CROSS SECTIONS.	
33-35	STRUCTURE CROSS SECTIONS.	
~~M-203-B~~	~~APPROACH ROADS, FLARING, CUT SLOPE TREATMENT, BRIDGE & CREST WIDENING~~	~~7-30-68~~
M-203-C	DITCH TYPES	7-23-68
M-206-A	EXCAVATION AND BACKFILL FOR STRUCTURES (2 SHEETS)	11-1-68
M-500-A	LETTERS AND FIGURES FOR STRUCTURE NUMBERS	7-1-65
M-601-A	SINGLE AND DOUBLE CONCRETE BOX CULVERTS	10-25-68
M-601-D	WINGWALLS FOR CONCRETE BOX CULVERTS (2:1 SIDE SLOPES)	10-25-68
M-603-M	METAL CULVERT PIPE H-20 LOADING	7-23-68
M-606-AB	GUARD RAIL TYPE 3 (3 SHEETS)	7-10-68
M-614-A	TIMBER BARRICADES	11-15-68
M-614-1C	STANDARD CONSTRUCTION IDENTIFICATION SIGNS (2 SHEETS)	7-26-68
M-614-TB	TRAFFIC SIGNING FOR HIGHWAY CONSTRUCTION (3 SHEETS)	12-24-68
~~S-614-29A~~	~~TYPICAL PAVEMENT MARKINGS~~	~~7-10-68~~

"As Constructed NO Revisions"
Sheets 2, 8, 10-11 and 14-15

STA. 1190+00 BEGIN S0004(6)*
STA. 1190+00 END S0004(5)



TABULATION OF LENGTH & DESIGN DATA

STATION	ROADWAY LIN. FT.
1190+00 BEGIN S0004(6)* 1190+00 END S0004(5) 1480+00 END S0004(6)	29,000.0
TOTAL	29,000.0

SUMMARY	LIN. FT.	MILES
Roadway (Net & Gross Length)	29,000.0	5.492

DESIGN DATA	
MAXIMUM DEGREE OF CURVE	NONE
MAXIMUM GRADE	2.90%
MINIMUM S.S.D.-HORIZONTAL	>1300 FT.
MINIMUM S.S.D.-VERTICAL	530 FT. (EST.)
MAXIMUM DESIGN SPEED	50 M.P.H.

1989 DESIGN TRAFFIC VOLUME — ADT-218, DHV-26

Contractor: Ed Loloff Const. Co
Resident Engr: Novie Francis
Date Completed: May 5, 1970

DIVISION OF HIGHWAYS
APPROVED
Dwight M. Sowers 6-3-70
DIST. CONSTRUCTION ENGR. DATE

SEE SPECIAL PROVISIONS FOR NOTICE TO BIDDERS

DIVISION OF HIGHWAYS
APPROVED
CHIEF ENGINEER 2-24-69 DATE

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
BUREAU OF PUBLIC ROADS
APPROVED DATE
DIVISION ENGINEER

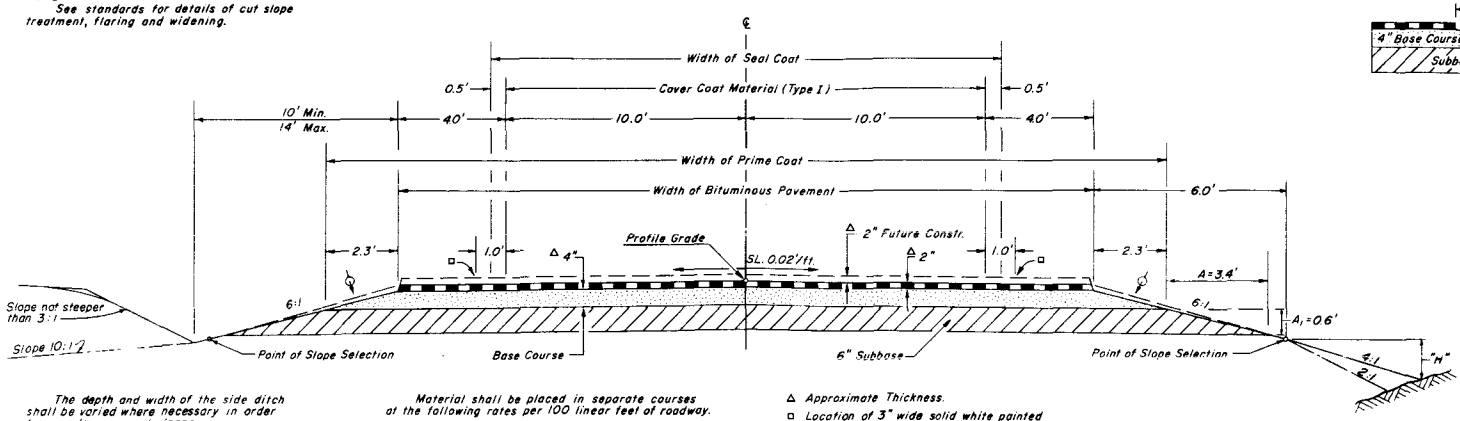
C.K.M.

DEPARTMENT OF HIGHWAYS, STATE OF COLORADO
FORM D.O.H. 126
JUNE 1964

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	S 0004 (6)	2	

TYPICAL SECTION

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



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

The profile grade shall be the combined thickness of subbase, base course surfacing and bituminous pavement, above the present roadbed.

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

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

Bituminous Pavement.....	Tons 33
Base Course.....	Tons 68

△ Approximate Thickness.

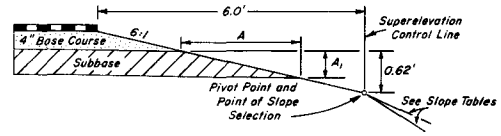
□ Location of 3" wide solid white painted stripe.

The contractor will be required to place additional gravel or other suitable material to this line after completion of paving operation.

Breakpoints on slopes and in bottoms of ditches shall be rounded on construction for a pleasing appearance.

TYPICAL SIDE SLOPE DETAILS

Bottom of Subbase ABOVE Superelevation Control Line Intersection



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.

GENERAL NOTES

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

Prime Coat MC	@	0.40 Gals. per Sq. Yd.
Seal Coat RC	@	0.30 Gals. per Sq. Yd.
Cover Coat Material	@	25 Lbs. per Sq. Yd.

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

Depth of Moisture-Density control for this project shall be as follows:

Full depth of all embankments.
Bases of cuts and fills 6".

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.

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

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

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

Guard posts and delineators will be removed by State Forces.

It is estimated that 500 Hours of Flagging for controlling traffic will be required for this project.

The type of Compaction for Structure Backfill (Class 3) shall be "Standard."

It is estimated that 260 gal of Pavement Marking Paint will be required for project. This quantity includes the following

White Paint	253 gals
Yellow Paint	7 gals
Glass Beads	1,560 Lbs (Type I) or 1,040 Lbs (Type II)

DEPARTMENT OF HIGHWAYS
HIGHWAYS — STATE OF COLORADO
4 113 Motor
1968

SUMMARY OF APPROXIMATE QUANTITIES

AS CONSTRUCTED
REVISED DATE 4-11-69

FEDERAL ROAD DIVISION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	S 0004(6)	3	

CONTRACT ITEM NO.	CONTRACT ITEM	UNIT				TOTAL S 0004(6) Plan	Final	Diff.	Reference Sheet	TOTAL S 0002(29) Plan	Final	Diff.	Reference Sheet			COMBINED PROJECT TOTALS	Final		
202	Removal of Structure	Each				3	2	-1	7	8	8	0				11	10		
203	Unclassified Excavation (Haul)	Cu. Yd.	Bid Field Quantity			34,000	39,277 ~~39941~~	+5,941	5	16,000	16,676	+ 676				50,000	56,617		
203	Stripping	Cu. Yd.				29,000	4,849	-24,151	6	24,000	4,016	-19,984				53,000	8,865		
203	Embankment (Standard)	Cu. Yd.				53,000	53,810	+ 810	5	29,000	19,421	- 9,579				82,000	73,231		
204	Haul	Tan Mi.				589,400	597,439	+8,039	5	744,300	670,905	-73,395				1,333,700	1,268,344		
206	Structure Excavation (Haul)	Cu. Yd.				900	792	-108	7	160	190	+ 30				1,060	982		
206	Structure Backfill (Class 3)(Haul)	Cu. Yd.				290	256	- 34	7	120	140	+ 20				410	396		
209	Wetting	M Gal.				3,010	2,826	- 184	Form 7	1,840	821.60	-1018.40				4,850	3,648		
210	Reset Mailbox Structure	Each				2	1	-1	7	—						2	1		
210	Reset End Section	Each				—				14	14	0				14	14		
210	Relay Pipe (36 inch)	Lin. Ft.				~~146~~	48	- 98	7	—						146	48		
304	Aggregate Base Course (Class 2)	Ton				38,500	38,492.35	- 7.65	Scale Books 5	39,100	34,436.25	- 4663.75				77,600	72,928.60		
304	Aggregate Base Course (Class 7)	Ton				22,300	22,977.00	+ 677	Scale Books 5	8,300	8,424.15	+ 124.15				30,600	31,401.15		
403	Hot Bituminous Pavement (Grading F)(Hydrated Lime)	Ton				9,900	9,750.85	- 149.15	Scale Books 5	9,900	8,524.40	- 1375.60				19,800	18,275.25		
409	Cover Coat Material (Type I)	Ton				810	872.50	+ 62.50	Scale Book	590	648.35	+ 58.35				1,400	1,520.85		
411	Asphalt Cement (120-150 Pen.)	Ton				710	660.40	- 49.60	Form 49	730	583.52	- 146.48				1,440	1,243.92		
411	Liquid Asphaltic Material (MC-70)	Gal.				43,000	34,924	- 8,076	Form 49	18,400	17,263	- 1137				61,400	52,187		
411	Liquid Asphaltic Material (RC-800)	Gal.				20,400	19,697	- 703	Form 49	15,500	15,476	- 24				35,900	35,173		
506	Riprap	Cu. Yd.				30	66	+ 36	7	—						30	66		
601	Concrete Class A	Cu. Yd.				98	97.02	- 0.98	7	—						98	97.02		
602	Reinforcing Steel	Lb.				9,600	9516	- 84	7	—						9,600	9516		
603	18 Inch Corrugated Steel Pipe	Lin. Ft.				314	314	0	7	554	554	0				868	868		
603	24 Inch Corrugated Steel Pipe	Lin. Ft.				312	312	0	7	—						312	312		
603	30 Inch Corrugated Steel Pipe	Lin. Ft.				—				50	34	- 16				50	34		
603	36 Inch Corrugated Steel Pipe	Lin. Ft.				34	34	0	7	46	62	+ 16				80	96		
603	48 Inch Corrugated Steel Pipe	Lin. Ft.				—				8	8	0				8	8		
606	Guard Rail Type 3	Lin. Ft.				750	750	0	7	—						750	750		

DEPARTMENT OF HIGHWAYS
HIGHWAYS — STATE OF COLORADO

SUMMARY OF ~~APPROXIMATE~~ Final QUANTITIES

9-11-69 (R-1) 3-5-69 G.K.M.

FEDERAL ROAD BRIDGE NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
•	COLORADO	S0004(6)	4	

CONTRACT ITEM NO.	CONTRACT ITEM	UNIT	TOTAL S 0004 (6) Plan	Final	Diff.	Refference Sheet	TOTAL S0002(29) Plan	Final	Diff.	Refference Sheet	COMBINED PROJECT TOTALS	
512	Delineator (Type I)	Each	—				38	38	0	BK1 Pg 47	38	38
614	Flagging	Hour	500	503	+ 3	Form 7	1,200	1,056	− 144		1,700	1559
614	Pavement Marking Paint	Gal	260	252	− 8	Bk2 Pg 10	180	168	− 12		440	420
(R-1) 620	Field Office	Each	1	1	0	BK1 Pg 50	—				1	1
620	Field Laboratory	Each	1	1	0	BK1 Pg 50	1	1	0	BK1 Pg 50	2	2
620	Sanitary Facility	Each	1	1	0	BK1 Pg 50	1	1	0	BK1 Pg 50	2	2
626	Mobilization	Lump Sum	Prorated				Prorated				•	
	— STATE FORCES —											
	Furnishing and Installing Identification Sign	Each	2	2	0	BK1 Pg 39	2	2	0	BK1 Pg 7, 45	4	4
	* Signing Entire Project	Lump Sum	•				•				•	

* Non Fed. Aid

FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	S 0004(6)	5	

AS CONVERTED
9-11-69

SUMMARY OF EARTHWORK QUANTITIES

UNCLASSIFIED EXCAVATION

Roadway (From Cross Sections) Data Processing	~~6,115~~	39685
* Widened Cuts	~~23,332~~	
* Estimated for Subsidence	~~2,945~~	0
Structure Quantities as Embankment	190	~~164~~
Structure Quantities as Ditch Excavation, ~~Sta 7~~	~~40~~	92
* Estimated for Cut Slope Treatment	~~500~~	
TOTAL FOR PAY QUANTITY	~~33,122~~ Cu. Yds.	~~54441~~ Cu. Yds. 39,777

EMBANKMENTS (STANDARD)
(Moisture and Density Control)

Embankment (Net) Data Processing	~~24,955~~	26 312
Base of Cuts and Fills, ~~Sta Special Provisions~~	~~27,498~~	27 498
TOTAL FOR PAY QUANTITY	~~52,453~~ Cu. Yds.	53,810 Cu. Yds.

ROADWAY QUANTITIES BALANCE
(For Information Only)

EXCAVATION:

Unclassified	~~6,115~~
Widening	~~23,332~~
TOTAL	~~29,447~~ Cu. Yds

EMBANKMENT:

Roadway (From Cross Sections)	~~24,955~~	26,312
TOTAL	~~24,955~~ Cu. Yds.	26,312 Cu. Yds.

EMBANKMENT x FACTOR	~~29,447~~
TOTAL	~~29,447~~ Cu. Yds.

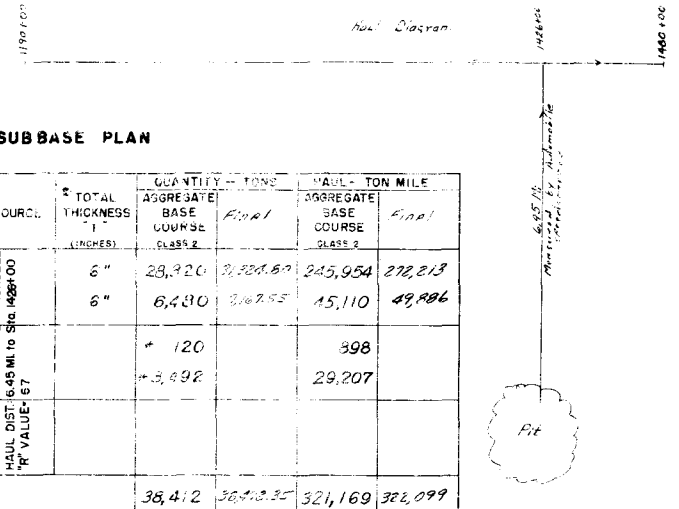
* Not in Roadway (From Cross Sections)

BASE COURSE AND SURFACE COURSE PLAN

MATERIAL TO BE PLACED	SOURCE	QUANTITY-TONS: BASE COURSE, AGGREGATE BASE COURSE CLASS 7	BASE COURSE, Final	SURFACE COURSE, HOT BITUMINOUS PAVEMENT GRADING F	SURFACE COURSE, Final	HAUL-TON MILE: BASE COURSE, AGGREGATE BASE COURSE CLASS 7	BASE COURSE, Final	SURFACE COURSE, HOT BITUMINOUS PAVEMENT GRADING F	SURFACE COURSE, Final
1190+00 to 1426+00	OWNER: FELIX & MAMIE H. MUNDELL HAUL DIST: 6.45 MI. to Sta. 1426+00 "R" VALUE = 77 (BASE COURSE)	16,048	19,314.00	7,788	8104.90	139,374	167,839	67,637	70,389
1426+00 to 1480+00		3,672	3,663.00	1,782	1,500.65	25,492	25,494	12,371	10,447
Appr. to Proj. Sta. 1480+		* 88		33	17.05	508		247	186
From Structure Quantities		* 550		202	128.25	4,598		1,689	985
Add. Mat'l. for Shoulder Finishing		*1,947		—		16,277		—	
PROJECT TOTALS		22,285	22,977	9,805	9,750.85	186,250	193,333	81,944	82,001

* Not in Roadway Quant.

Haul Diagram



SUBBASE PLAN

MATERIAL TO BE PLACED	SOURCE	* TOTAL THICKNESS "T" (INCHES)	QUANTITY-TONS: AGGREGATE BASE COURSE CLASS 2	Final	HAUL-TON MILE: AGGREGATE BASE COURSE CLASS 2	Final
1190+00 to 1426+00	OWNER: FELIX & MAMIE H. MUNDELL HAUL DIST: 6.45 MI. to Sta. 1426+00 "R" VALUE = 67	6"	28,320	31,324.89	245,954	272,213
1426+00 to 1480+00		6"	6,480	3,167.55	45,110	49,886
Appr. to Proj. Sta. 1480+			* 120		398	
Est. For Corr. Irreg. in Subgrade			*3,892		29,207	
PROJECT TOTALS			38,412	38,492.35	321,169	322,099

* Not in Roadway Quant.

* BASED ON DESIGN CURVE "B"

STMENT OF HIGHWAYS-STATE OF COLORADO
- D. O. H 126
H 1968

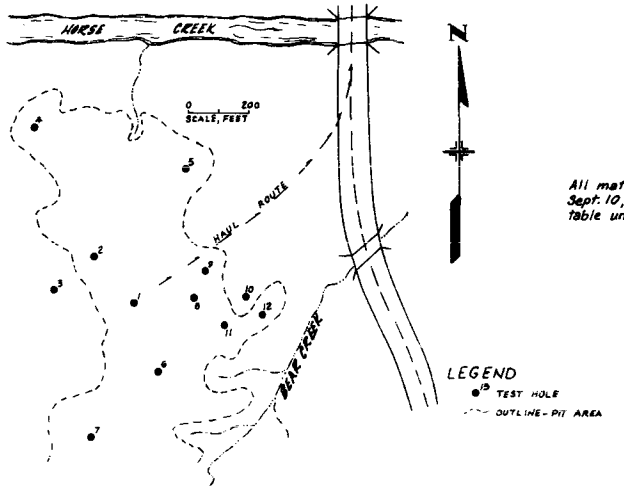
FEDERAL ROAD REGION NO.	DISTRICT	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	S 0004(6)	6	

PIT SKETCH

MUNDELL PIT

Use: Subbase, Base Course, and Bituminous Pavement.
Location: Part of Northeast ¼, Sec. 3, T. 30S., R. 42 W.
Owner: Felix and Mamie H. Mundell, Walsh, Colorado.
Quantity Available: 165,000 Cu. Yds.
Stripping: Removing Overburden – ~~14,500 Cu. Yds.~~ 4,849 Cu. Yds. – Book No. 1 Page 46 (S 0004(6))
Replacing Overburden – ~~14,500 Cu. Yds.~~ 0 Cu. Yds.
Haul Distance: 6.45 MILES TO STA. 1426 + 00

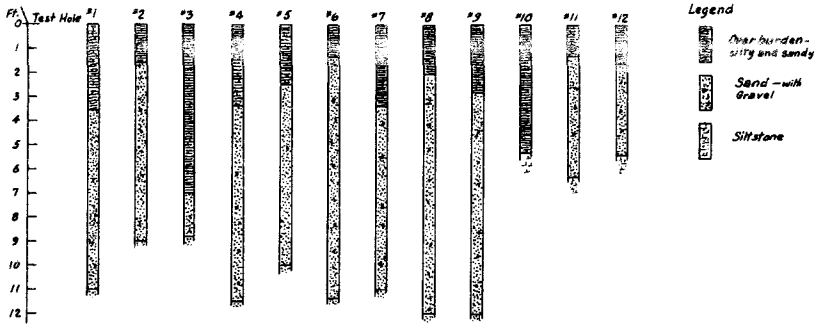
AS CONSTRUCTED
REVISED DATE 9-11-69



All material tests are as of Sept. 10, 1968. Depth of water table unknown on above date.

Log of Pit

Sample No. 5015



DEPARTMENT OF HIGHWAYS-STATE OF COLORADO
FORM D.O.H. 125 (MYLAR)
REV. FEBRUARY 1967

STRUCTURE QUANTITIES

AS CONSTRUCTED
9-11-69

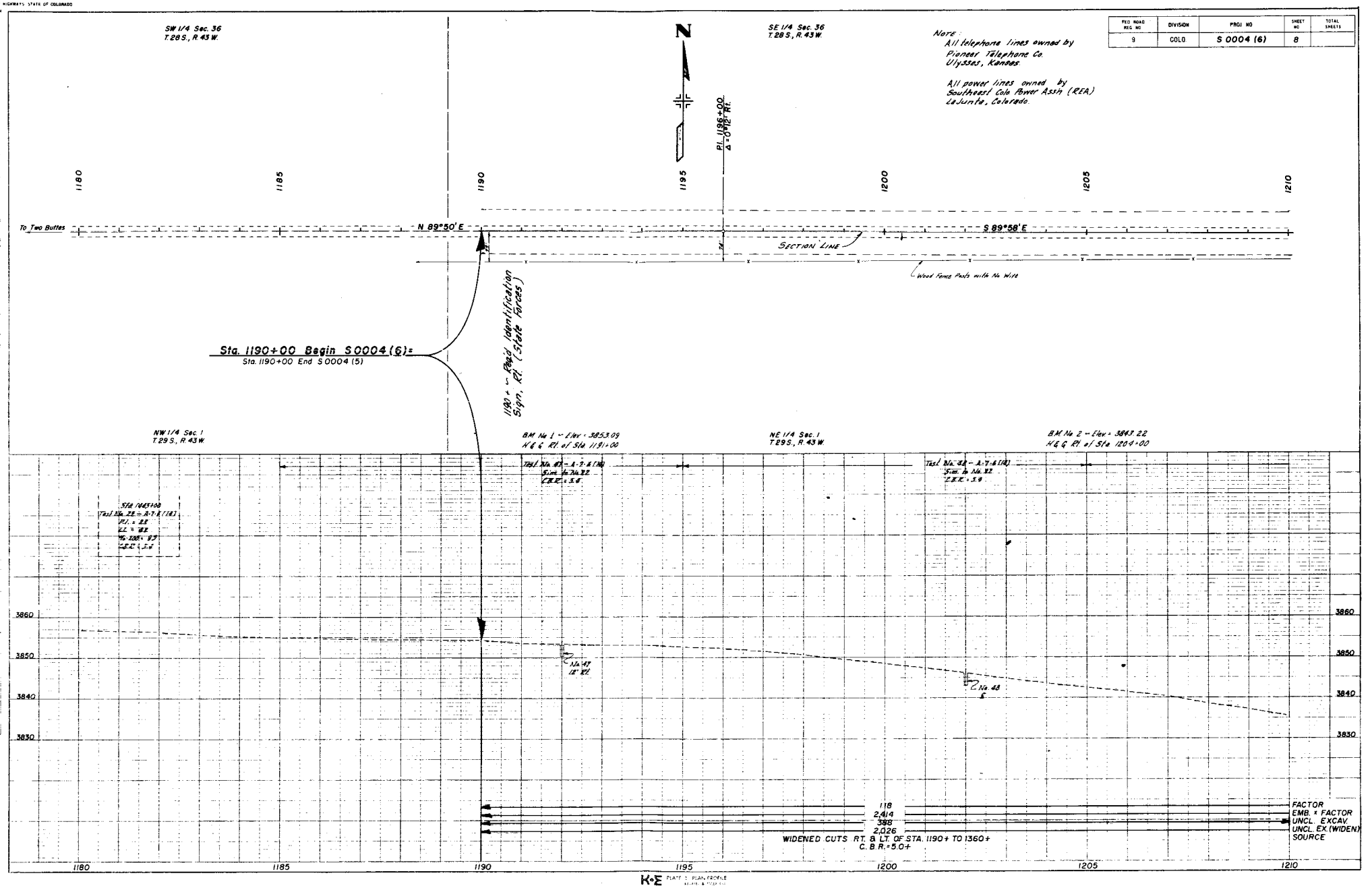
FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
9	COLORADO	S 0004 (6)	7

LOCATION	REMOVAL OF STRUCTURE EACH	UNCLASSIFIED EXCAVATION CUBIC YARD EXCAV.	EMB.	DITCH	STRUCTURE EXCAVATION CUBIC YARD	STRUCTURE BACKFILL CUBIC YARD CL. 3	AGGREGATE BASE COURSE (CLASS 7) TON	HOT BITUMINOUS PAVEMENT (GRADING F) TON	CONCRETE CUBIC YARD CL. A	REINFORCING STEEL LB.	Reference Book	Pg.	CORRUGATED STEEL PIPE LINEAR FEET 18"	24"	36"	"H" OVER CULV. FT.	MISCELLANEOUS
1212+			~~70~~	44	~~2~~ 12	~~7~~	~~55~~	~~28~~ 19.10			1	7	44			1.0	
1215+62					~~270~~ 86	~~85~~ 32					1	8-9			34	1.0	~~100~~ 48 Lin. Ft. of Relay Pipe (36 Inch). Rip Rap-35 cy
1215+ to 1216+																	300 Lin. Ft. of Guard Rail, Type 3.
1216+10				20	498	100			97.02	9,516	1	11-13				9.0	~~22~~ 31 Cu. Yds. of Riprap
1217+			~~70~~		~~3~~ 9	~~4~~	~~22~~	~~2~~ ⊗			1	14	26			1.0	
1267+			~~70~~ 20		~~3~~ 5	~~4~~	~~14~~	~~2~~ ⊗			1	16	26			1.0	
1267+			~~70~~				~~55~~	~~28~~ 16.20			1	15					
1293+			~~20~~ 16		~~3~~ 19	~~9~~	~~22~~	~~4~~ ⊗			1	17	28			1.0	
1320±			~~20~~ 32		~~3~~ 12	~~5~~	~~14~~	~~4~~ ⊗			1	18	26 RI 40			1.0 1.0	
1324+ to 1326+											1	19					450 Lin. Ft. of Guard Rail, Type 3.
1334+50 ~~1329+~~			~~70~~ 30		~~3~~ 1	~~5~~	~~22~~	~~2~~ ⊗			1	20	28			1.0	
1332+			~~70~~				~~14~~	~~2~~ ⊗			1	21					
1346+			~~70~~ 30				~~13~~	~~2~~ ⊗			1	22					
1350+00				~~50~~	~~21~~ 15	~~14~~ 16					1	23		~~60~~ 68		2.0	
1373+			~~70~~				~~55~~	~~28~~ 15.00			1	24					
1373+			~~70~~		~~4~~ 12	~~6~~	~~32~~	~~4~~ ⊗			1	25	40			1.0	
1420+58	1			5	~~21~~ 29	~~15~~					1	26		64		3.0	
1421+18	1			~~50~~	~~24~~ 47	~~16~~ 29					1	28		~~60~~ 120		3.0	
1423+			~~70~~		~~4~~ 10	~~5~~	~~15~~	~~8~~ ⊗			1	30	30			1.0	
1425+			~~70~~	17	~~4~~ 41	~~14~~	~~55~~	~~28~~ 62.30			1	31		60		1.0	
1425+			~~70~~				~~11~~	~~2~~ ⊗			1	32					
1425+85	✕			6							1	34					
1426+25				~~5~~	~~20~~	~~14~~					1	33		~~60~~		1.0	
1452+			~~70~~ 18		~~4~~ 7	~~5~~	~~11~~	~~2~~ ⊗				35	26			1.0	
1478+			~~20~~ 18				~~110~~	~~56~~ 15.65			1	36					
1480+		▲	▲				●	●			1	37					
Entire Project											1	~~38~~					~~2~~ Reset Mailbox Structure
Project Totals	~~2~~ 2		~~190~~ 164	~~40~~ 92	~~894~~ 792	~~288~~ 256	~~550~~	~~282~~ 128.25	97.02	9,516			314	312	34		

▲ Included in Profile Quantities.
● Included in Surfacing Plan.
⊗ Included in Rdwy Quantities

DEPARTMENT OF HIGHWAYS, STATE OF COLORADO

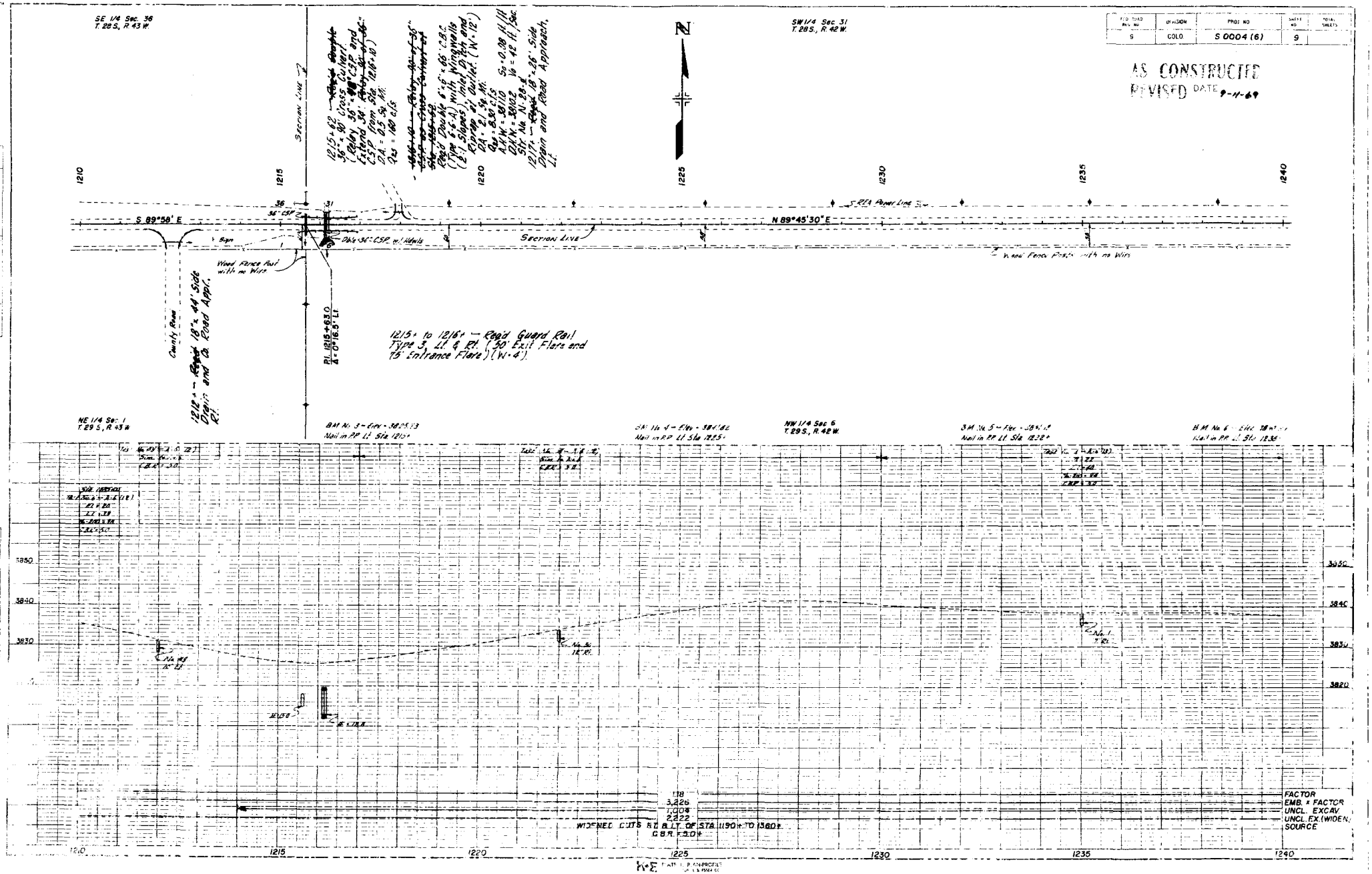
FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0004 (6)	8	



K+E PLATE 1 PLAN PROFILE

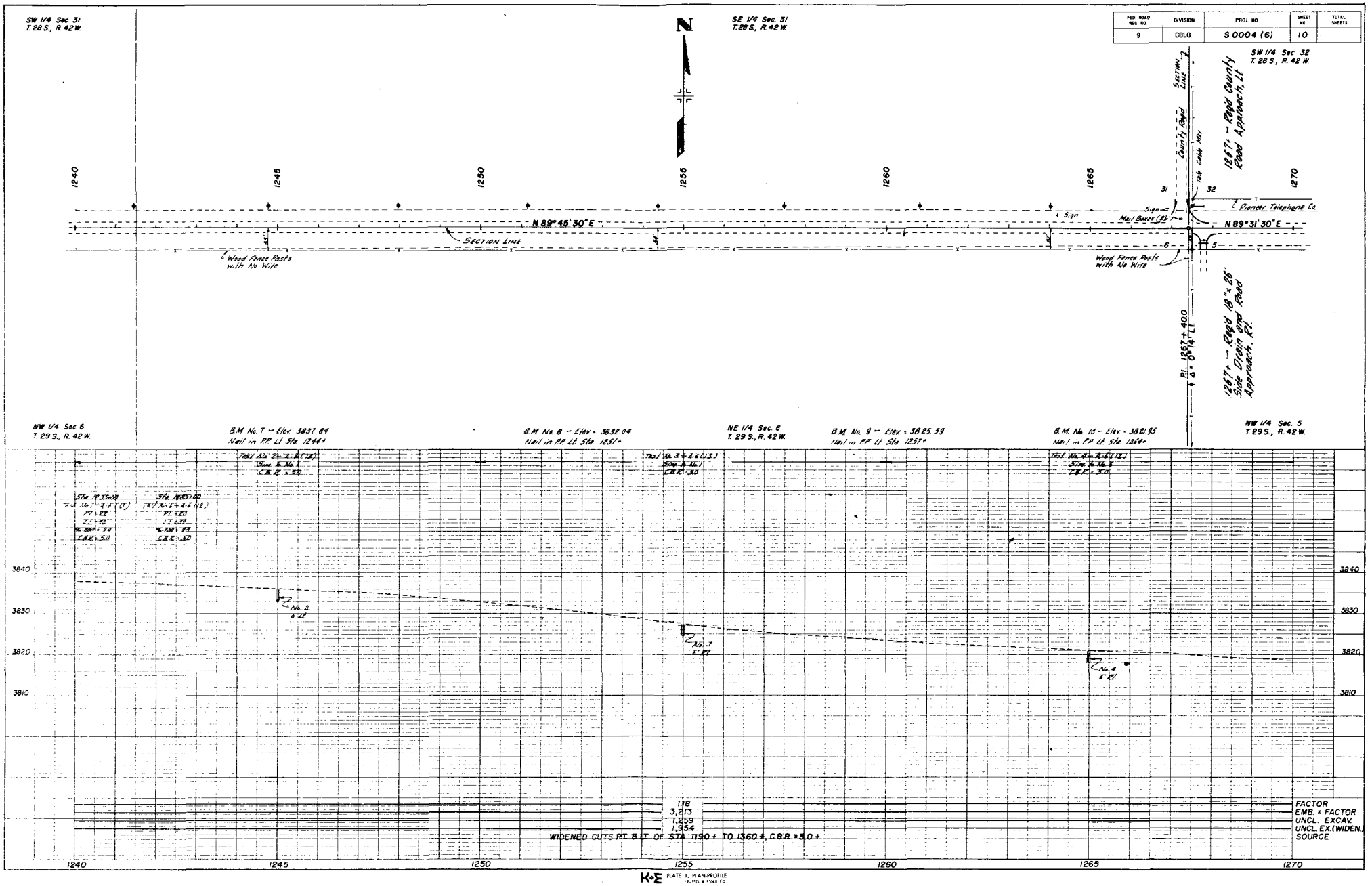
FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0004 (6)	9	

AS CONSTRUCTED
REVISED DATE 9-11-69



DEPARTMENT OF HIGHWAYS STATE OF COLORADO
Form D O N 134
Aug. 1965

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0004 (6)	10	



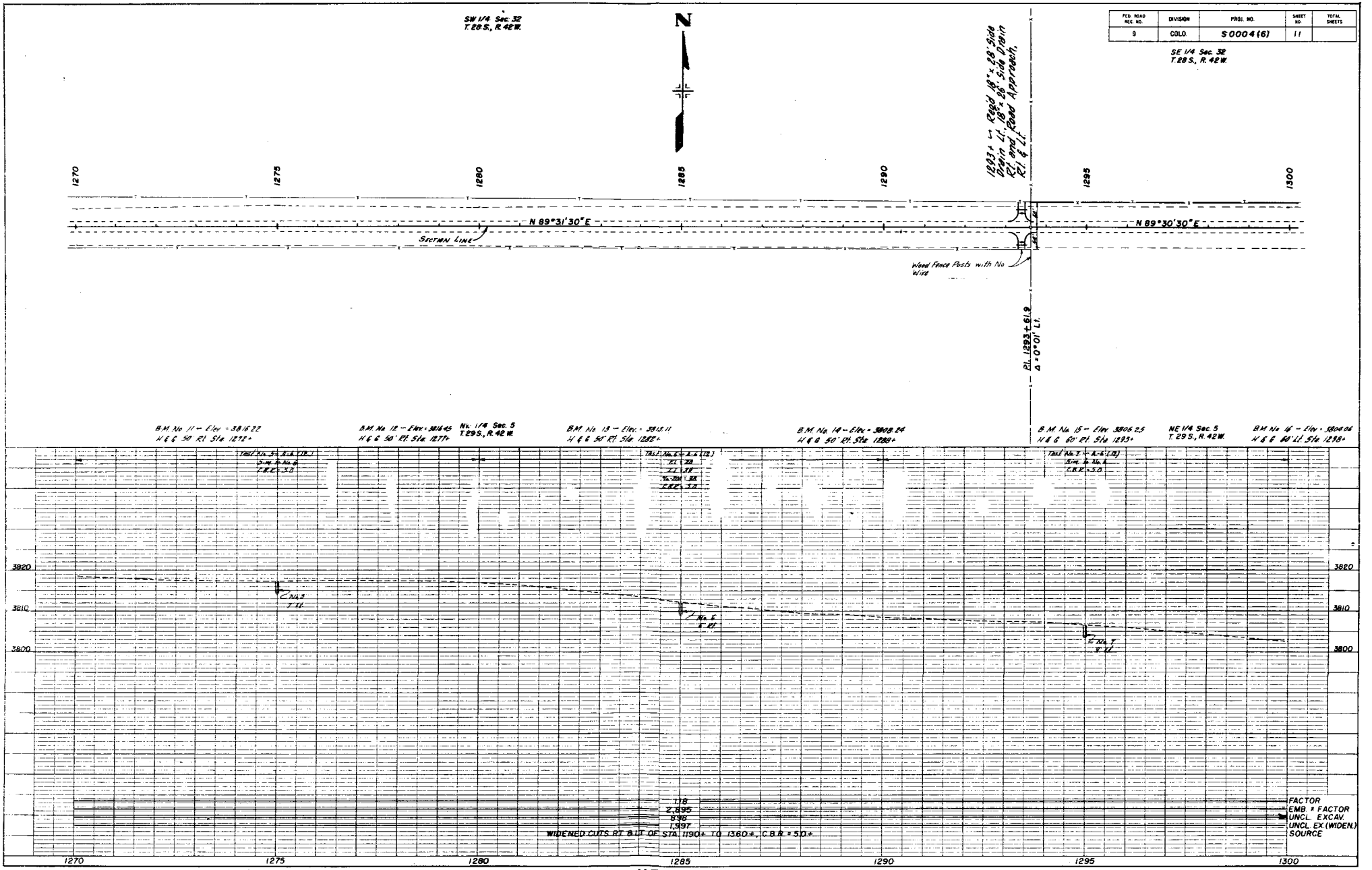
PLAN

PROFILE

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

DEPARTMENT OF HIGHWAYS, STATE OF COLORADO
FORM 1 C N 134
Aug. 1955

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0004 (6)	11	



PLAN
SUPPLIED
DRAWN
NOTE BOOK
NO.

PROFILE
SUPPLIED
DRAWN
NOTE BOOK
NO.

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

DEPARTMENT OF HIGHWAYS, STATE OF COLORADO

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO	S 0004 (6)	12	

AS CONSTRUCTED
REVISED DATE 9-11-69

SE 1/4 Sec. 32
T. 28 S., R. 42 W.

SW 1/4 Sec. 33
T. 28 S., R. 42 W.

1320+ ~~Reqd~~ 18" x 40' Side Drain and Double Road Approach, Lt.

1324+50 ~~1324+~~ ~~Reqd~~ 18" x 28' Side Drain and Road Approach, Lt.

Section Line

1300 1305 1310 1315 1320 1325 1330

Tele Cable Mtr

22' Cab

32 33

N 89°30'30" E

N 89°18'30" E

Section Line

5 4

Tel & Ant (Str. No. N-26-C)

P.I. 132+50.1
Δ = 0°12' Lt.

1324+ to 1326+ ~ Reqd Guard Rail Type 3, Lt. & Rt. (75' Ex. & and Entrance Flares) (W=4')
(Guard Rail is not to be fastened to masonry headwalls)

NE 1/4 Sec. 5
T. 29 S., R. 42 W.

S.M. No. 17 ~ Elev. = 3723.22
K & G 50' Lt. Sta. 1308+

B.M. No. 18 ~ Elev. = 3765.18
K & G 60' Lt. Sta. 1319+

NW 1/4 Sec. 4
T. 29 S., R. 42 W.

Test No. 25 ~ A.L. (Lt.)
R.L. = 2.0
L.L. = 15
% Zap = 9.8
C.B.R. = 3.0

Test No. 9 ~ A.L. (Rt.)
S.M. to No. 6
C.B.R. = 5.0

Test No. 21 ~ A.L. (Lt.)
R.L. = 2.0
L.L. = 24
% Zap = 7.1
C.B.R. = 3.0

Sta. 1283+00
Test No. 26 ~ A.L. (Lt.)
R.L. = 2.0
L.L. = 15
% Zap = 9.8
C.B.R. = 3.0

3810 3800 3790 3780 3770 3760

No. 8
8' Rt.

No. 9
9' Lt.

No. 14
7' Lt.

18
3760
3752

158 50

WIDENED CUTS RT & LT OF STA. 1150+ TO 1360+, C.B.R. = 5.0+

FACTOR
EMB. x FACTOR
UNCL. EXCAV.
UNCL. EX (WIDEN)
SOURCE

1300 1305 1310 1315 1320 1325 1330

K+E

FED. ROAD REG. NO	DIVISION	PROJ. NO	SHEET NO	TOTAL SHEETS
9	COLO.	S 0004(6)	13	

AS CONSTRUCTED
REVISED DATE 9-11-69

PLAN

SW 1/4 Sec. 33
T. 28 S., R. 42 W.

SE 1/4 Sec. 33
T. 28 S., R. 42 W.

1350 + 00 — ~~Rigid~~ 24" x ~~90'~~ 68' Cross Culvert and Inlet Ditch.

PI. 1346 + 47.3
Δ = 0°08' Rt.

1332 + — ~~Rigid~~ Road Approach, Rt.

1346 + — ~~Rigid~~ Road Approach, Rt.

1330 1335 1340 1345 1350 1355 1360

N 89°18' 30" E — SECTION LINE — N 89°26' 30" E

Tele Cable Mkr.

B.M. No. 19 — Elev. = 3763.85
H & G 85' Rt. Sta. 1330+

NW 1/4 Sec. 4
T. 29 S., R. 42 W.

B.M. No. 20 — Elev. = 3772.42
H & G 45' Lt. Sta. 1340+

NE 1/4 Sec. 4
T. 29 S., R. 42 W.

B.M. No. 21 — Elev. = 3771.70
H & G 45' Lt. Sta. 1350+

PROFILE

3780
3770
3760

Test No. 11 — X-S (D.)
Sim. to No. 12
C.B.R. = 3.0

Test No. 12 — X-S (D.)
W = 18
L.L. = 38
% Bit. = 10
C.B.R. = 3.0

Test No. 13 — X-S (D.)
Sim. to No. 12
C.B.R. = 3.0

No. 11
1 RL

No. 12
7' LT

C.E. = 1350

No. 14
1 RL

FACTOR	1.18
EMB. x FACTOR	3,357
UNCL. EXCAV.	636
UNCL. EX. (WIDEN.)	2,721
SOURCE	

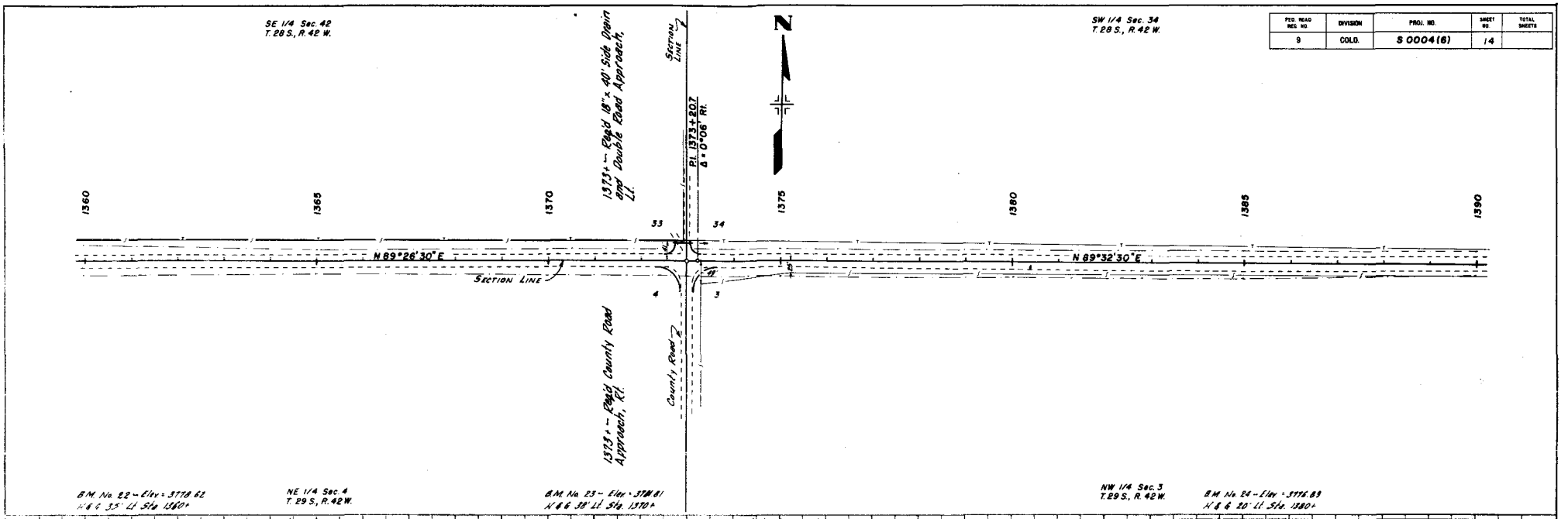
WIDENING QTYS. BY SCALE OF STA. 1901 + 1360 + C.B.R. = 3.0 +

1330 1335 1340 1345 1350 1355 1360

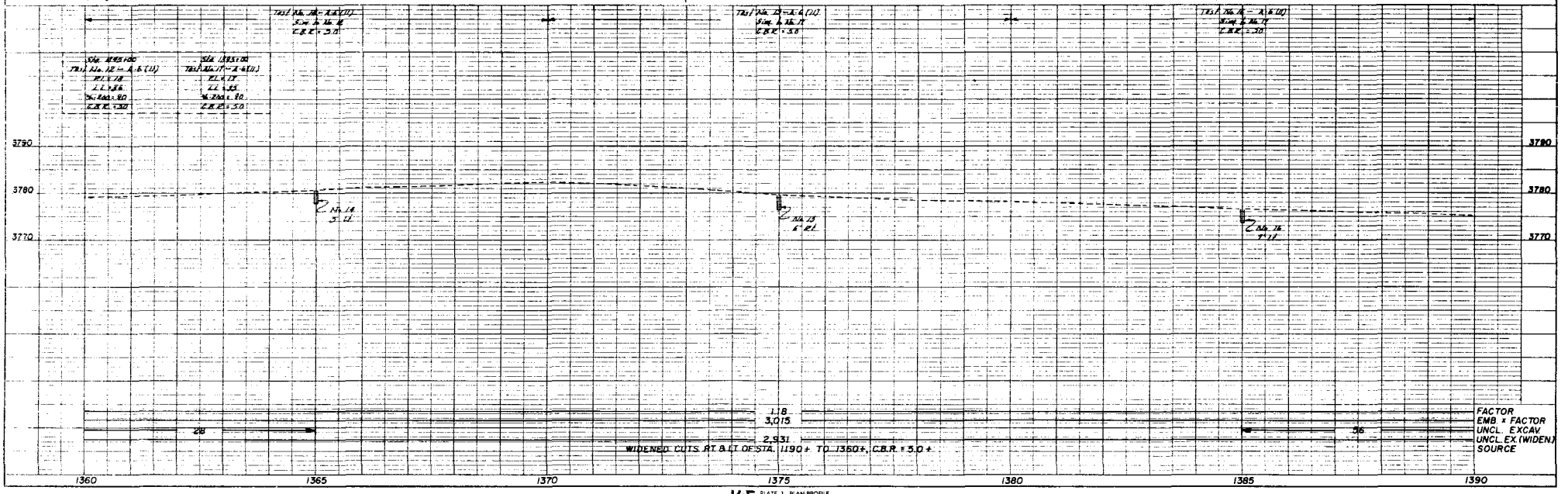
DEPARTMENT OF HIGHWAYS STATE OF COLORADO
Form D O H 34
Aug 1965

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0004(8)	14	

PLAN



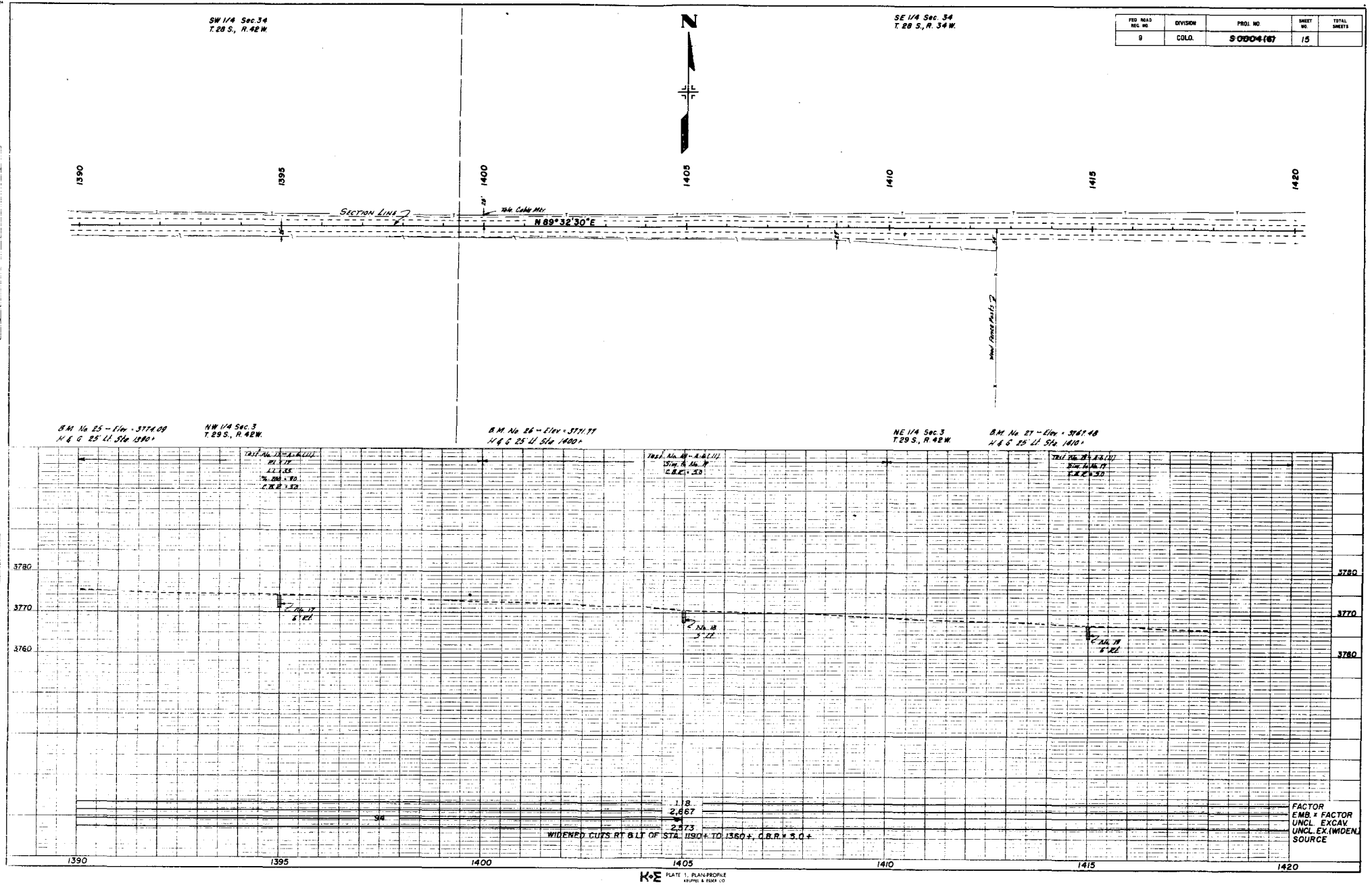
PROFILE



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

DEPARTMENT OF HIGHWAYS STATE OF COLORADO

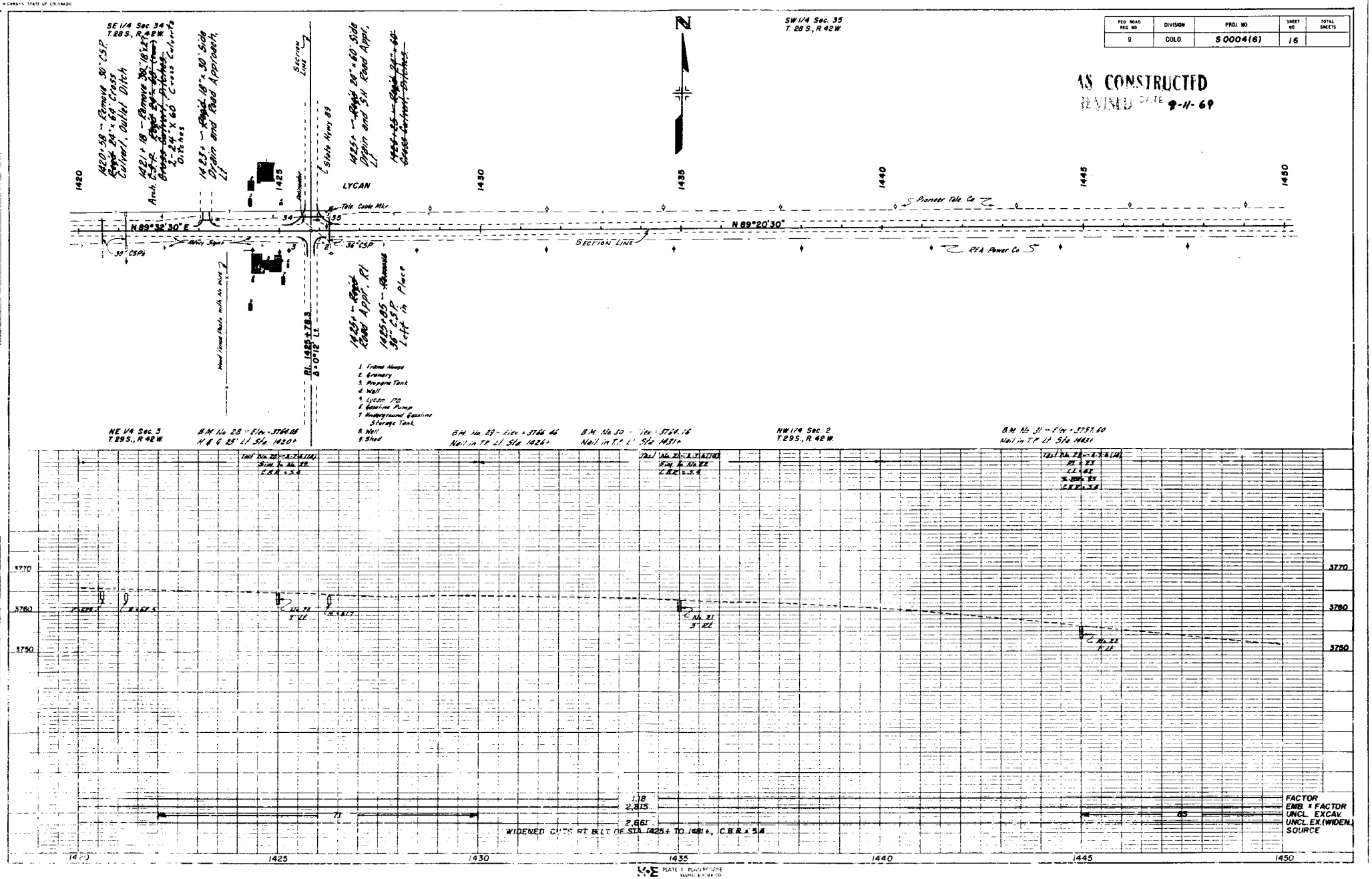
FED. ROAD REG. NO.	DIVISION	PROJ. NO	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0004(6)	15	



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

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0004(6)	16	

AS CONSTRUCTED
REVISED DATE 9-11-69



PLAN

PROFILE

PLATE 1. PLAN-PROFILE

FED. ROAD REG. NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLO.	S 0004(6)	17	

AS CONSTRUCTED
REVISED DATE 9-11-69

SW 1/4 Sec. 35
T.28 S., R. 42 W.

SE 1/4 Sec. 35
T.28 S., R. 42 W.

SW 1/4 Sec. 36
T.28 S., R. 42 W.

N

PI. 1452+00.0
Δ = 0°06' Rt.

1452+ – Repair 18" x 26' Side Drain and Road Approach, Lt.

1478+ – Repair County Road Approach, Rt. & Lt.

PI. 1478+56.0
Δ = 0°10' Rt.

1480+ – Repair Identification Sign, Lt. (State Forces).

1450 1455 1460 1465 1470 1475 1480

N 89°20'30" E — N 89°26'30" E — N 89°36'30" E

Section Line

35 36

2 1

County Road

1480+ – Repair Approach to Project.

Sta. 1480+00 End S0004(6)

Section Line

NW 1/4 Sec. 2
T.29 S., R. 42 W.

B.M. No. 32 – Elev. 3749.37
Nail in T.P. Lt. Sta. 1454+

NE 1/4 Sec. 2
T.29 S., R. 42 W.

B.M. No. 33 – Elev. = 3741.84
Nail in T.P. Lt. Sta. 1466+

B.M. No. 34 – Elev. = 3738.36
Nail in T.P. Lt. Sta. 1478+

NW 1/4 Sec. 1
T.29 S., R. 42 W.

Trail No. 22 – R.T.-6 (M)
RT. 23
LT. 22
R.C.B. 33
C.B.C. 34

3760 3750 3740

3760 3750 3740 3730

Appr. To Project

118
2,085
7,390
695

WIDENED CUTS RT. & LT. OF STA. 1425+ TO 1481+ C.B.R. x 5.4

FACTOR
EMB. x FACTOR
UNCL. EXCAV.
UNCL. EX. (WIDEN)
SOURCE

1450 1455 1460 1465 1470 1475 1480

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

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

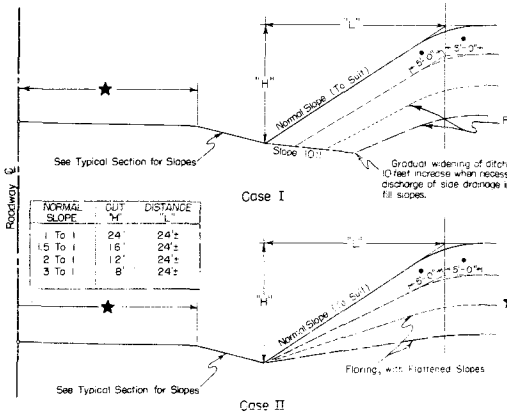
STANDARD M-203-B

(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

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'±

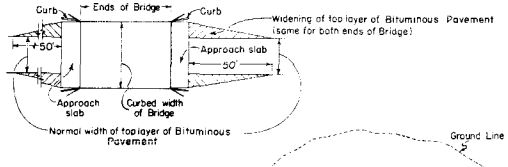
FLARING OF EARTH CUTS: The backslopes at ends of all earth cuts shall be flattened & where necessary the ditch shall be widened gradually to discharge side ditch drainage away from the base of adjacent fill slopes in order to avoid erosion & to improve appearance. The transition of flattened backslopes & 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.

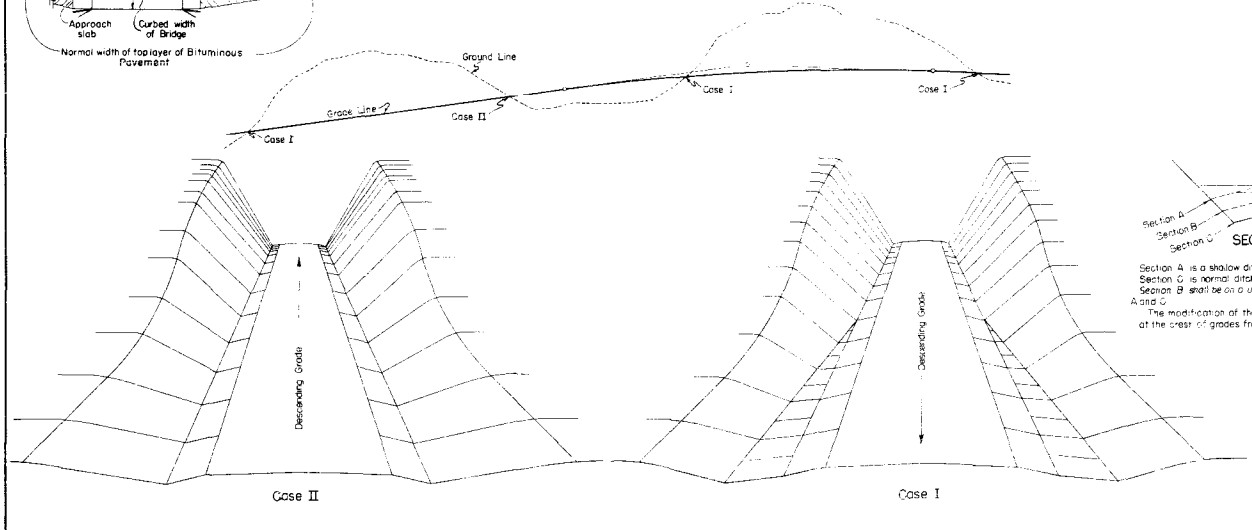
*CUT SLOPE TREATMENT IN EARTH CUTS: The intersection of cut slopes with the existing ground shall be rounded in earth cuts, beginning 5 ft. outside the slope stake and extending 5 ft. down the cut slope. Where the cut slope is less than 5 ft. reduce each of the above widths of slope treatment to the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

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

WIDENING OF TOP LAYER OF BITUMINOUS PAVEMENT AT BRIDGE APPROACHES



PLAN OF FLARING IN EARTH CUTS

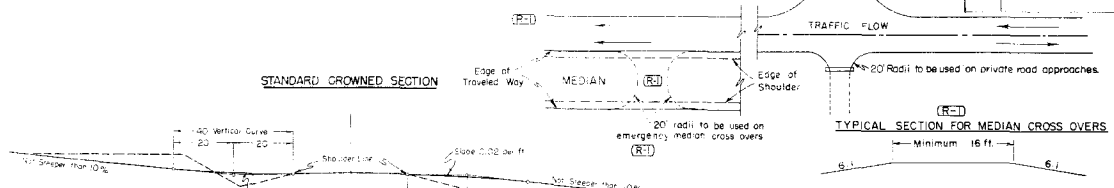


TYPICAL PLANS FOR SIDE APPROACH ROADS AND EMERGENCY MEDIAN CROSS OVERS

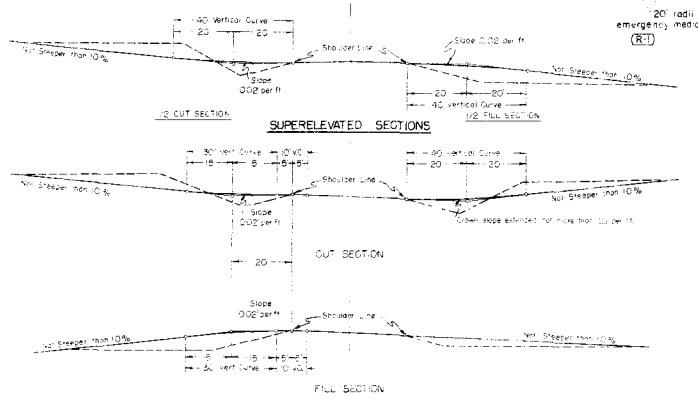
(R-1)

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.

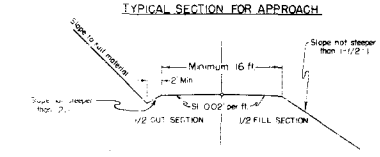


STANDARD CROWNED SECTION



TYPICAL SECTION FOR MEDIAN CROSS OVERS

TYPICAL SECTION FOR APPROACH

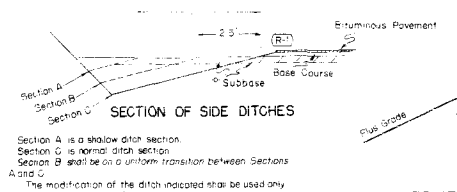


NOTE

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.

DETAILS FOR DITCH & WIDENED SHOULDERS AT CREST OF GRADES

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



SECTION OF SIDE DITCHES

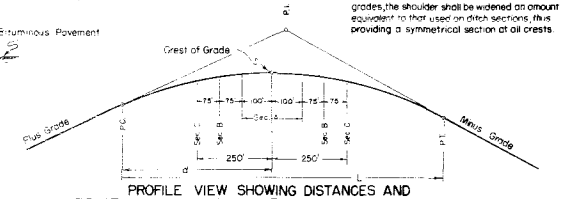
Section A is a shallow ditch section.
Section C is normal ditch section.
Section B shall be on a uniform transition between Sections A and C.
The modification of the ditch indicated shall be used only at the crest of grades from which drainage breaks both ways.

Formula for finding the Crest of Grade

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

NOTE

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



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

GENERAL NOTES

(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 less than the maximum shown are to be used wherever feasible.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

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

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

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

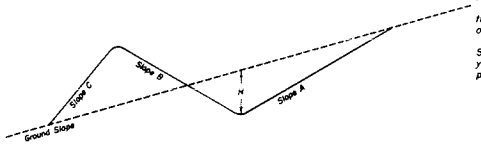
STANDARD TYPES *of* DITCHES *and* CONSTRUCTION METHODS

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

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

DETAILS *for* CONTOUR INTERCEPTING DITCHES

Typical Section for Contour Intercepting Ditches



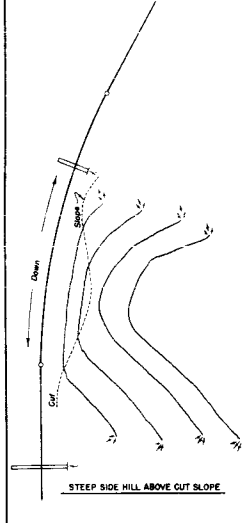
PURPOSE & USE OF THE TABLE

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

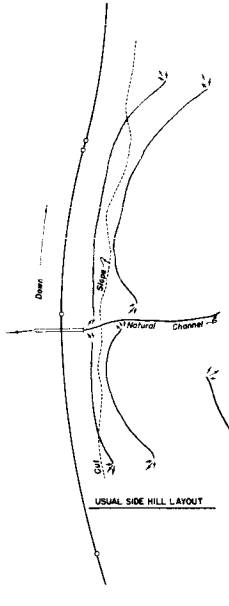
Foremost consideration in constructing these ditches is given first to the natural ground line slope confronted in construction, thence to the other values shown on the Typical Section.

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

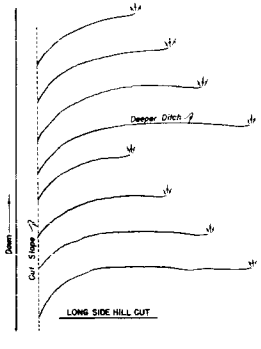
Typical Construction Layouts



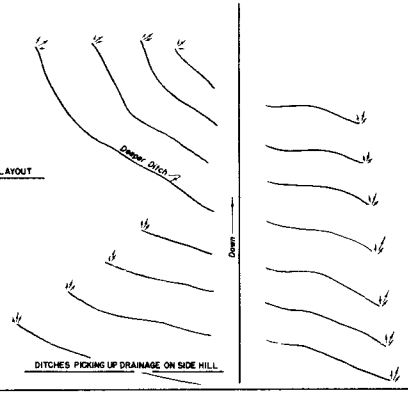
STEEP SIDE HILL ABOVE CUT SLOPE



USUAL SIDE HILL LAYOUT



LONG SIDE HILL CUT



DITCHES PICKING UP DRAINAGE ON SIDE HILL

Scale of Sketches in Feet

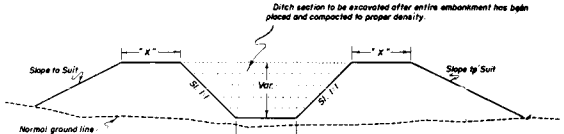
100 0 100 200 300 400

Table of Slopes and Yardages

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

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

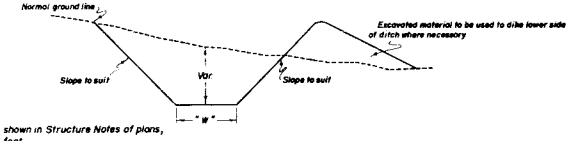
TYPICAL SECTIONS *for* DRAINAGE, IRRIGATION DITCHES *and* CHANNEL CHANGES



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

For Embankment Sections

(Generally for use in Irrigation Ditches & Channel Changes)



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

For Cut Sections

REVISIONS			
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 [illegible]
Made by C.G.M.	Staff Design Engr.
Checked by	Date: July 1, 1965

STANDARD M-206-A

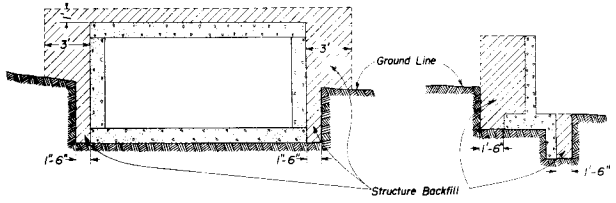
(JULY 1, 1965)

(SHEET 1 OF 2 SHEETS)

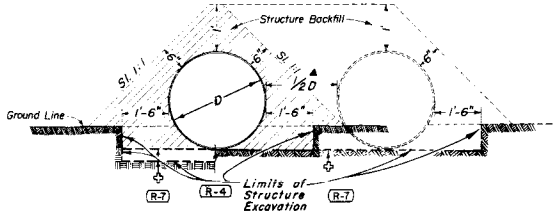
FED. ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.
8	COLO.		

REVISION			
R-1	10-20-65	ADDED PIER VIEW	M.R.H.
R-2	12-7-65	STR. EXCV.	M.R.H.
R-3	4-25-66	Class 2 Backfill (Trench)	M.R.H.
R-4	3-17-67	Conduit, Underdr'n, Box	M.R.H.
R-5	4-26-68	Limit Str. Excavation	M.R.H.
R-6	7-23-68	Dept. Name, Gen'l. Note	M.R.H.
R-7	11-1-68	Limit Str. Excavation	M.R.H.

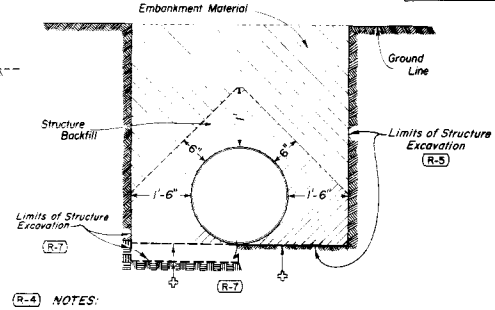
CONCRETE BOX CULVERTS & WINGWALLS



CIRCULAR CONDUIT

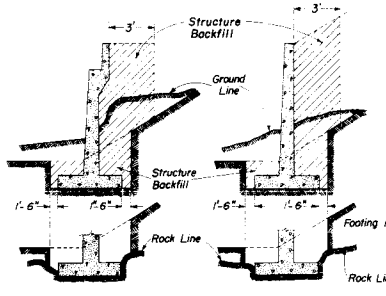


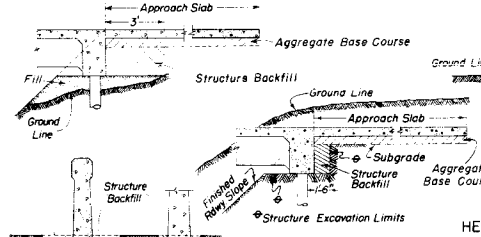
SIPHONS OR CONDUIT IN TRENCH



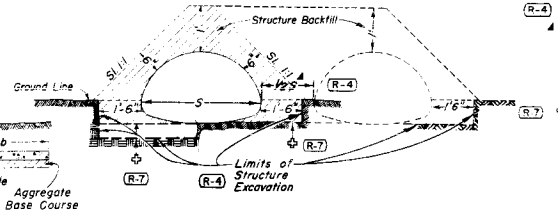
PIERS, ABUTMENTS, RETAINING WALLS ETC.

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



R-4 NOTES:

▲ *When two or more conduits are laid side by side they shall be spaced so that adjacent sides of pipe shall be ½ the Diameter or Span or 3 feet apart whichever is less. Minimum spacing shall not be less than 1 foot.* R-4

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 metal, reinforced concrete, and structural plate pipe culverts.*

GENERAL NOTES

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

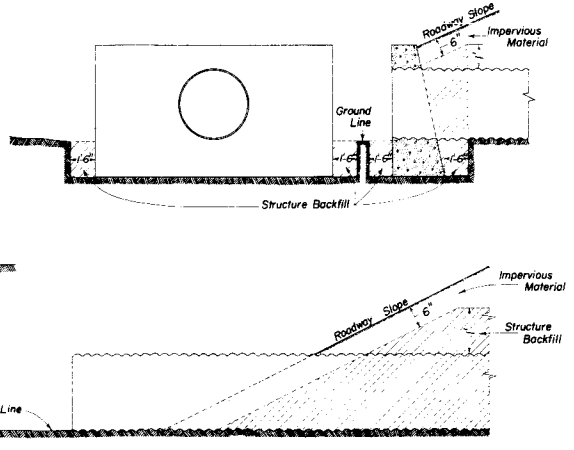
Where the roadway cross section is in fill, excavation for concrete footings (except those in rock or those on piles) and for box culverts shall be done according to the following:

R-6 *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.*

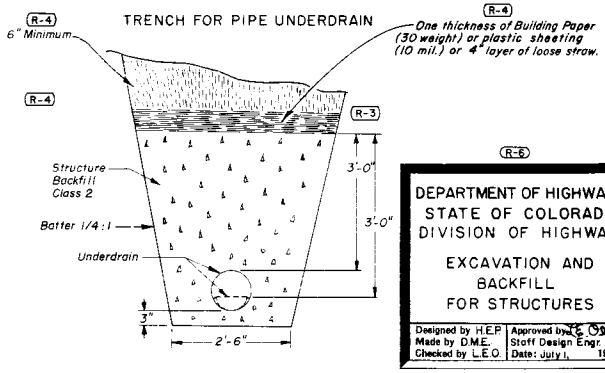
Excavation and backfill patterns different from those indicated on these sheets will be shown elsewhere on the plans.

R-4 ***Excavation for structure installation shall be classified as "Structure Excavation" unless otherwise shown on plans.***

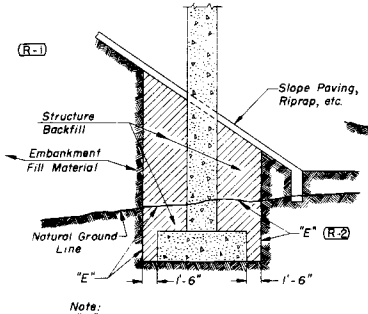
HEADWALLS AND END OF CULVERTS



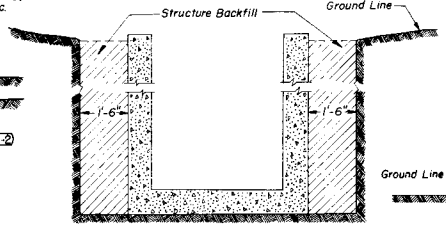
TRENCH FOR PIPE UNDERDRAIN



DROP INLETS, DIVISION BOXES, INTERCEPTING HEADWALLS, ETC.



Note:
"E" = Limits of Structure Excavation



R-6

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

EXCAVATION AND BACKFILL FOR STRUCTURES

Designed by H.E.P.	Approved by:
Made by D.M.E.	Staff Design Engr.
Checked by L.E.O.	Date: July 1, 1965

STANDARD M-206-A

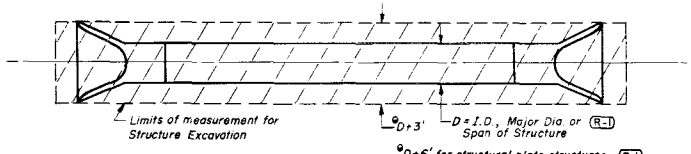
(SHEET 2)

(JULY 1, 1965)

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

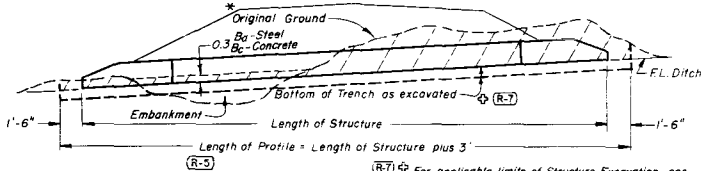
	REVISIONS:		
R-1	3-17-67	I. D. on Pipe Culvert Span or D.	M.R.H.
R-5	4-26-68	Structure Excavation in Fill	M.R.H.
R-6	7-23-68	Dept. Name & Detail	M.R.H.
R-7	11-1-68	Limit Str. Excavation	M.R.H.

STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS



PLAN

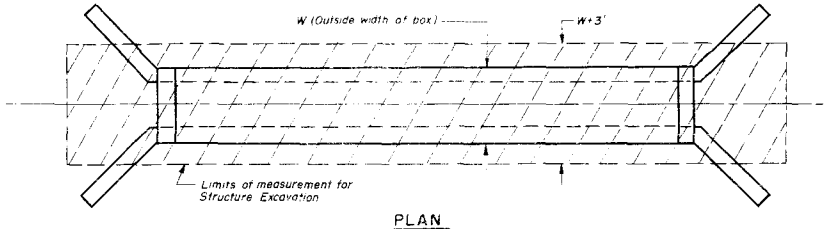
*D+6' for structural plate structures. R-1



PROFILE

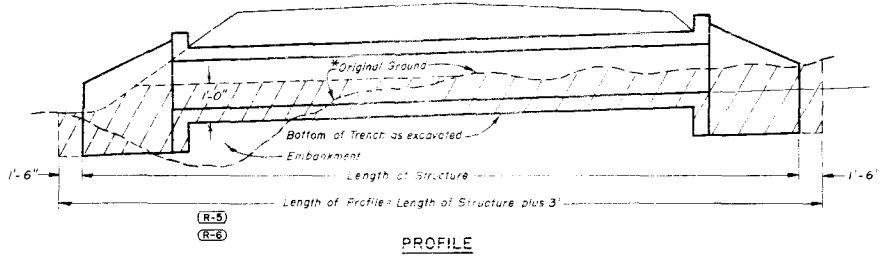
R-7 For applicable limits of Structure Excavation, see bedding details on standards for metal, reinforced concrete and structural plate pipe culverts.

STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS



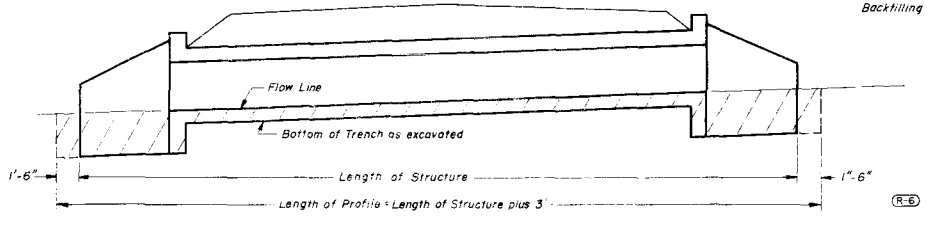
PLAN

Without Channel Change or Channel Improvement



PROFILE

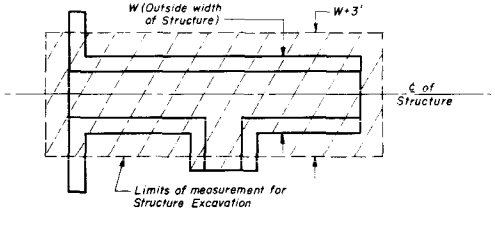
With Channel Change or Channel Improvement



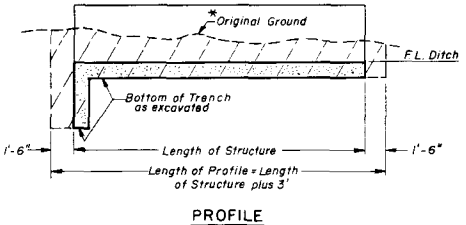
PROFILE

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

STRUCTURE EXCAVATION MEASUREMENT FOR DIVERSION OR DIVISION BOXES



PLAN



PROFILE

* Along ℄ of Structure

Areas to be used for Structure Excavation computations.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

EXCAVATION AND BACKFILL FOR STRUCTURES

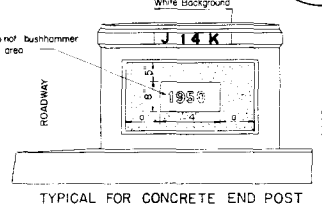
Designed by: M.R.H.	Approved by: [signature]
Made by: H.P.B.	Staff Design Engr.
Checked by:	Date: July 1, 1965

STANDARD M-500-A

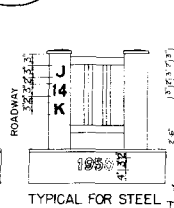
(JULY 1, 1965)

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

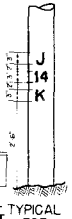
abcdefghijklmnopqrstuvwxyz



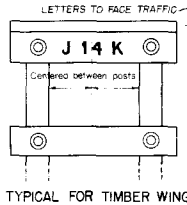
TYPICAL FOR CONCRETE END POST



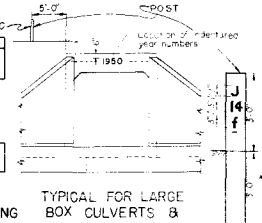
TYPICAL FOR STEEL HANDRAIL END POST



TYPICAL FOR SIGN POSTS



TYPICAL FOR TIMBER WING HANDRAIL



TYPICAL FOR LARGE BOX CULVERTS & STRUCTURES WITHOUT END POSTS

GENERAL NOTES

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

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

THE YEAR NUMBERS ARE RECESSED IN CONCRETE 3/8" MINIMUM AS SHOWN INTO THE FRONT OF THE ENDPOST ON THE RIGHT HAND SIDE OF EACH BRIDGE END AND INTO THE FACE OF THE DOWNSTREAM HEADWALL OF CULVERTS AS SHOWN ON PLAN DETAILS. NUMBERS TO BE MADE OF WOOD, METAL OR OTHER SUITABLE MATERIAL AND ATTACHED TO THE FORMS BEFORE CONCRETE IS POURED. THE YEAR NUMBER OF EACH STRUCTURE SHALL CORRESPOND WITH THE YEAR IN WHICH THE CONCRETE IS POURED.

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

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

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

ALL PRIMER WHITE BACKGROUND RECTANGULAR IN SHAPE AND EXTENDING THREE INCHES BEYOND THE LIMITS OF THE NUMBER SHALL BE PAINTED WITH TWO COATS OF ACCEPTABLE WHITE PAINT UNLESS ON WOOD, WHICH CONDITION PRESENTS SPECIAL PAINTING. THE SURFACE MUST BE THOROUGHLY DRIED, CLEANED AND PROPERLY SIZED ON TIMBER HANDRAILS. THE WHITE PAINT USED ON THE BRIDGE WILL BE SATISFACTORY.

AFTER THE WHITE BACKGROUND HAS DRIED SUFFICIENTLY, THE CORRECT STRUCTURE NUMBER SHALL BE CAREFULLY STENCILED WITH "EXTERIOR BLACK PAINT" AS TYPICAL IN SECTION "CC" PAINTED, OR ANY ACCEPTABLE EQUIVALENT. THE GRADES OF THE STENCILED LETTERS AND FIGURES SHALL BE CAREFULLY FILLED IN BY HAND TO MAKE SOLID FIGURES.

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

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

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

IN ADDITION TO THE PRECEDING STATED ABOVE, STRUCTURE NUMBERS FOR HIGHWAYS FROM UNDER CROSSROADS ARE TO BE PLACED AT THE FOLLOWING PLACES:

(a) FOR STRUCTURES OF 3 OR MORE SPANS, THE STRUCTURE NUMBER SHALL BE STENCILED, FACING TRAFFIC, ON THE OUTSIDE FACE OF THE END COLUMN OF THE RIGHT-HAND PIER.

(b) FOR 2-SPAN STRUCTURES, THE STRUCTURE NUMBER SHALL BE STENCILED, FACING TRAFFIC, ON THE OUTSIDE FACE OF EACH END COLUMN AND THE CENTER PIER.

STRUCTURE NO. _____

REVISIONS

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

LETTERS AND FIGURES FOR STRUCTURE NUMBERS

Designed by Made by Checked by	Approved by J. P. Hurlbut Bridge Engineer Date: July 1, 1965

STANDARD M-601-A

(JULY 1, 1965)

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

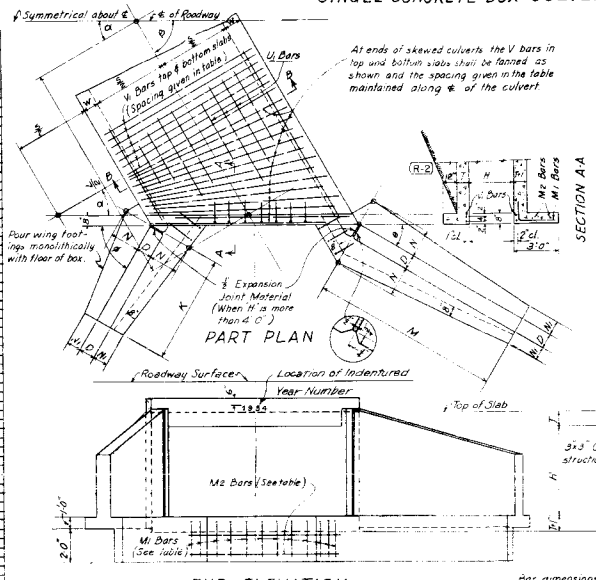
SINGLE CONCRETE BOX CULVERT

Dimensions & Quantities (see Wingwall Standard for Wings)

Height of Fill Allowed	Type	Span S	height H	Slab T	Wall w	Bar size & spacing V1 Size	V1 Spa	V1 Sp'a	W1 Size	W1 Spa	W1 Sp'a	No. bars required U1	M1	Quantities for One Lin Ft of Box Concrete Cu Yds	Steel Lbs	Quantities for Two Headwalls Concrete Cu Yds	Steel Lbs
35'-0"	2A	2'-0"	2'-0"	6"	8"	3/4"	12"	1/2"	12"	8	8	0.232	17.5	1.30	81		
			3'-0"							10		0.295	19.8	1.50	117		
30'-0"	3A	3'-0"	3'-0"	7"	8"	5/8"	12"	1/2"	12"	12	Case a	0.358	23.0	1.65	123		
			3'-0"							10		0.362	21.8	1.75	150		
20'-0"	4A	4'-0"	3'-0"	7½"	8"	7/8"	12"	5/8"	12"	14		0.412	26.6	1.90	154		
			4'-0"							16	Case a	0.461	27.3	2.10	158		
			3'-0"							16	12	0.481	29.4	2.20	183		
16'-0"	5A	5'-0"	4'-0"	8"	8"	3/4"	8"	1/2"	8"	18		0.530	42.7	2.40	187		
			5'-0"							20	Case a	0.579	52.0	2.60	191		
20'-0"	5B	5'-0"	3'-0"	8½"	8"	7/8"	8"	3/4"	8"	16	12	0.500	43.5	2.20	163		
			4'-0"							18		0.545	49.8	2.40	167		
			5'-0"							20	Case a	0.598	52.2	2.60	171		
14'-0"	6A	6'-0"	4'-0"	8½"	8"	7/8"	8"	3/4"	8"	22		0.625	64.1	2.85	185		
			5'-0"							22	14	0.682	67.1	3.05	186		
			6'-0"							24	Case a	0.704	69.4	3.20	188		
			5'-0"							26		0.753	84.9	3.30	196		
20'-0"	6B	6'-0"	4'-0"	10"	8"	7/8"	8"	5/8"	8"	20		0.677	72.4	3.20	221		
			5'-0"							22	14	0.720	76.9	3.30	225		
			6'-0"							24	Case a	0.761	81.4	3.40	236		
			5'-0"							26		0.810	86.5	3.55	239		
12'-0"	7A	7'-0"	4'-0"	9"	9"	3/4"	7"	1/2"	7"	22		0.770	68.3	3.05	203		
			5'-0"							24	16	0.776	71.9	3.20	212		
			6'-0"							26	Case a	0.832	75.5	3.40	216		
			6'-0"							28		0.887	79.2	3.70	220		
15'-0"	7B	7'-0"	5'-0"	10"	9"	7/8"	8"	5/8"	8"	24		0.877	87.0	3.65	253		
			6'-0"							26	16	0.887	85.5	3.85	282		
			7'-0"							28	Case a	0.883	90.0	3.95	264		
			6'-0"							30		0.938	94.5	3.75	223		
20'-0"	7C	7'-0"	4'-0"	11"	9"	5/8"	7"	5/8"	7"	22		0.826	91.1	3.10	257		
			5'-0"							24	16	0.881	96.0	3.30	263		
			6'-0"							26	Case a	0.937	101.0	3.50	268		
			7'-0"							28		0.992	106.0	3.75	274		
10'-0"	8A	8'-0"	4'-0"	9½"	10"	5/8"	7"	1/2"	7"	24		0.844	75.8	3.40	235		
			5'-0"							26	18	0.905	79.5	3.60	239		
			6'-0"							28	Case a	0.966	83.2	3.80	243		
			5'-0"							30		1.034	86.8	4.10	247		
			6'-0"							32		1.095	90.5	4.40	251		
16'-0"	8B	8'-0"	5'-0"	11½"	10"	7/8"	7"	5/8"	7"	28		0.963	100.2	3.90	292		
			6'-0"							30	18	1.025	103.9	4.20	297		
			7'-0"							32	Case a	1.086	110.8	4.30	302		
			7'-0"							34		1.148	117.8	4.50	306		
			4'-0"							30		1.010	109.6	4.25	316		
20'-0"	8C	8'-0"	5'-0"	12½"	10"	7/8"	6"	5/8"	6"	32		1.083	115.8	4.55	322		
			6'-0"							34	18	1.084	121.4	4.75	328		
			7'-0"							36	Case a	1.146	126.9	4.95	334		
			8'-0"							38		1.208	132.5	5.15	339		
			5'-0"							34		1.270	138.1	4.50	415		
7'-0"	9A	9'-0"	6'-0"	10"	11"	7/8"	8"	5/8"	8"	36		1.040	103.7	4.00	376		
			7'-0"							38	20	1.108	107.1	4.20	381		
			8'-0"							40	Case a	1.176	111.6	4.50	387		
			9'-0"							42		1.242	116.1	4.80	392		
			5'-0"							36		1.311	120.7	5.15	398		
14'-0"	9B	9'-0"	6'-0"	12"	11"	7/8"	6"	5/8"	6"	38		1.174	121.3	4.10	357		
			7'-0"							40	20	1.243	127.5	4.30	363		
			8'-0"							42	Case a	1.310	133.7	4.60	368		
			9'-0"							44		1.378	139.8	4.90	374		
			6'-0"							40		1.309	154.2	5.20	447		
20'-0"	9C	9'-0"	7'-0"	14"	11"	7/8"	7"	3/4"	7"	42	20	1.377	160.9	5.40	453		
			8'-0"							44	Case a	1.444	167.5	5.70	458		
			9'-0"							46		1.511	174.0	6.00	463		
			6'-0"							44		1.581	176.6	5.55	435		
5'-0"	10A	10'-0"	7'-0"	10½"	12"	5/8"	8"	1/2"	8"	46		1.355	177.1	5.00	355		
			8'-0"							48	22	1.332	171.0	4.90	358		
			9'-0"							50	Case a	1.406	174.9	5.20	363		
			10'-0"							52		1.483	178.8	5.60	367		
			6'-0"							50		1.552	192.1	5.25	371		
			7'-0"							52		1.624	195.4	4.70	367		
10'-0"	10B	10'-0"	8'-0"	12"	12"	7/8"	7"	5/8"	7"	54	22	1.623	199.0	5.00	372		
			9'-0"							56	Case a	1.717	202.6	5.30	378		
			10'-0"							58		1.791	206.3	5.65	383		
			7'-0"							54		1.696	230.3	6.05	448		
16'-0"	10C	10'-0"	8'-0"	14"	12"	7/8"	8"	3/4"	8"	58	22	1.818	150.7	4.80	449		
			9'-0"							60	Case a	1.893	156.6	5.10	456		
			10'-0"							62		1.966	162.5	5.40	464		
			7'-0"							60		1.971	186.6	5.65	527		
5'-0"	11A	11'-0"	8'-0"	11"	12"	7/8"	7"	5/8"	7"	62	24	1.875	192.5	5.95	532		
			9'-0"							64	Case a	1.944	198.4	6.25	537		
			10'-0"							66		2.013	204.3	6.50	542		
			7'-0"							64		2.064	223.9	6.25	625		
9'-0"	11B	11'-0"	8'-0"	12½"	12"	7/8"	8"	5/8"	8"	66	24	2.134	229.8	6.55	630		
			9'-0"							68	Case a	2.204	235.7	6.80	636		
			10'-0"							70		2.273	241.6	7.05	641		
			7'-0"							66		2.364	252.8	6.30	672		
13'-0"	11C	11'-0"	8'-0"	14"	12"	7/8"	6"	5/8"	6"	68	24	2.434	259.7	6.60	678		
			9'-0"							70	Case a	2.503	266.6	6.90	683		
			10'-0"							72		2.573	273.5	7.20	689		
			7'-0"							68		2.608	293.5	6.70	736		
5'-0"	12A	12'-0"	8'-0"	12"	12"	7/8"	7"	5/8"	7"	70	26	2.678	301.4	7.00	742		
			9'-0"							72	Case a	2.747	309.3	7.30	749		
			10'-0"							74		2.817	317.2	7.60	755		
			7'-0"							70		2.853	338.1	7.05	817		
10'-0"	12B	12'-0"	8'-0"	14"	12"	7/8"	7"	5/8"	7"	72	26	2.922	347.0	7.35	824		
			9'-0"							74	Case a	2.992	355.9	7.65	831		
			10'-0"							76		3.061	364.8	7.95	838		
			7'-0"							72		3.097	384.8	7.40	901		
4'-0"	13A	13'-0"	8'-0"	12½"	12"	7/8"	7"	5/8"	7"	74	28	3.167	393.7	7.70	908		
			9'-0"							76	Case a	3.236	402.6	8.00	916		
			10'-0"							78		3.306	411.5	8.30	923		
			7'-0"							74		3.342	431.5	7.70	986		
8'-0"	13B	13'-0"	8'-0"	14"	12"	7/8"	7"	5/8"	7"	76	28	3.412	440.4	8.00	993		
			9'-0"							78	Case a	3.483	449.3	8.30	1000		
			10'-0"							80		3.553	458.2	8.60	1007		
			7'-0"							76		3.589	478.2	8.05	1070		
4'-0"	14A	14'-0"	8'-0"	13½"	12"	7/8"	8"	5/8"	8"	78	30	3.661	487.1	8.35	1077		
			9'-0"							80	Case a	3.734	496.0	8.65	1084		
			10'-0"							82		3.806	504.9	8.95	1091		
			7'-0"							78		3.842	525.0	8.40	1154		
8'-0"	14B	14'-0"	8'-0"	15"	12"	7/8"	7"	5/8"	7"	80	30	3.916	533.9	8.70	1161		
			9'-0"							82	Case a	3.989	542.8	9.00	1168		
			10'-0"							84		4.062	551.7	9.30	1175		

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

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



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

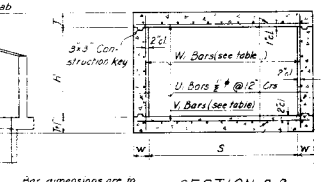
Mark	Size	No. Req'd	Type	Length
V1	See table	10+ 24L/Spa	I	S+2W-6
W1	See table	6+ 24L/Spa	I	H+2T-5
U1	1/2" ϕ	See table	I	L+1'-0"
M1	1/2" ϕ	See table	II	3'-6"
M2	1/2" ϕ	4	I	(S+2W-6)/Cos α

Straight — Type I; 2'-6" — Type II

(Bar dimensions are out to out of bar)

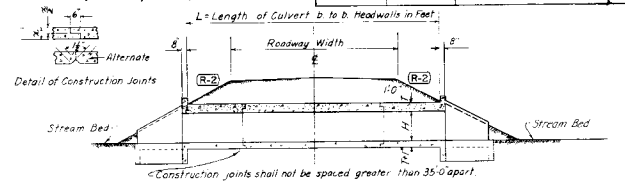
Possible Combinations (Span & Height)

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



SECTION B-B

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



TYPICAL SECTION THROUGH CULVERT

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

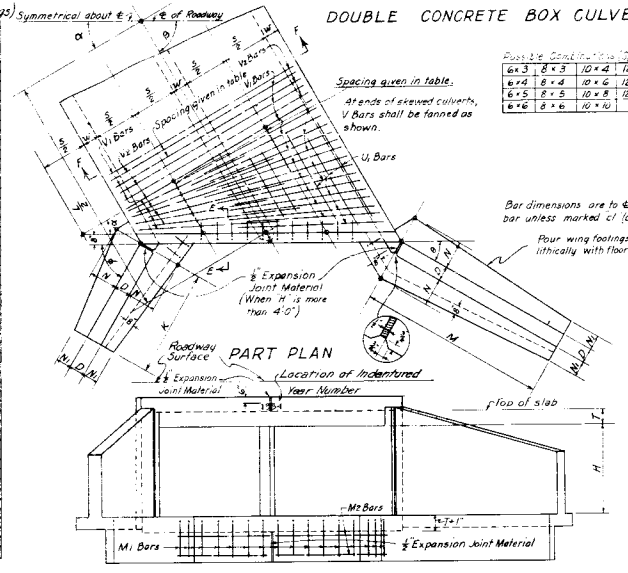
REVISIONS			
R-1	7-23-68	Dept Name	M.R.H.
R-2	10-25-68	Delete Slope	M.R.H.

DOUBLE CONCRETE BOX CULVERT

Dimensions & Quantities (see Wingwall Standard for Wings)

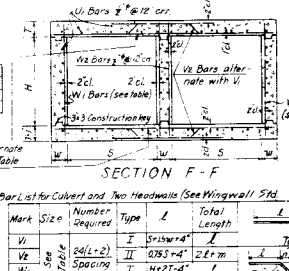
Height of Fill Allowed	Type	Span S	height H	Slab T	Wall w	Bar size & spacing V1 Size	V1 Spa	V1 Sp'a	W1 Size	W1 Spa	W1 Sp'a	No. Bars Required U1	M1	Quantities for One Lin Ft of Box Concrete Cu Yds	Steel Lbs	Quantities for Two Headwalls Concrete Cu Yds	Steel Lbs
			3'-0"							12	48			1.000	1123	385	527
10'-0"	6-6-A	6'-0"	4'-0"	8½"	8"	1/2"	6"	1/2"	12"	16	52	32		1.033	1177	460	556
			5'-0"			5/8"	Spa	5/8"		20	56	Case a		1.128	1231	485	543
			6'-0"							12	60			1.222	1285	565	551
			3'-0"							12	48			1.087	1203	445	529
			4'-0"							16	52	32		1.121	1257	465	537
15'-0"	6-6-B	6'-0"	5'-0"	9½"	8"	5/8"	5"	5/8"	12"	18	56	Case a		1.235	1311	490	546
			6'-0"							20	60			1.302	1365	510	553
			3'-0"							12	48			1.173	1300	460	531
			4'-0"							16	52	32		1.247	1374	475	535
20'-0"	6-6-C	6'-0"	5'-0"	10½"	8"	3/4"	5"	3/4"	12"	18	56	Case a		1.321	1425	498	547
			6'-0"							20	60			1.395	1504	515	555
			3'-0"							12	60			1.427	1742	580	606
10'-0"	8-8-A	8'-0"	4'-0"	10"	10"	5/8"	6"	5/8"	12"	16	64	40		1.569	1798	605	514
			5'-0"				Spa			18	68	Case a		1.662	1852	630	522
			6'-0"							12	72			1.755	1906	655	531
			3'-0"							12	64			1.592	1886	520	508
			4'-0"			5/8"	5"	5/8"	12"	16	68	40		1.694	1920	615	516
15'-0"	8-8-B	8'-0"	5'-0"	11"	10"		Spa			18	68	Case a		1.797	1954	640	524
			6'-0"							20	72			1.869	2029	665	533
			3'-0"							12	60			1.963	2080	600	513
			4'-0"			5/8"	4"	5/8"	12"	16	64	40		1.858	2014	630	522
20'-0"	8-8-C	8'-0"	5'-0"	12½"	10"		Spa			18	68	Case a		1.948	2046	658	532
			6'-0"							20	72			2.041	2227	678	533
			4'-0"			3/4"	5"	3/4"	12"	18	78			1.935	2283	740	714
5'-0"	10-10-A	10'-0"	6'-0"	10"	12"		Spa			20	84	48		2.027	2398	795	733
			8'-0"			5/8"	7"	5/8"	12"	24	94	Case a		2.380	2652	870	752
			10'-0"							9	102			2.602	2756	955	771
			4'-0"			3/4"	7"	3/4"		18	78			2.270	2665	765	721
10'-0"	10-10-B	10'-0"	6'-0"	12"	12"		Spa		12"	20	84	48		2.442	2845	820	740
			8'-0"			5/8"	7"	5/8"		24	94	Case a		2.664	2880	890	759
			10'-0"							8	102			2.806	2882	975	778
			4'-0"			3/4"	7"	3/4"		18	78			2.602	3087	885	757
15'-0"	10-10-C	10'-0"	6'-0"	14"	12"		Spa		12"	20	84	48		2.795	3236	940	746
			8'-0"			5/8"	6"	5/8"		24	94	Case a		2.947	3350	915	765
			10'-0"							8	102			3.170	3525	1200	784
			4'-0"			3/4"	7"	3/4"		18	98			3.195	3760	1030	835
5'-0"	12-12-A	12'-0"	6'-0"	12"	12"		Spa		12"	20	104	56		3.287	3875	1050	864
			8'-0"			5/8"	7"	5/8"		24	114	Case a		3.505	3928	1070	882
			10'-0"							8	124			3.598	3541	1115	902
			4'-0"			3/4"	7"	3/4"		18	98			3.416	3651	1055	870
10'-0"	12-12-B	12'-0"	6'-0"	14"	12"		Spa		12"	20	104	56		3.638	3847	1055	889
			8'-0"			5/8"	6"	5/8"		24	114	Case a		3.860	4113	1140	908
			10'-0"							8	124			4.083	4379	1225	926
			4'-0"			3/4"	7"	3/4"		18	110			3.562	3962	1095	924
15'-0"	12-12-C	12'-0"	6'-0"	16"	12"		Spa		12"	20	118	64		3.825	4280	1160	1003
			8'-0"			5/8"	6"	5/8"		24	126	Case a		4.077	4596	1230	1083
			10'-0"							8	134			4.324	4894	1305	1162
			4'-0"			3/4"	7"	3/4"		18	110			3.824	4094	1105	958
5'-0"	14-14-A	14'-0"	6'-0"	15"	12"		Spa		12"	20	118	64		4.046	4262	1175	1007
			8'-0"			5/8"	6"	5/8"		24	126	Case a		4.269	4505	1245	1026
			10'-0"							8	134			4.491	4749	1315	1045
			4'-0"			3/4"	7"	3/4"		18	118			4.286	4929	1275	1092
10'-0"	14-14-B	14'-0"	6'-0"	16"	12"		Spa		12"	20	126	64		4.509	5184	1345	1111
			8'-0"			5/8"	5"	5/8"		24	134	Case a		4.731	5439	1415	1130
			10'-0"							8	142			4.954	5694	1485	1149

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



Possible Combinations (Span & Height)

6'x3'	8'x3'	10'x4'	12'x6'	14'x6'
6'x4'	8'x4'	10'x6'	12'x8'	14'x8'
6'x5'	8'x5'	10'x8'	12'x10'	14'x10'
6'x6'	8'x6'	10'x10'		



SECTION F-F

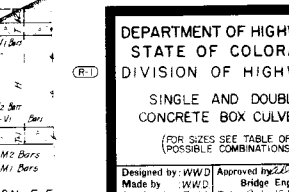
Bar List for Culvert and Two Headwalls (See Wingwall Std. for Wings)

Mark	Size	Number Required	Type	ℓ	Total Length
V1	See Table	24(L+2) Spacing	I	S+15W+4"	ℓ
V2			II	0.75S+4"	2E+m
W1			I	H+27-4"	ℓ
W2		2(L+2)	I	H+27-4"	ℓ
U1	1/2" ϕ	See Table	I	L+12"	ℓ
M1	1/2" ϕ	See Table	III		3'-6"
M2	1/2" ϕ	8	I	(S+1.5W)/Cos α	ℓ

Type I, Type II, Type III

(Bar dimensions are out to out of bar)

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



SECTION E-E

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

SINGLE AND DOUBLE CONCRETE BOX CULVERTS

(FOR SIZES SEE TABLE OF POSSIBLE COMBINATIONS)

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

STANDARD M-601-D
(JULY 1, 1965)

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

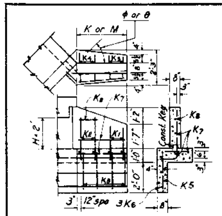
REVISIONS

	Date	Description	By
(R-1)	7-17-67	General Note	M.R.H.
(R-2)	7-15-68	General Note & Dept. Name	M.R.H.
(R-3)	10-25-68	Gen'l. Note	M.R.H.

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

β	α	φ	θ	H=2'-0" K	H=2'-0" M	H=3'-0" K	H=3'-0" M	H=4'-0" K	H=4'-0" M	H=5'-0" K	H=5'-0" M	H=6'-0" K	H=6'-0" M	H=7'-0" K	H=7'-0" M	H=8'-0" K	H=8'-0" M	H=9'-0" K	H=9'-0" M	H=10'-0" K	H=10'-0" M
45°	45°	67°30'	22°30'	2'-4"	6'-2"	3'-7"	8'-7"	4'-10"	11'-7"	5'-11"	14'-2"	6'-10"	16'-5"	7'-9"	18'-8"	8'-8"	20'-10"	9'-8"	23'-2"	10'-7"	25'-5"
60°	30°	60°	30°	2'-9"	4'-9"	3'-10"	6'-7"	5'-2"	8'-10"	6'-3"	10'-10"	7'-3"	12'-7"	8'-3"	14'-5"	9'-3"	16'-0"	10'-3"	17'-9"	11'-3"	19'-6"
75°	15°	52°30'	37°30'	3'-0"	3'-11"	4'-2"	5'-5"	5'-7"	7'-3"	6'-10"	8'-11"	7'-11"	10'-4"	9'-0"	11'-9"	10'-1"	13'-2"	11'-2"	14'-7"	12'-3"	16'-0"
90°	0°	45°	45°	3'-4"	3'-4"	4'-8"	4'-8"	6'-3"	6'-3"	7'-8"	7'-8"	8'-11"	8'-11"	10'-2"	10'-2"	11'-4"	11'-4"	12'-7"	12'-7"	13'-9"	13'-9"
105°	15°	37°30'	52°30'	3'-11"	3'-0	5'-5"	4'-2"	7'-3"	5'-7"	8'-11"	6'-10"	10'-4"	7'-11"	11'-9"	9'-0"	13'-2"	10'-1"	14'-7"	11'-2"	16'-0"	12'-3"
120°	30°	30°	60°	4'-9"	2'-9"	6'-7"	3'-10"	8'-10"	5'-2"	10'-10"	6'-3"	12'-7"	7'-3"	14'-5"	8'-3"	16'-0"	9'-3"	17'-9"	10'-3"	19'-6"	11'-3"
135°	45°	22°30'	67°30'	6'-2"	2'-4"	8'-7"	3'-7"	11'-7"	4'-10"	14'-2"	5'-11"	16'-5"	6'-10"	18'-8"	7'-9"	20'-10"	8'-8"	23'-2"	9'-8"	25'-5"	10'-7"

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



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

Type I

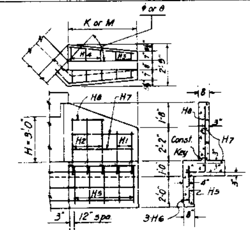
K3 = 1'-2"
K4 = 1'-5"
K5 = 2'-6"

Type II

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

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

WING DETAIL WHEN H = 2'-0"



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

Type I

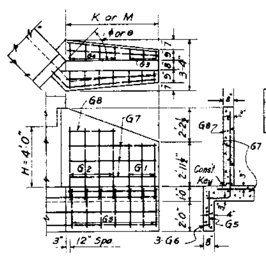
H3 = 1'-5"
H4 = 1'-7"
H5 = 2'-6"

Type II

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

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

WING DETAIL WHEN H = 3'-0"



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

Type I

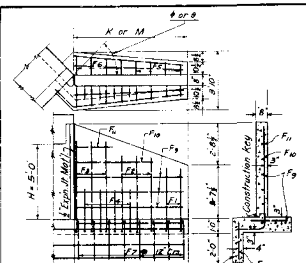
G3 = 1'-7"
G4 = 1'-11"
G5 = 2'-6"

Type II

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

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

WING DETAIL WHEN H = 4'-0"



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

Type I

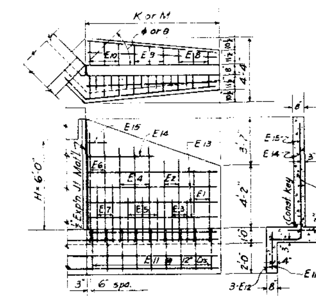
F5 = 1'-10"
F6 = 2'-2"
F7 = 2'-6"

Type II

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

When φ or θ equals	F1 1/2"φ Type I	F2 1/2"φ Type I	F3 1/2"φ Type I	F4 1/2"φ Type I	F5 1/2"φ Type II	F6 1/2"φ Type II	F7 1/2"φ Type II	3-F8 1/2"φ Type II	7-F9 1/2"φ Type II	1-F10 1/2"φ Type II	1-F11 1/2"φ Type II	Concrete Cu. Yds.	Steel Lbs.
22°30'	5	5	5	6	7	8	17	17'-3"	13'-10"	9'-2"	4'-2"	4.06	237
30°	3	4	4	5	5	6	13	13'-3"	10'-6"	7'-2"	3'-2"	3.10	180
37-30'	3	3	3	4	4	5	11	11'-0"	8'-7"	5'-2"	2'-2"	2.55	147
45°	2	3	3	4	4	4	9	9'-6"	7'-4"	5'-2"	2'-2"	2.20	130
52°30'	2	2	3	3	3	4	8	8'-6"	6'-6"	4'-2"	2'-2"	1.96	113
60°	2	2	3	3	3	4	8	7'-9"	5'-11"	4'-2"	2'-2"	1.79	109
67°30'	2	2	2	3	3	3	7	7'-3"	5'-7"	3'-2"	1'-2"	1.69	97

WING DETAIL WHEN H = 5'-0"



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

Type I

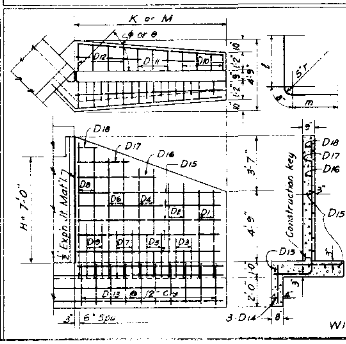
E8 = 1'-10"
E9 = 2'-1"
E10 = 2'-5"
E11 = 2'-6"

Type II

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

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

WING DETAIL WHEN H = 6'-0"



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

Type I

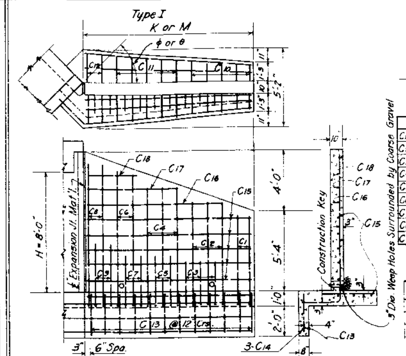
D10 = 2'-0"
D11 = 2'-3"
D12 = 2'-7"
D13 = 2'-6"

Type II

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

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

WING DETAIL WHEN H = 7'-0"



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

Type I

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

Type II

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

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

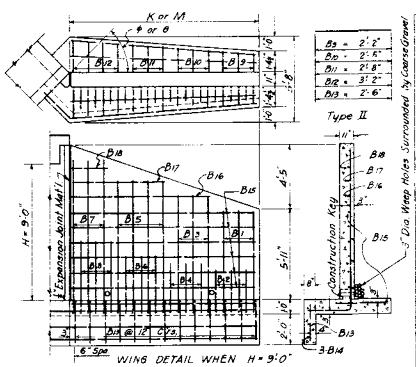
WING DETAIL WHEN H = 8'-0"

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

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

Type I

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



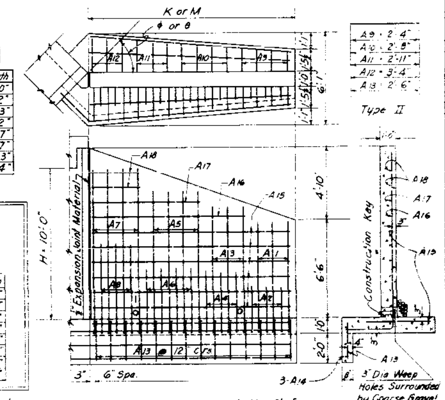
B9 = 2'-2"
B10 = 2'-5"
B11 = 2'-8"
B12 = 3'-2"
B13 = 2'-6"

Type II

WING DETAIL WHEN H = 9'-0"

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

Type I



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

Type II

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

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

WING DETAIL WHEN H = 10'-0"

GENERAL NOTES

ALL WORK SHALL BE DONE ACCORDING TO THE STANDARD SPECIFICATIONS APPLICABLE TO THE PROJECT.
ALL CONCRETE SHALL BE CLASS "A".
ALL WING SURFACES TO RECEIVE CLASS I FINISH.
WING FOOTINGS AND FLOOR OF BOX SHALL BE POURED MONOLITHICALLY.

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

(R-3) EACH REINFORCING STEEL BAR SHALL BE TAGGED WITH THE NUMBER DESIGNATION AND THE STATION NUMBER OF THE PROJECT.
SECONDARY BARS WHEN SPLICED SHALL LAP
(R-2) 24 DIAMETERS OF THE BAR. DIMENSIONS FOR REINFORCING STEEL NOT SHOWN AS CLEAR SHALL BE TO THE CENTER LINE OF THE BAR. OUT TO OUT DIMENSIONS SHALL BE USED ON BAR BENDING DETAILS.
SUPPORTING SOILS FOR ALL CULVERTS MUST BE COMPOSED OF FIRM AND UNIFORM MATERIAL THROUGHOUT.
HORIZONTAL CONSTRUCTION KEYS ARE NOT REQUIRED WHEN FOOTINGS AND WALL ARE POURED MONOLITHICALLY.
ALL CONSTRUCTION KEYS SHOWN BETWEEN FOOTINGS AND WALLS ARE 3" X 3".
(R-1) When excavating for footings the final surface elevation shall be undisturbed natural or compacted soil.

STEEL WEIGHTS INCLUDE 1% ± FOR OVERRUN.
EXPANSION JOINT MATERIAL IS TO BE INCLUDED IN THE PRICE OF CLASS "A" CONCRETE
(R-2) AND SHALL CONFORM TO A.A.S.H.O. DESIGNATION M-213.
FOR CULVERTS REQUIRED AND GOVERNING DIMENSIONS SEE "LIST OF STRUCTURES".

LOADING DATA INTERSTATE ALTERNATE

LIVE LOAD: A.A.S.H.O. (HS20-44)
DEAD LOAD: CONCRETE 150 POUNDS PER CUBIC FOOT
EARTH 84 POUNDS PER CUBIC FOOT.

DESIGNING DATA

(R-2) A.A.S.H.O. 1965 UNIT STRESSES, EXCEPT AS NOTED

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

(R-2) DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

WINGWALLS FOR
CONCRETE BOX CULVERTS
(R-3) 2:1 SIDE SLOPES

Designed by: W.W.D. | Approved by: [signature]
Made by: W.W.D. | Bridge Engineer
Checked by: T.J.M. | Date: July 1, 1965

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.

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

TABLE I
CORRUGATED STEEL PIPE

(2" x 1/2") OR (2·2/3" x 1/2") CORRUGATIONS

PIPE SIZE (B_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
		GAGE														
12	0.8	16	16	16	16	16	16	16	16	16	16	16	16	16	14	12
15	1.2	16	16	16	16	16	16	16	16	16	16	16	14	12	12	10
18	1.8	16	16	16	16	16	16	16	16	14	14	12	12	10	8	
24	3.1	16	16	16	16	16	14	12	10	10	8					
30	4.9	16	16	16	16	14	14	12	12	10	8					
36	7.1	16	16	16	16	14	12	10	8							
42	9.6	16	16	16	16	16	14	14	12							
48	12.6	16	16	16	16	14	14	12	8							
54	15.9	14	14	14	14	14	12	12								
60	19.6	12	12	12	12	12	12	10								
66	23.6	12	12	12	12	10	10	8								
72	28.3	10	10	10	10	8										
78	33.0	8	8	8	8											
84	38.0	8	8	8												

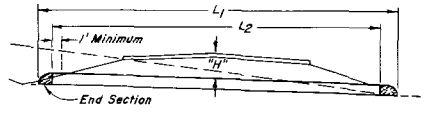
---- See General Note.

TABLE II
CORRUGATED STEEL PIPE ARCH

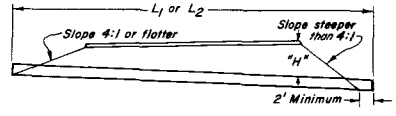
(2" x 1/2") OR (2·2/3" x 1/2") CORRUGATIONS

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

METAL CULVERT WITH END SECTIONS



METAL CULVERT WITHOUT END SECTIONS



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

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

3" x 1" CORRUGATIONS

RIVETED OR HELICAL 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
		GAGE												
36	7.1	16	16	16	16	16	14	14	12	12	12	12	10	8
42	9.6	16	16	16	16	14	14	14	12	12	12	12	12	8
48	12.6	16	16	16	14	14	14	12	12	12	10	8		
54	15.9	16	16	16	14	14	12	12	10	8				
60	19.6	16	16	16	14	12	12	12	10					
66	23.8	16	16	14	14	12	12	10						
72	28.3	16	16	14	12	12	12	10						
79	33.0	16	16	14	12	10	8							
84	38.0	14	14	14	12	12								
90	44.0	14	14	12	12	12								
96	50.3	12	12	12	12	10								
102	57.0	12	12	12	12									
108	64.0	12	12	12	10									
114	70.9	10	10	10	8									
120	78.6	10	10	10	8									

==== See General Note.

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

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

TABLE IV
CORRUGATED STEEL PIPE

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
		GAGE														
36	7.1	16	16	16	16	16	16	16	14	14	14	12	12	12	12	10
42	9.6	16	16	16	16	16	16	16	14	14	12	12	12	10	8	
48	12.6	16	16	16	16	16	14	14	14	12	12	12	10	8		
54	15.9	16	16	16	16	16	14	14	12	12	10	10				
60	19.6	16	16	16	16	14	14	12	12	10	8					
66	23.8	16	16	16	14	14	12	12	10	8						
72	28.3	16	16	16	14	14	12	12	10							
78	33.0	16	16	16	14	12	12	10	8							
84	38.0	14	14	14	14	12	12	10								
90	44.0	14	14	14	14	12	12	10								
96	50.3	12	12	12	12	12	10	8								
102	57.0	12	12	12	12	12	10	8								
108	64.0	12	12	12	12	12	10									
114	70.9	10	10	10	10	10	8									
120	78.6	10	10	10	10	10										

---- See General Note.

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

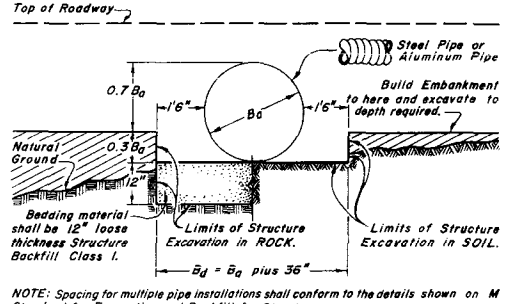
7/16" rivets may be used on pipes with gages to the right of or below the heavy solid line.

TABLE V
CORRUGATED STEEL PIPE ARCH

(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
			GAGE				
43 x 27	6.4	7 3/4	16	16	16		
50 x 31	8.7	9	16	16	16		
58 x 36	11.4	10 1/2	16	16	16		
65 x 40	14.3	12	16	16	16		
72 x 44	17.6	13 1/4	16	16	16		
73 x 55	22.0	18	16	16	16	16	16
81 x 59	26.0	18	14	14	14	14	14
Ø 87 x 63	31.0	18	14	14	14	14	
Ø 95 x 67	35.0	18	12	12	12		
Ø 103 x 71	41.0	18	12	12			

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
		GAGE												
12	0.8	16	16	16	16	16	16	16	14	12	12	12	12	12
18	1.8	16	16	16	16	14	12	10	8	8				
24	3.1	16	16	16	14	10								
30	4.9	16	16	16	12	12	8							
36	7.1	16	16	14	12	8								
42	9.6	14	14	12	14	12	12	8						
48	12.6	12	12	12	12	10	8	8						
54	15.9	12	12	10	8	8								
60	19.6	10	10	8										
66	23.8	10	8											
72	28.3	8												

---- 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
			GAGE					
18 x 11	1.1	4 3/4	16	16	16	16	16	16
22 x 13	1.6	4 3/4	16	16	16	16	16	
25 x 16	2.2	4 1/2	16	16	16	16		
29 x 18	2.8	4 1/2	16	16	16			
36 x 22	4.4	5	16	16				
43 x 27	6.4	5 1/2	14					
50 x 31	8.7	6	12					
58 x 36	11.4	7	10					
65 x 40	14.3	8	10					
72 x 44	17.6	9	8					

GENERAL NOTES

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

The tables on this sheet show minimum gages for structural requirements only. They are intended for use only where corrosive and/or abrasive conditions are negligible. Heavier gages and/or protective coatings shall be used where site investigations indicate corrosive and/or abrasive conditions.

Gages shown are U.S. Standard and are minimum requirements for use with adequate bedding and backfill, in accordance with the Standard Specifications.

Gages shown are for finished construction. During construction, adequate cover shall be provided to protect the structure from damage.

The minimum depth of fill excluding pavement over corrugated metal pipe culverts shall be as 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 gages to the right of or below the heavy dashed line shown in the tables on this sheet, shall be elongated 5 percent on the vertical axis as installed. (Tables I, III, IV and VI)

Maximum fill heights shown are for bearing pressures of 2 tons per square foot. (Tables II, V and VII)

Fill heights greater than 90' shall be used only after thorough investigation of foundation material. (Tables I and IV)

Variations from corner radii shown will be acceptable provided the pipe is of sufficient strength to support 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)

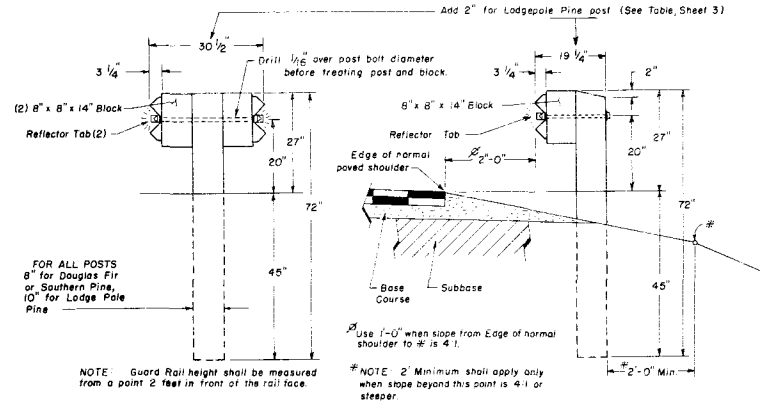
Designed by M.R.H.	Approved by [illegible]
Made by J.R.B.	Staff Design Engineer
Checked by R.S.M.	Date: March 20, 1967

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

STANDARD M-606-AB

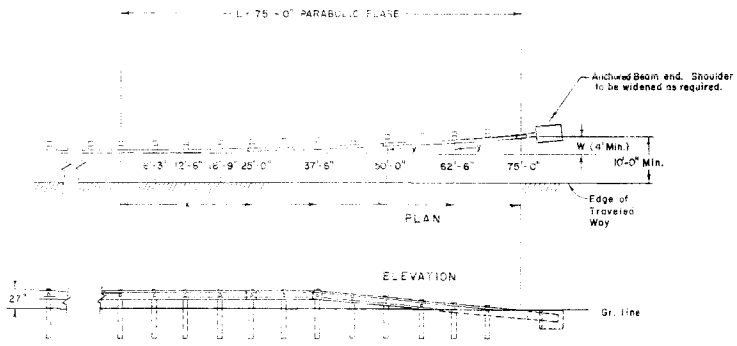
(MARCH 1, 1968)
(SHEET 1 OF 3)

REVISIONS		
(R-1) 7-10-68	Add typical post & obstr.	M.R.H.

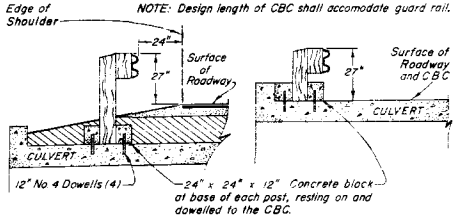


NOTE: Guard Rail height shall be measured from a point 2 feet in front of the rail face.

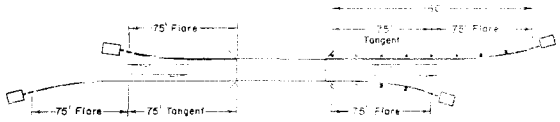
(R-1) TYPICAL POST INSTALLATIONS



PARABOLIC TRANSITION & END TREATMENT



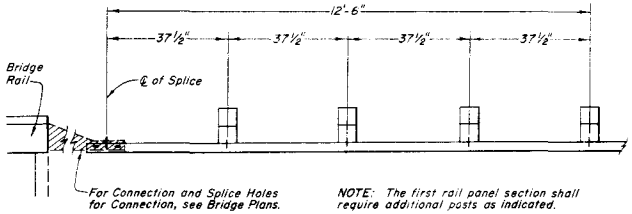
GUARD RAIL ACROSS CONCRETE BOX CULVERT



2-LANE HIGHWAY

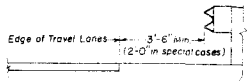
BRIDGE APPROACH GUARD RAIL

NOTE: For divided highways see Sheet No. 2

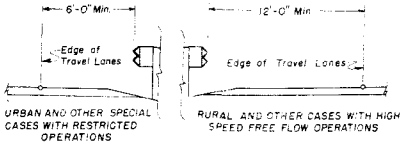


NOTE: The first rail panel section shall require additional posts as indicated.

GUARD RAIL AT BRIDGES



FOR NON-DEPRESSED MEDIAN AND CONTINUOUS GUARD RAIL



URBAN AND OTHER SPECIAL CASES WITH RESTRICTED OPERATIONS

RURAL AND OTHER CASES WITH HIGH SPEED FREE FLOW OPERATIONS

(R-1) GUARD RAIL FOR OBSTRUCTIONS IN MEDIAN

(See Sheet No. 3)

GENERAL NOTES

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

All timber shall be close grained Douglas Fir of the Coast Region, Dense Longleaf or Shortleaf Southern Pine, or Lodgepole Pine. Timber shall be free of heart centers and shall conform to Construction Grade, Paragraph 125.B of Standard No. 15 Grading and Dressing Rules of West Coast Douglas Fir (1956) or Dense Structural 58 and LL Structural 59, Paragraph 285 of 1956 Grading Rules for Southern Pine.

All timber shall be square edged, full sawn, and the tops of posts shall be beveled as shown. Blocks and posts shall be 8"x8" except that posts fabricated from Lodgepole Pine shall be 8"x10" (nailed with 8" face parallel to roadway center line).

Timber shall be incised and pressure treated with Grade I Creosote to a net retention of 8 pounds per cubic foot with a minimum penetration of 5/8 of an inch, except that blocks need not be incised before treatment. All bolt holes are to be drilled 1/16 inch larger than diameter of bolt before treatment is applied.

(R-1) Posts shall be spaced at 6'-3" center to center except when otherwise designated on this Standard or in the guardrail tabulation on the plans.

Where pedestrian hazards exist, sidewalks are to be constructed on the roadway shoulder. Guard rail shall be placed between the sidewalk and the edge of traffic lane.

(R-1) 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 coating Class 2.50 of Table 1 of ASTM Designation A 525.

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" or Class "D".

LEGEND

W = Full Parabolic Offset.

L = Length of Parabolic Transition.

x = Longitudinal Distance from beginning of flare.

y = Offset = $W \cdot x^2/L^2$

TABLE OF OFFSETS
FOR 75' PARABOLIC FLARES

	y					
x	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

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

GUARD RAIL
TYPE 3

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

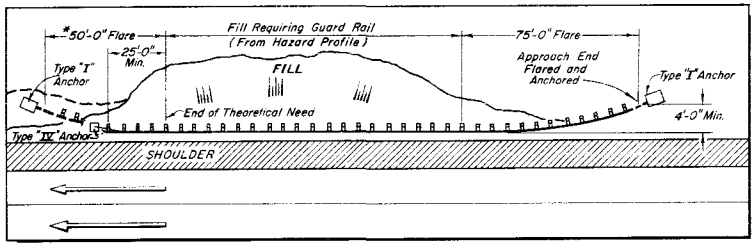
STANDARD M-606-AB

(MARCH 1, 1968)

(SHEET 2)

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

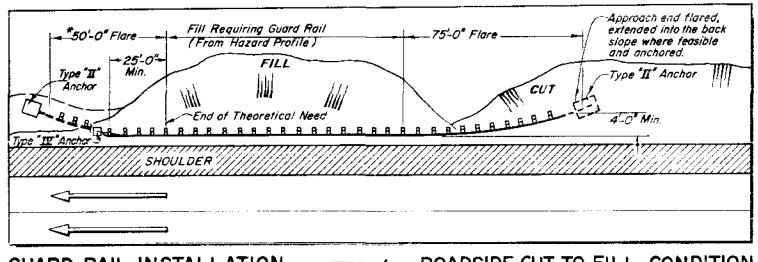
REVISIONS			
(R-1)	7-10-68	Add end anchorage	M.R.H.



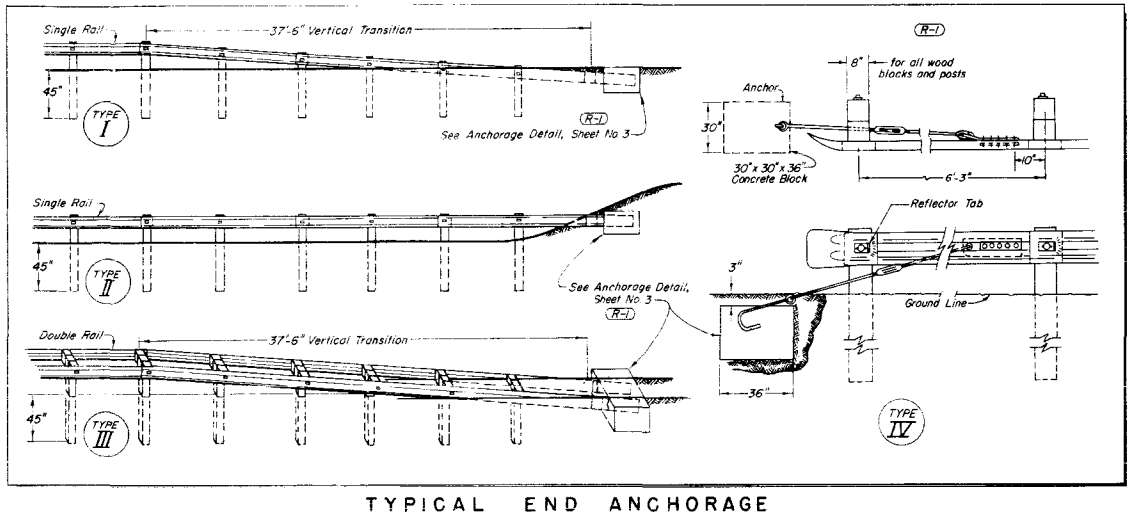
GUARD RAIL INSTALLATION — ROADSIDE FILL CONDITION

NOTES:

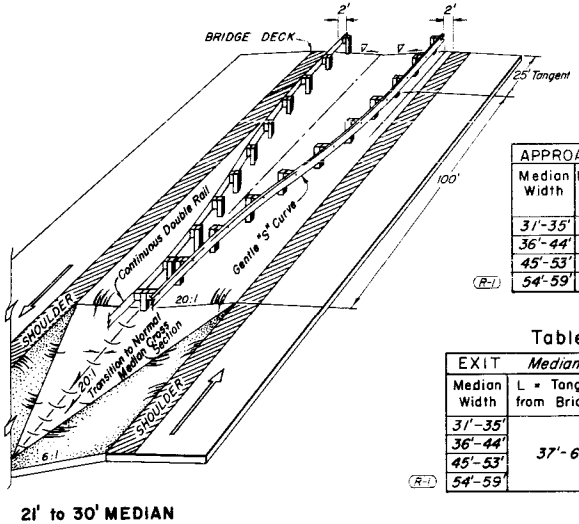
* 2-Lane Highways — The exit end of Guard Rail shall extend 50 feet past the end of theoretical need and shall be flared and anchored.



GUARD RAIL INSTALLATION — ROADSIDE CUT TO FILL CONDITION



TYPICAL END ANCHORAGE



21' to 30' MEDIAN

Table 1

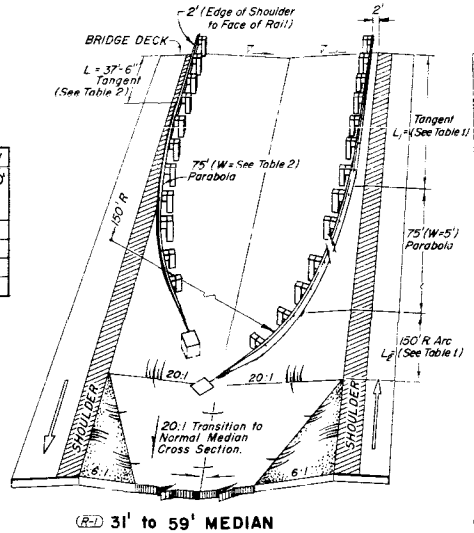
APPROACH Median Guard Rail			
Median Width	L_1=Tangent from Bridge	75' Parabolic Flare (then)	L_2 = 150' Radius Arc (then)
31'-35'	50'-0"	W = 5'	25'-0"
36'-44'	25'-0"		50'-0"
45'-53'	12'-6"		62'-6"
54'-59'	0'-0"		75'-0"

(R-1)

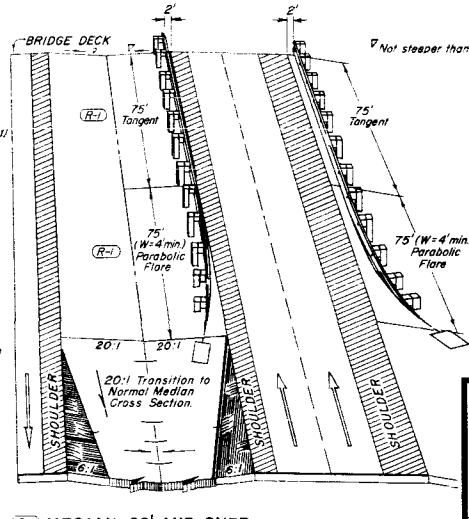
Table 2

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

GUARD RAIL AT BRIDGE APPROACH

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

GUARD RAIL
TYPE 3

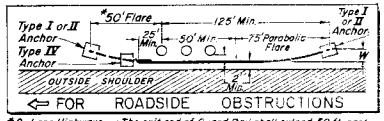
Designed by	M.R.H.	Approved by	
Made by	J.R.B.	Staff Design Engineer	
Checked by	R.S.M.	Date: March 1, 1968	

STANDARD M-606-AB

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

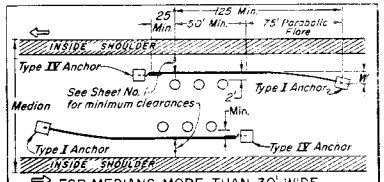
FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO			

REVISIONS			
R-1	7-10-68	Entire sheet redone.	M.R.H.

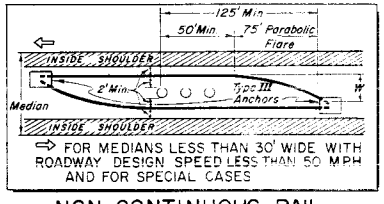


⇦ FOR ROADSIDE OBSTRUCTIONS

*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.

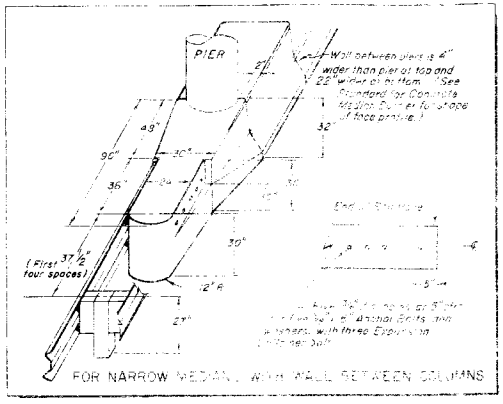


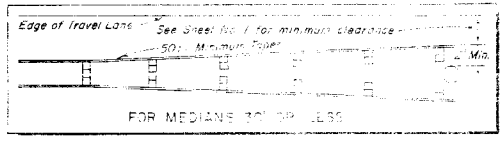
⇨ FOR MEDIANS MORE THAN 30' WIDE (NORMAL INSTALLATION)



⇨ FOR MEDIANS LESS THAN 30' WIDE WITH ROADWAY DESIGN SPEED LESS THAN 50 MPH AND FOR SPECIAL CASES

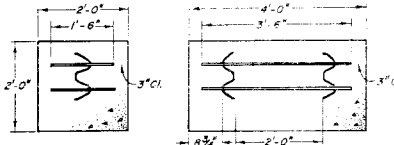
NON-CONTINUOUS RAIL





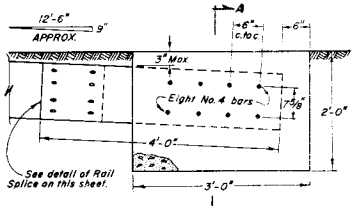
CONTINUOUS RAIL

TYPICAL GUARD RAIL FOR OBSTRUCTIONS

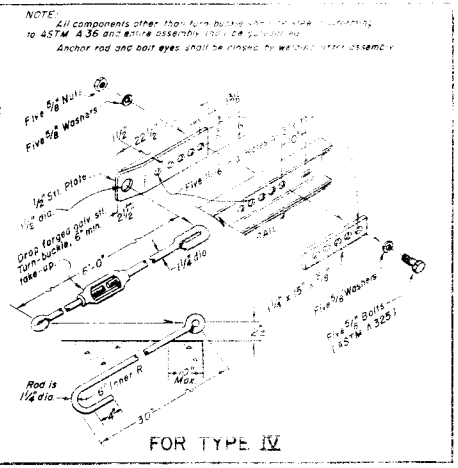


SECTION A-A
FOR TYPES I & II

SECTION A-A
FOR TYPE III

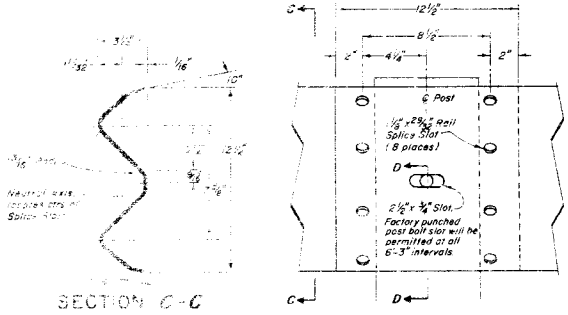


FOR TYPES I, II & III



FOR TYPE IV

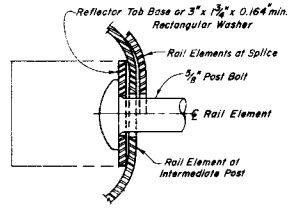
DETAILS FOR TYPICAL END ANCHORAGE

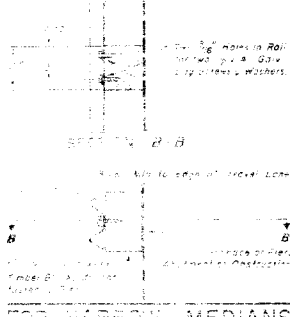


SECTION C-C

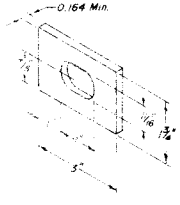
SECTION D-D

DETAIL OF RAIL AND SPLICE

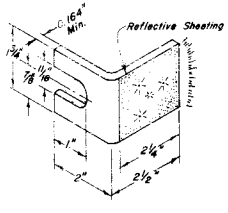




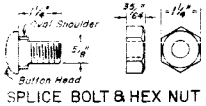
FOR NARROW MEDIANS
(To be used when clear distance cannot be obtained)



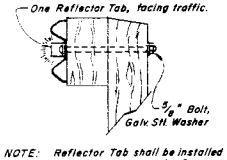
RECTANGULAR WASHER DETAIL



REFLECTOR TAB DETAIL

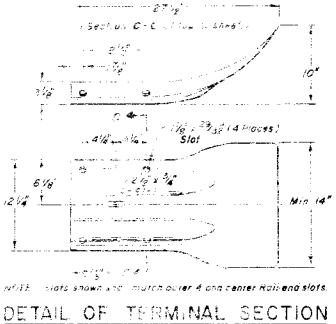


SPLICE BOLT & HEX NUT
(NEED 8 PER SPLICE, 4 PER TERMINAL)

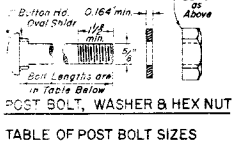


NOTE: Reflector Tab shall be installed on alternate posts or at max. 12'-6" spacing.

INSTALLATION DETAIL OF REFLECTOR TAB



DETAIL OF TERMINAL SECTION



POST BOLT, WASHER & HEX NUT

TABLE OF POST BOLT SIZES

Block / Post	RAIL	BOLT SIZE
8" 8" 8"	Double	⅝" x 25¾"
8" 8"	Single	⅝" x 17½"
LODGEPOLE PINE 8" 10" 8"	Double	⅝" x 27¾"
8" 10"	Single	⅝" x 19½"

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-614-A

(JULY 1, 1965)

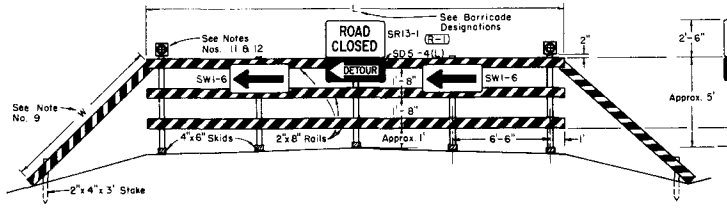
FEDERAL ROAD REGION NO.	DISTRICT	PROJECT NO.	SHEET NO.
9	COLORADO		

REVISIONS			
(R-1)	11-15-68	Rev. Dept. Name & Code Nos.	JLS

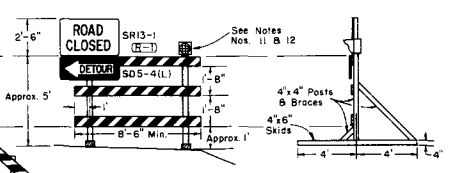
CLASS I BARRICADES
(3 RAILS)

MOVABLE

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

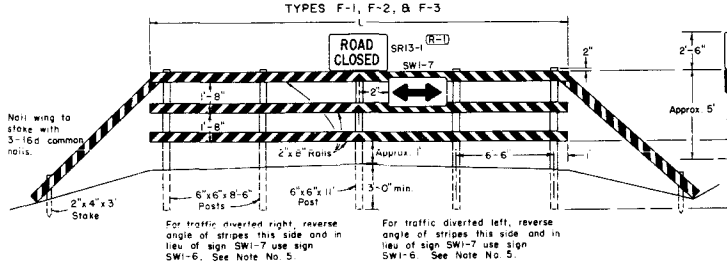


TYPE M-4

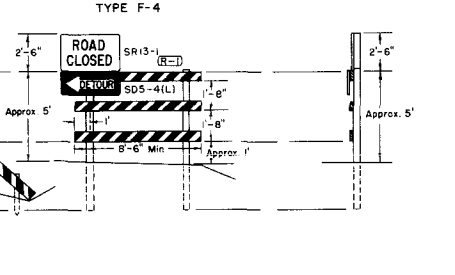


FIXED

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



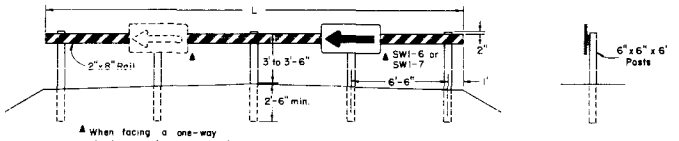
TYPE F-4

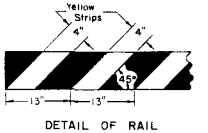


CLASS II BARRICADE
(1 RAIL)

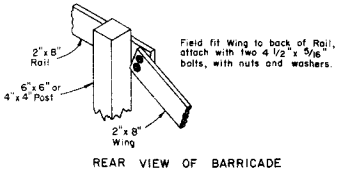
FIXED

TYPE F-6

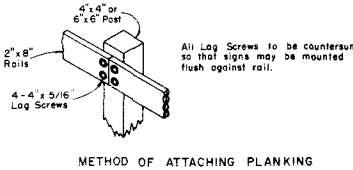




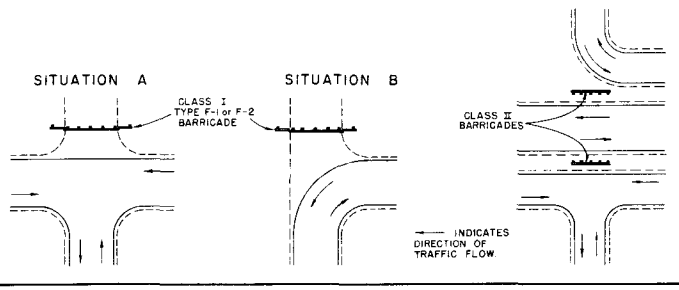
DETAIL OF RAIL AND WING STRIPING



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. All signs and sign materials shall conform to the standards set forth in the "Manual on Uniform Traffic Control Devices for All Classes of Streets and Highways" published by the Department of Highways and this standard.
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. Painting shall conform with Subsection 508.06 of the Standard Specifications. All skids, braces, and posts shall be painted with 2 coats of "Exterior Black Paint." Planking and wings on all barricades shall be painted with 2 coats of "Exterior Black Paint" on all sides before adding reflective strips. Reflective strips shall be "cut from smooth surface yellow reflective sheeting" of a type approved by the Department.
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. All timber used shall conform to the Standard Specifications for Miscellaneous Untreated Timber S4S. Timber shall conform to Construction grade Paragraph 123B or 125B of Standard No. 15 Grading & Dressing Rule for West Coast Douglas Fir (1956) or Dense Structural 58 and LL Structural 58 Paragraph 284 or 285 of 1956 Grading Rules for Southern Pine.
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. Alternate materials or other reflective elements on Traffic signs or Barricades will be permitted only after approval of such material by the Department in writing.
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. 3C 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.
	I	M-2	F-2	35'-44'	41'	Barricade complete with SR12-1 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 6'-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

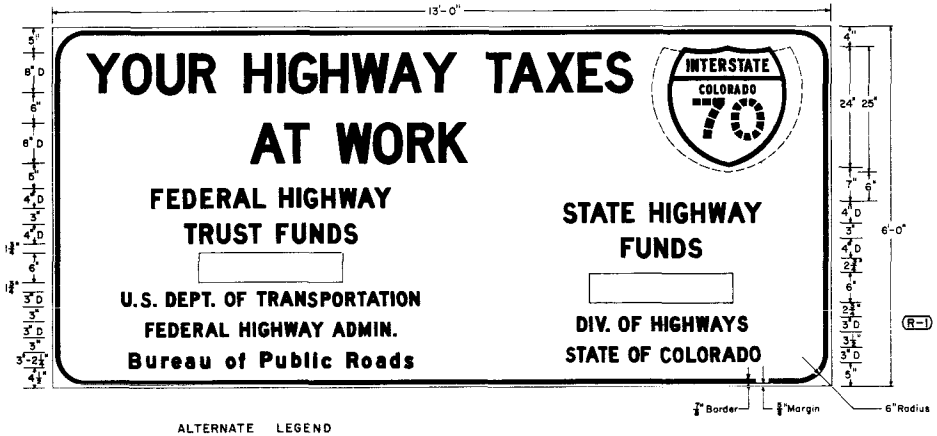
STANDARD M-614-IC

JULY 5, 1968

(SHEET 1 OF 2 SHEETS)

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

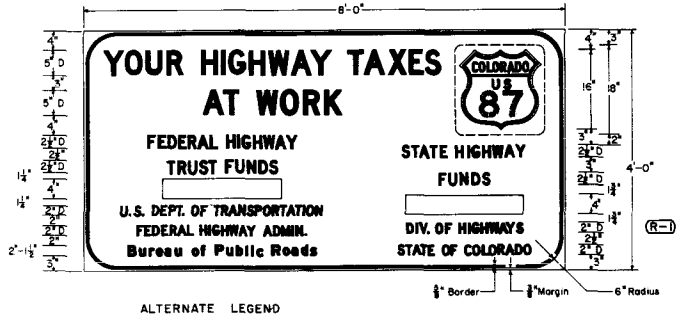
REVISIONS		
(R-1) 7-26-68	Rev. Legend and Notes	G.W.F.



ALTERNATE LEGEND

4"D FEDERAL

4"D FUNDS

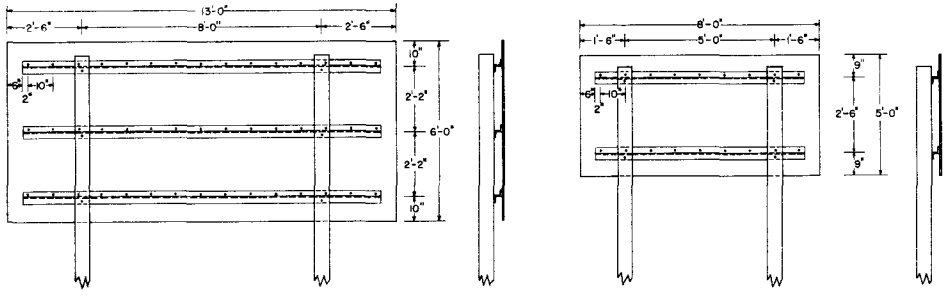


ALTERNATE LEGEND

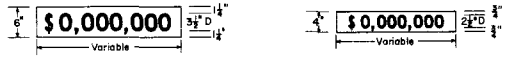
2 1/2"D FEDERAL

2 1/2"D FUNDS

FABRICATION DETAILS



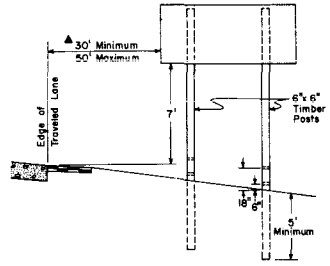
"AMOUNT OF FUNDS" PLAQUE DETAILS



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	

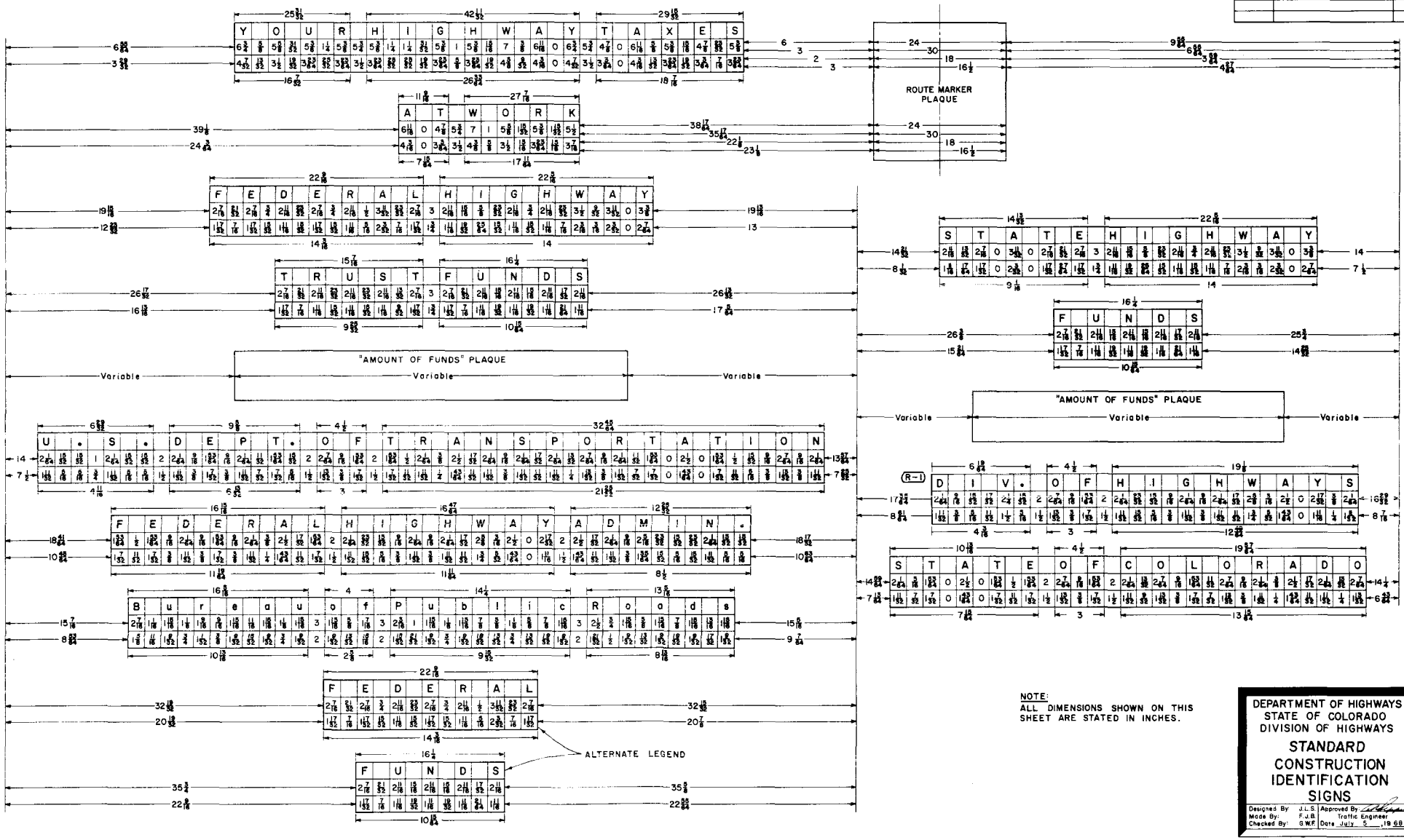
STANDARD M-614-IC

JULY 5, 1968

(SHEET 2 OF 2 SHEETS)

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

REVISIONS		
(R-1) 7-26-68	Rev. Legend	G.W.F.



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.	Approved By:	
Made By:	F.J.B.	Traffic Engineer	
Checked By:	G.W.F.	Date July 5	1968

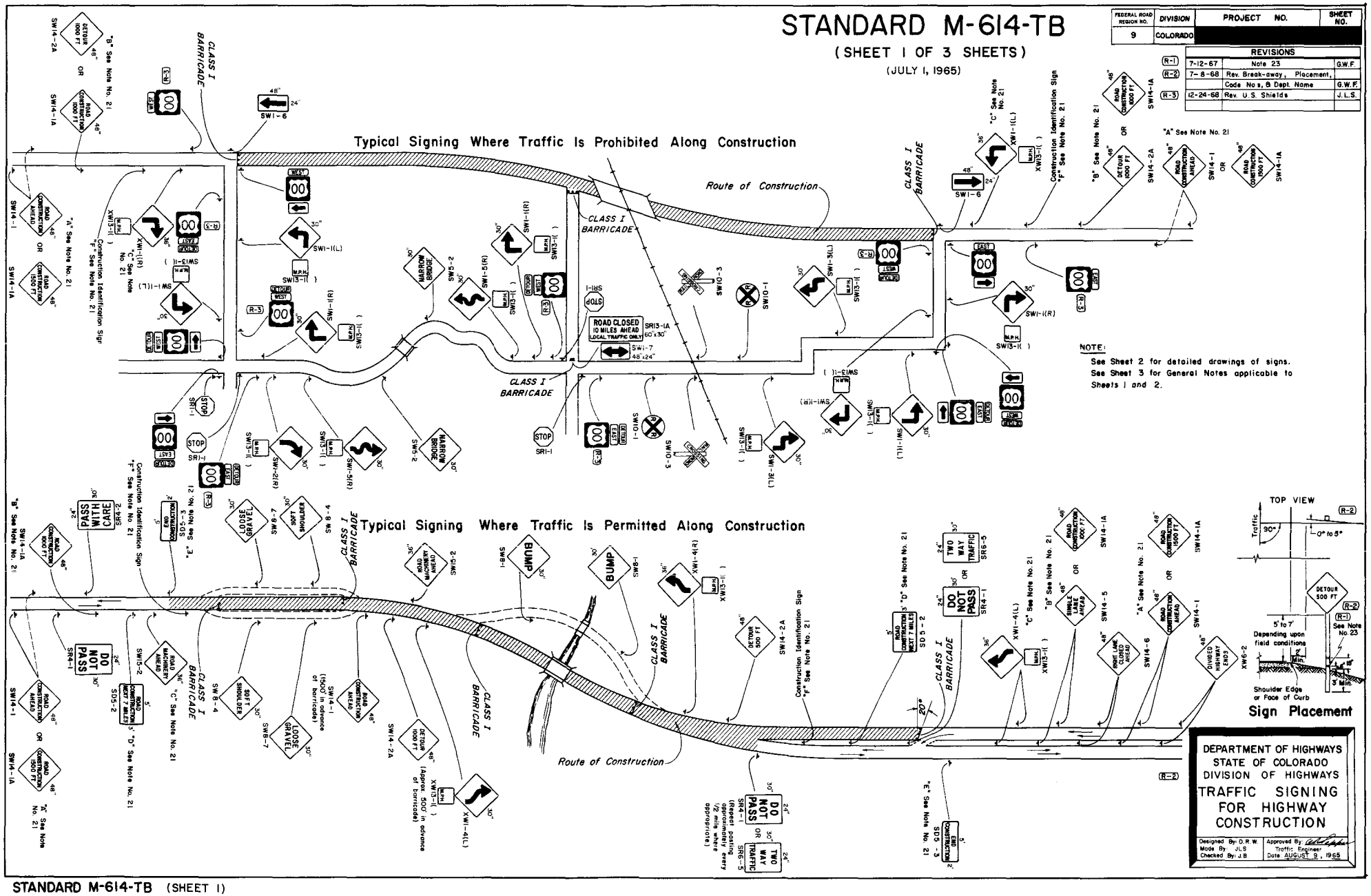
STANDARD M-614-TB

(SHEET 1 OF 3 SHEETS)

(JULY 1, 1965)

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

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 2 OF 3 SHEETS)

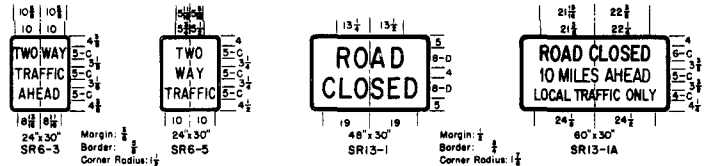
(JULY 1, 1965)

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.

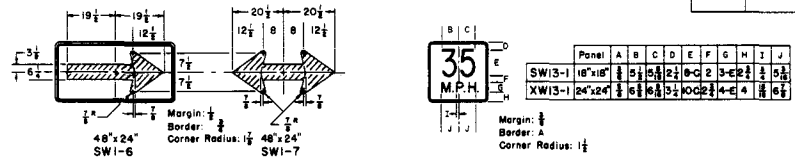
REGULATORY SIGNS

See Note No. 9



WARNING SIGNS

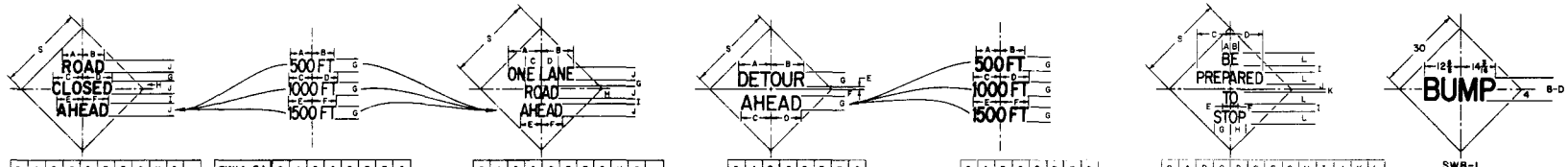
See Note No. 10



	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 3/8	1/4	5 1/16
XW13-1	24"x24"	3/8	6 1/8	6 5/16	3 1/2	10-C	2 3/4	4-E	4	1/16	6 1/8

WARNING SIGNS

See Note No. 10



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

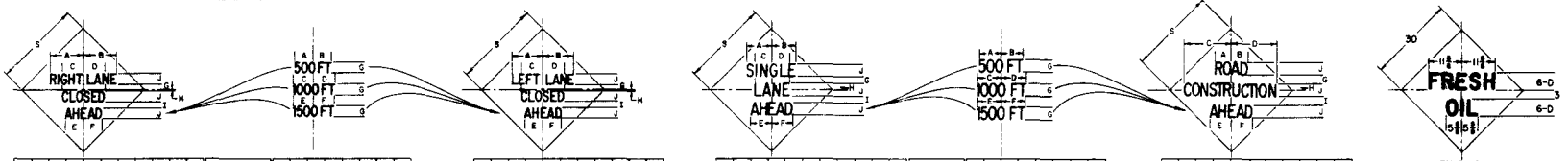
	S	A	B	C	D	E	F	G
SW14-3A	48	12	12 1/16	3 3/8	14 1/2	13 1/2	3 3/8	7-C
CW14-4A	36	8 5/8	9 1/8	10 1/8	9 1/2	9 3/4	3	5-C
CW14-3A								

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

	S	A	B	C	D	E	F	G
SW14-2	48	18 1/2	18 1/2	6 1/2	6 1/2	1 1/2	3 1/2	8-D
CW14-2	36	13 1/2	13 1/2	2 1/2	2 1/2	1 1/2	2 1/2	6-D

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

	S	A	B	C	D	E	F	G	H	I	J	K	L
SW14-7B	36	2 1/2	3 1/2	13 1/2	13 1/2	2 1/2	2 1/2	6 1/2	6 1/2	3	2	1	5-C



	S	A	B	C	D	E	F	G	H	I	J
SW14-6(R)	48	18 1/2	18 1/2	11 1/2	11 1/2	10 1/2	10 1/2	2 1/2	1/8	3 1/2	6-C
CW14-6(R)	36	13 1/2	13 1/2	9 1/2	9 1/2	8 1/2	8 1/2	2 1/2	1/8	2 1/2	5-C

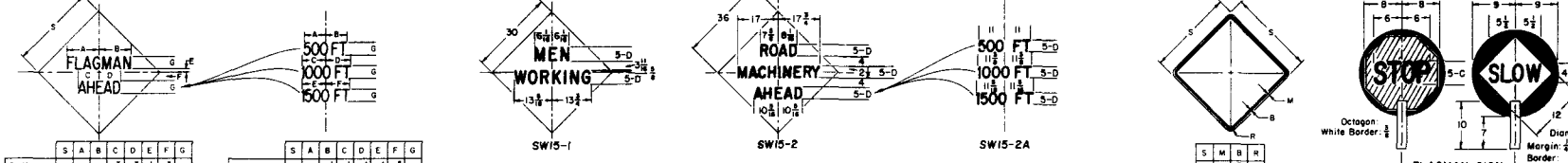
	S	A	B	C	D	E	F	G
SW14-6A(R)	48	10 1/2	10 1/2	11 1/2	11 1/2	11 1/2	11 1/2	6-C
SW14-6A(L)	48	10 1/2	10 1/2	11 1/2	12 1/2	11 1/2	11 1/2	6-C
CW14-6A(R)	36	8 1/2	8 1/2	9 1/2	10 1/2	9 1/2	9 1/2	5-C
CW14-6A(L)								

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

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

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

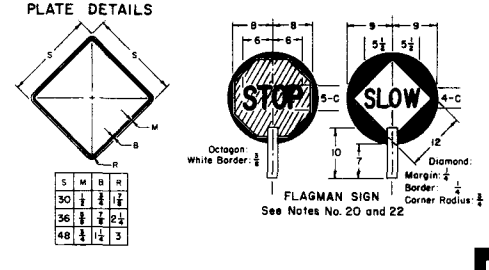
	S	A	B	C	D	E	F	G	H	I	J
SW14-1	48	9	9 1/2	26	25 1/2	11 1/2	11 1/2	4 1/2	3 1/2	4 1/2	7-C
CW14-1	36	6 1/2	6 1/2	19	18 1/2	8 1/2	8 1/2	3 1/2	2 1/2	3 1/2	5-C



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

	S	A	B	C	D	E	F	G
SW14-7A	48	12	12 1/2	13 1/2	14 1/2	13 1/2	13 1/2	7-C
CW14-7A	36	10 1/2	10 1/2	11 1/2	12 1/2	11 1/2	11 1/2	6-C

PLATE DETAILS



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

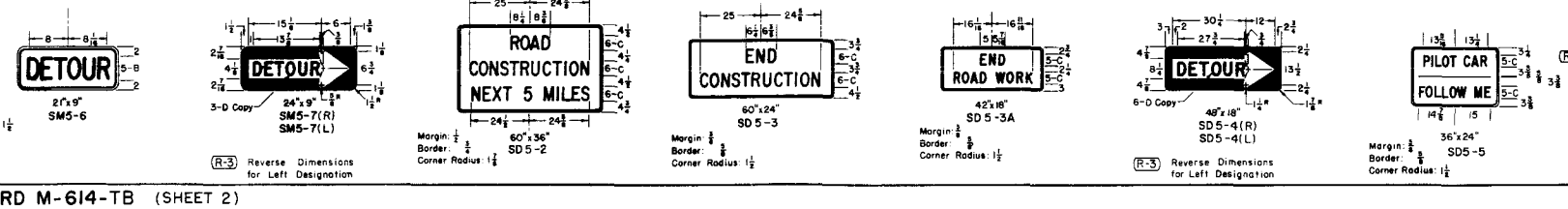
NOTES:

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		

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. (R-3) 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.

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. (R-1) (R-2) Each 6"x 6" 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-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

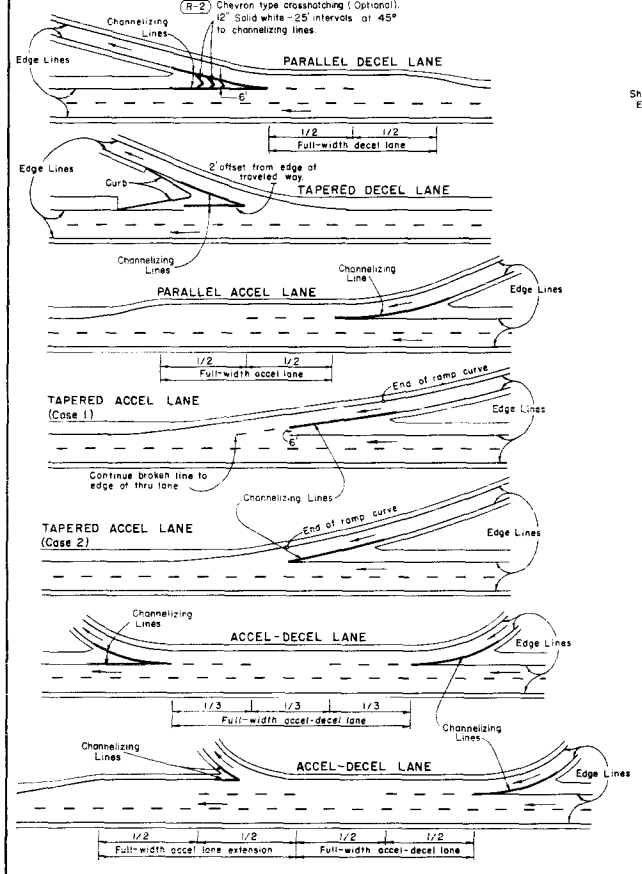
STANDARD S-614-29A

(AUG. 1, 1965)

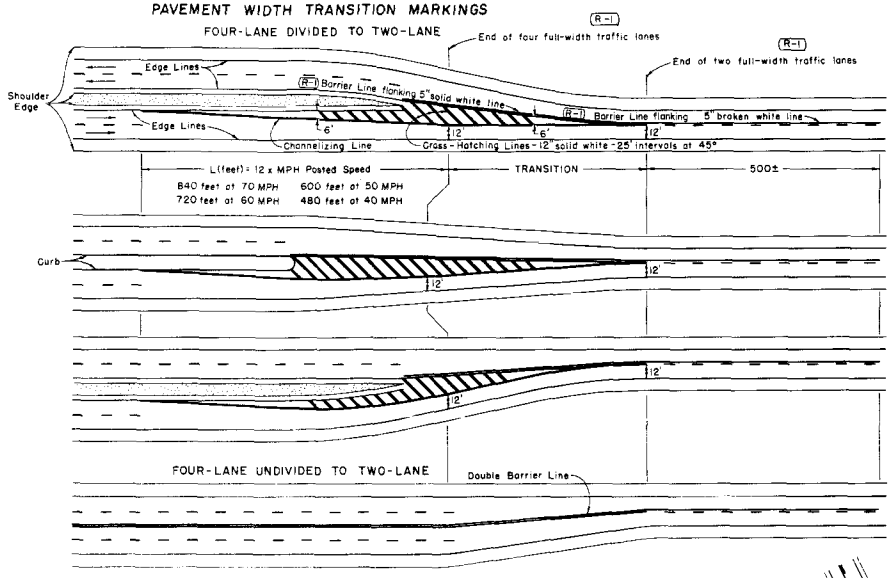
FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO			

REVISIONS			
R-1	7-11-67	Stopline & Notes	G.W.F.
R-2	2-15-68	Diag. edge line & Chevron X-hatch	G.W.F.
R-3	7-10-68	Rev. Title Block	G.W.F.

ENTRANCE AND EXIT RAMP MARKINGS



PAVEMENT WIDTH TRANSITION MARKINGS



GENERAL NOTES:

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

LANE LINES AND CENTER LINES
1. Broken white, 5 inches wide - 15 foot segments with 25 foot gaps.
2. Solid white, 5 inches wide (if noted).

BARRIER LINES
1. Solid yellow, 5 inches wide.
2. Apply parallel to and spaced 3 inches from other indicated line.

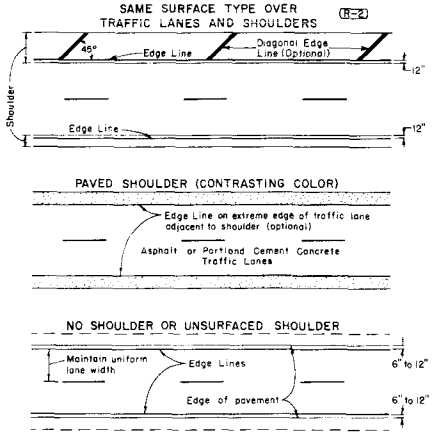
(R-2) EDGE LINES
1. Parallel - Solid white, 3 inches wide.
2. Diagonal - Solid white, 12 inches wide, spaced at intervals of 20' - 100'.

CHANNELIZING LINES
1. Solid white, 10 inches wide.

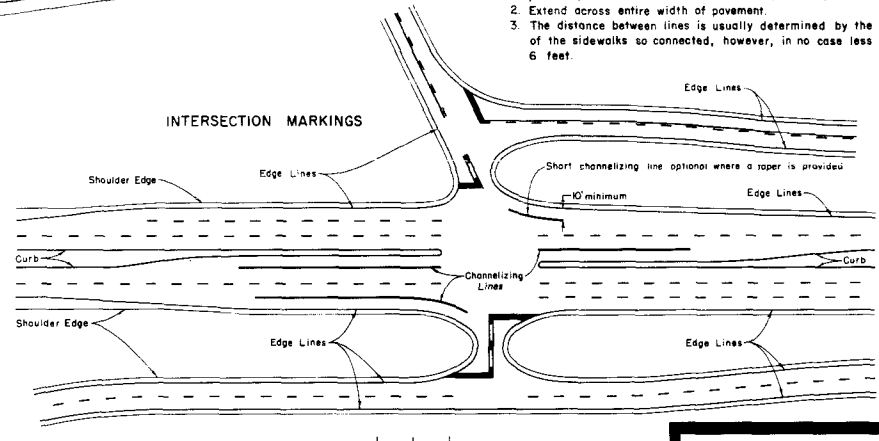
STOP LINES
1. Solid white, 24 inches wide.
2. Shall extend across all approach lanes at locations indicated on plans.
3. Locate at the desired stopping point, not more than 30 feet nor less than 4 feet from the nearest edge of the intersecting traffic lane.

CROSSWALK LINES
1. Solid white, 12 inches wide. If no advance stop line is provided, increase the width of the crosswalk lines to 24 inches.
2. Extend across entire width of pavement.
3. The distance between lines is usually determined by the width of the sidewalks so connected, however, in no case less than 6 feet.

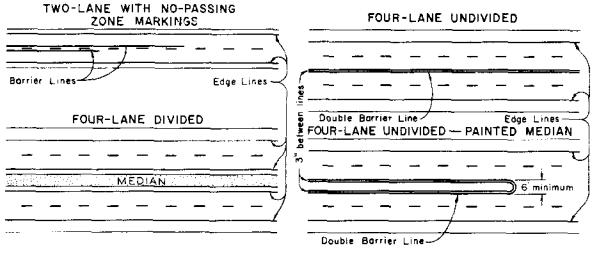
PAVEMENT EDGE LINE TYPICAL APPLICATIONS



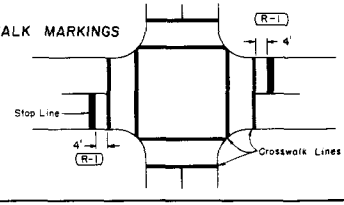
INTERSECTION MARKINGS



CENTER LINE AND LANE LINE MARKINGS



CROSSWALK MARKINGS



DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
DIVISION OF HIGHWAYS

TYPICAL PAVEMENT MARKINGS

Designed By: J.B.
Made By: H.B.D.
Checked By: D.R.W.
Approved By: [signature] Traffic Engineer
Date: AUGUST 11, 1965