INACTIVE 12/5/68

| FEDERAL ROAD REGION NO. | DIVISION | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 9 | COLORADO | CC10-0075-05 | 1 |

(R-1) 2-21-68 D.M.H.

FINAL CONSTRUCTION

TITLE SHEET

# DEPARTMENT OF HIGHWAYS
# STATE OF COLORADO

## PLAN AND PROFILE OF PROPOSED
## COLORADO PROJECT NO. CC 10-0075-05
## STATE HIGHWAY NO. 75

JEFFERSON, ARAPAHOE, AND DOUGLAS COUNTIES

AS CONSTRUCTED
REVISED DATE 11-16-68

### CONVENTIONAL SIGNS

CENTER LINE (PLAN SHEET / TITLE SHEET)
COUNTY LINE
TOWNSHIP OR RANGE LINE
LAND LINES (SECTION LINE, ½ SECTION LINE, ¼ SECTION LINE)
CITY LIMITS
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)
ACCESS DENIED BY DEED
TOP OF CUTS
TOE OF FILLS
DETOUR
PROPOSED POWER LINE

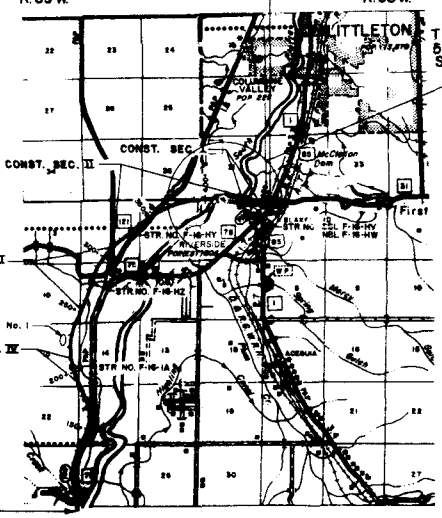
### TABULATION OF LENGTH

| Sta. to Sta. | Sec. | Roadway: No Work | Roadway: Arapahoe | Roadway: Jefferson | Roadway: Douglas | Structures: Arapahoe | Structures: Jefferson |
|---|---|---|---|---|---|---|---|
| 80+00 to 198+88 | | 11,888.0 | | | | | |
| 198+88 to 202+92.5 | 4 | | | 1,004.5 | | | |
| 202+92.5 to 203+15.5 | 4 | | | | | | 23.0 |
| 203+15.5 to 210+50 | 4 | | | 734.5 | | | |
| 210+50 to 254+50 | | 4,400.0 | | | | | |
| 254+50 to 274+93.0 | 3 | | | 2,043.0 | | | |
| 274+93 to 275+97 | 3 | | | | | | 34.0 |
| 275+97 to 277+80 | 3 | | | 253.0 | | | |
| 277+80 to 314+00 | | 3,620.0 | | | | | |
| 314+00 to 331+41.4 | 2 | | | 1,741.4 | | | |
| 331+41.4 to 331+72.6 | 2 | | | | | | 31.2 |
| 331+72.6 to 335+78 | 2 | | | 405.4 | | | |
| 335+78 to 432+00 | | 9,622.0 | | | | | |
| 432+00 to 446+13.3 | 1 | | 1,213.3 | | | | |
| 444+13.3 to 445+86.7 | 1 | | | | | 173.4 | |
| 445+86.7 to 450+00 | 1 | | | | 413.3 | | |
| 450+00 to 463+00 | | 1,300.0 | | | | | |
| Total Feet | | 30,830.0 | 1,213.3 | 6,181.8 | 413.3 | 173.4 | 88.2 |
| Total Miles | | 5.839 | 0.230 | 1.171 | 0.078 | 0.033 | 0.017 |

SCALES OF ORIGINAL DRAWINGS
ON PLAN, 1 IN. = 100 FT.
ON PROFILE, 1 IN. = 100 FT. HORIZONTAL; 1 IN. = 10 FT. VERTICAL
GRADE LINE ON PROFILE IS SHOWN AS GRADE OF FINISHED ROAD
GROSS LENGTH OF PROJECT: 38,839.7 Ft. = 7.358 Mi.
NET LENGTH OF PROJECT: 8,070.0 Ft. = 1.529 Mi.

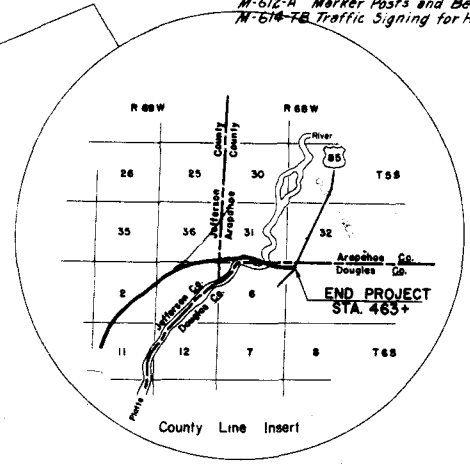
"As Constructed No Revisions"
Sheet No. 23
"Void By Construction"
Sheet No. 3

END PROJECT CC 10-0075-05
STA. 463+00




BEGIN PROJECT CC 10-0075-05
STA. 80+00

SCALE OF MILES




County Line Insert

### INDEX OF SHEETS


| SHEET NO | |
|---|---|
| 1. | Title Sheet |
| 2. | Typical Sections |
| 3B, 3C | Summary of ~~Approximate~~ Final Quantities |
| 4. | List of Structures |
| 5-12. | Platte River Bridge, Sta 445+00 |
| 13. | Layout of Massey Draw, Double Box Culv. Sta. 331+57 |
| 14. | Layout of Deer Creek Triple Box Culv. Sta. 275+10 (R-1) |
| 15. | Special Details of Conc Box Culverts |
| 16. | Layout of Brush Creek Double Box Conc. Sta. 203+06 |
| 17. | Special Details of Brush Creek Structure |
| 18. | Miscellaneous Details |
| 19. | Plan & Profile, Sta. 432+ to 450+ |
| 20. | Plan & Profile, Sta. 315+ to 345+ |
| 21. | Plan & Profile, Sta. 253+ to 283+ |
| 22. | Plan & Profile, Sta. 195+ to 210+ |
| 23. | Pit Location |
| 24. | Summary of Earthwork Quantities |
| M-203-A-1 | Superelevation of Curves - Divided Hwys. (7-26-67) |
| M-203-B | Approach Roads, Flairing, Cut Slope Treatment, Bridge & Crest Widening (2-6-68) |
| M-206-A | Excavation & Backfill for Structures (2 Sheets) (3-17-67) |
| M-500-A | Letters & Figures for Structure Numbers (7-1-65) |
| M-510-AA | Structual Plate Culvert Details (2 Sheets) (3-20-67) |
| M-601-A | Single & Double Concrete Box Culverts (7-1-65) |
| M-601-B | Triple Concrete Box Culvert (7-1-65) |
| M-601-C | Wingwalls for Concrete Box Culverts, 4:1 Side Slopes (2 Sheets) (7-17-67) |
| M-604-BA | Inlet, Type C (12-18-67) |
| M-612-A | Marker Posts and Bench Marks (5-2-66) |
| M-614-7B | Traffic Signing for Highway Construction (3 Sheets) (7-12-67) |


SEE SPECIAL PROVISIONS FOR NOTICE TO BIDDERS

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO
APPROVED: [signature] 2/20/68
CHIEF ENGINEER DATE

PLANS PREPARED UNDER
CONTRACT
CC 10-0075-05
BY
BARTON, STODDARD, MILHOLLIN & HIGGINS
DENVER, COLO. BOISE, IDAHO

| | |
|---|---|
| Contractor | C J Abbott Inc. |
| Resident Eng. | H.D. Shepperd |
| Project Eng. | Wm. A. Schlingme. |
| Date Completed | Nov. 16, 1968 |

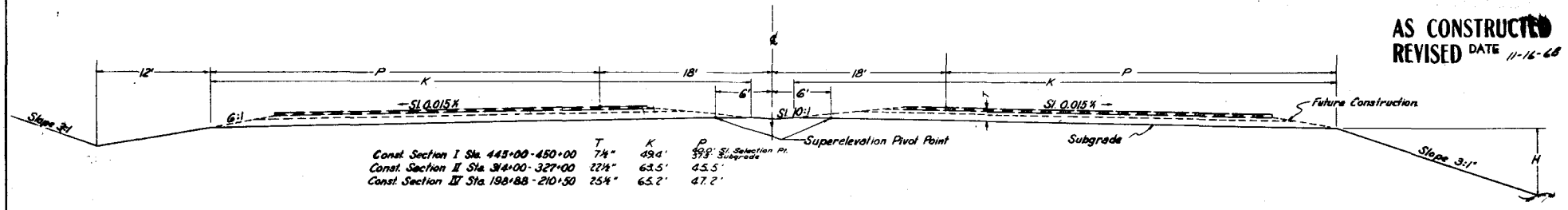
DEPARTMENT OF HIGHWAYS—STATE OF COLORADO
FORM D. O. H. 136
MARCH 1964

| FEDERAL ROAD REGION NO. | DISTRICT | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | CG10-0075-05 | 2 | 340 |

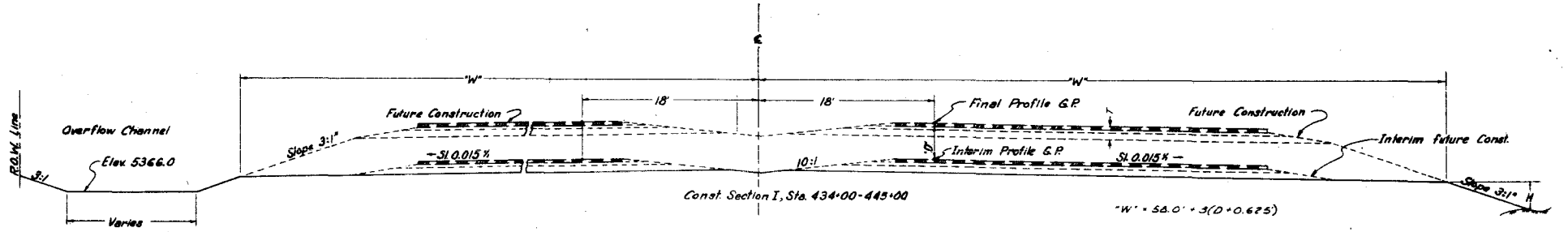
FINAL CONSTRUCTION

**AS CONSTRUCTED**
**REVISED** DATE 11-16-68

# TYPICAL SECTIONS



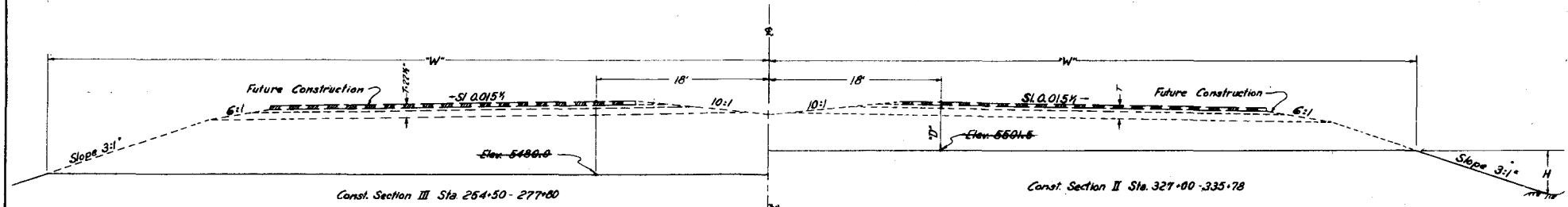

| | T | K | P |
|---|---|---|---|
| Const. Section I Sta. 445+00-450+00 | 7¼" | 49.4' | 49.9' Sl. Selection Pt. 37.3' Subgrade |
| Const. Section II Sta. 314+00-327+00 | 22¼" | 63.5' | 45.5' |
| Const. Section IV Sta. 198+88-210+50 | 25¼" | 65.2' | 47.2' |




Const. Section I, Sta. 434+00-445+00

"W" = 58.0' + 3(D + 0.625')

Const. Section I, Sta 432+00-434+00
(this section symmetrical about ℄)




Const. Section III Sta. 254+50-277+60

Const. Section II Sta. 327+00-335+78

| H | Slope |
|---|---|
| 6' or Less | 6:1 |
| 6' to 10' | 4:1 |
| Over 10' | 3:1 |

Both Sections are Symmetrical about ℄

NOTE: Embankment (Standard) to be constructed with moisture density control to 6" below natural ground in accordance with Section 203.11 of Standard Specifications.

"W" = 65.2' + 3(D - 2.125')

"W" = 63.5' + 3(D - 1.875')

DEPARTMENT OF HIGHWAYS
H. 126

(R-1) 2-27-68 D.H.H.

| FEDERAL ROAD REGION NO. | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | CC10-0075-05 | 3 | 24 |

# SUMMARY OF APPROXIMATE QUANTITIES

| SPECIFICATION ITEM NO. | LOCATION / ITEM | UNIT | Section 1 - Sta. 432+00 to 450+00 | | | | Section 2 - Sta. 314+00-335+78 | | | Section 3 - Sta. 254+50-277+80 | | | Section 4 - Sta. 198+88-210+50 | | | PROJECT TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Douglas County | Arapahoe County | | | Jefferson County | | | Jefferson County | | | Jefferson County | | | |
| | | | ROAD WAY | ROAD WAY | BRIDGE F-16-HV | BRIDGE F-16-HW | SECTION TOTAL | ROAD WAY | CBC F-16-HY | SECTION TOTAL | ROAD WAY | CBC F-16-HZ | SECTION TOTAL | ROAD WAY | CBC F-16-IA | SECTION TOTAL | |
| 201 | Clearing & Grubbing | L.S. | • | • | | | • | • | | • | • | | • | • | | • | • |
| 202 | Removal of Structure | Ea. | | | | | | | | | 4 | | 4 | | | | 4 |
| 202 | Removal of Bridge | Ea. | | | | | | | | | 1 | | 1 | | | | 1 |
| 203 | Unclassified Excavation (Haul) | C.Y. | 5,000 | 38,000 | | | 43,000 | 71,000 | 2000 | 73,000 | 3000 | | 3,000 | 136,000 | | 136,000 | 255,000 |
| 203 | Muck Excavation (Haul) | C.Y. | | | | | | | | | | 4000 | 4000 | | | | 4000 |
| 203 | Borrow (Haul) (R-1) | C.Y. | | | | | | | | | 666,000 | | 666,000 | | | | 666,000 |
| 203 | Embankment (Standard) | C.Y. | 17,000 | 27,000 | | | 44,000 | 67,000 | | 67,000 | 573,000 | | 573,000 | 118,000 | | 118,000 | 802000 |
| 206 | Structure Excavation (Haul) | C.Y. | | | 230 | 230 | 460 | | 350 | 350 | 10 | | 10 | 2120 | 240 | 2360 | 3,180 |
| 206 | Structure Backfill (Class 3) (Haul) | C.Y. | | | 80 | 80 | 160 | | 870 | 870 | 10 | 2700 | 2710 | 1220 | 440 | 1660 | 5,400 |
| 209 | Wetting | M.Gal. | 680 | 1080 | | | 1760 | 2680 | | 2680 | 22920 | | 22920 | 4720 | | 4720 | 32,080 |
| 210 | Reset Structure | Ea. | | | | | | | | | 2 | | 2 | | | | 2 |
| 502 | Steel Piling (10 BP 42) | Lin. Ft. | | | 1400 | 1400 | 2800 | | | | | | | | | | 2800 |
| 506 | Heavy Riprap | C.Y. | | | 270 | 270 | 540 | | | | | | | | 140 | 140 | 680 |
| 509 | Structural Steel (Galvinized) | L.S. | | | • | • | • | | | | | | | | | | • |
| 510 | Structural Plate Arch (15'-0" x 7'-9") | Lin. Ft. | | | | | | | | | | | | 580 | | 580 | 580 |
| 513 | Drain Pipe (4" Dia.) | Ea. | | | 6 | 6 | 12 | | | | | | | | | | 12 |
| 516 | Dampproofing (Linseed Oil) | Sq. Y. | | | 850 | 850 | 1700 | | | | | | | | | | 1700 |
| 601 | Concrete, (Class A) | C.Y. | | | 127 | 127 | 254 | | 1249 | 1249 | 4 | 2041 | 2045 | 214 | 451 | 665 | 4,213 |
| 601 | Concrete, (Class D) | C.Y. | | | 384 | 384 | 768 | | | | | | | | | | 768 |
| 602 | Reinforcing Steel (R-1) | Lbs. | | | 110,200 | 110,200 | 220,400 | | 185,100 | 185,100 | 300 | 300,800 | 301,100 | 18,100 | 42,600 | 60,700 | 767,300 |
| 604 | Inlet, Ty C (5') | Ea. | | | | | | | | | | | | 1 | | 1 | 1 |
| 619 | 8" Cast Iron Pipe | Lin. Ft. | | | | | | | | | | | | 12 | | 12 | 12 |
| 620 | Field Office | Ea. | | | | | | | | | | | | | | | 1 |
| 620 | Field Laboratory | Ea. | | | | | | | | | | | | | | | 1 |
| 620 | Sanitary Facility | Ea. | | | | | | | | | | | | | | | 1 |
| 626 | Mobilization | L.S. | | | | | | | | | | | | | | | • |
| | FORCE ACCOUNT Site Preparation | L.S. | | • | | | • | | | | | | | | | | • |

# LIST OF STRUCTURES

AS CONSTRUCTED
REVISED DATE 11-16-68

FINAL CONSTRUCTION

| FED. ROAD DIVISION NO. | DISTRICT | PROJECT NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 8 | COLO. | CC10-0075-05 | 4 | ~~260~~ |

| LOCATION | DESCRIPTION | | REMOVE STRUCTURE NO. | REMOVE STRUCTURE KIND | EXCAVATION CUBIC YARDS UNCL. | EXCAVATION CUBIC YARDS EMB. | EXCAVATION CUBIC YARDS UNCL. EXTRA | STRUCTURAL EXCAVATION CUBIC YARDS | STRUCTURE BACKFILL CUBIC YARDS CL. 3 | MECH. TAMPING HOURS | STR. STEEL | RIPRAP CU. YD. | CONCRETE CUBIC YARDS CL. "A" | REINFORCING STEEL LBS. | MEDIAN INLET TY | MEDIAN INLET H | CORRUGATED METAL CULVERT PIPE LINEAR FEET 18" | RESET STRUCTURE NO. | RESET STRUCTURE KIND | CAST IRON PIPE 8" | METAL APRONS FOR C.M.P. CULVERTS NO. | MISCELLANEOUS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 203+04 | Median Drain | Sec. IV | | | | | | *4 | *3 | | | | | | C | 5a | | | | | | |
| 203+25 | 90" Water Main Protection Structure | Sec. IV | | | 4,980 ~~4,483~~ | 3 226 ~~2,363~~ | | 1,652 ~~2,116~~ | 1,407 ~~1,209~~ | | | | 213.9 | 18,043 | | | | | | | | 580 L.F. Structual Pipe Arch |
| 203+25 | 8" Blow off valve pipe | Sec. IV | | | | | | | | | | | | | | | | | | ~~12~~ | | |
| 257+40 to 275+10 | Irrigation Channel Change | Sec. III | | | 2399 | ~~2,345~~ 1,806 | ~~408~~ | | | | | | | | | | | | | | | |
| 259+10 | | Sec. III | | ~~1 Hdgte.~~ | | | | | | | | | | | | | | | | | | |
| 262+10 | | Sec. III | | ~~1 Hdgte.~~ | | | | | | | | | | | | | | | | | | |
| 267+55 | | Sec. III | | | | | | | | | | | | | | | | ~~1 Hdgte.~~ | | | | |
| 272+20 | | Sec. III | | | | | | | | | | | | | | | | ~~1 Hdgte.~~ | | | | |
| 273+45 | | Sec. III | | ~~1 Hdgte.~~ | | | | | | | | | | | | | | | | | | |
| 274+05 | | Sec. III | 1 | Bridge | | | | | | | | | | | | | | | | | | |
| 274+60 | | Sec. III | 1 | Conc. Spillway | | | | | | | | | | | | | | | | | | |
| 274+60 | Req'd. Conc. Ditch Check | Sec. III | | | | | | 3.3 | 2.8 | | | | 1.71 1.66 | 150 | | | | | | | | |
| 275+10 | Req'd. Conc. Ditch Check | Sec. III | | | | | | 3.3 | 2.8 | | | | 1.66 1.71 | 150 | | | | | | | | |
| 442+50 to 445+00 | Arapahoe County | Sec. I | | | | | | ~~28~~ | | | | ~~136~~ | | | | | | | | | | |
| 445+00 to 446+00 | Douglas County | Sec. I | | | | | | ~~60~~ | | | | ~~291~~ | | | | | | | | | | |
| | Sub-Total Sec. IV | | | | 4,980 ~~4,483~~ | 3,226 ~~2,363~~ | | 1,652 ~~2,116~~ | 1,407 ~~1,209~~ | | | | 213.9 | 18,043 | 11 | | | | | ~~12~~ | | 580 L.F. Structual Pipe Arch |
| | Sub-Total Sec. III | | 2 ~~5~~ | | 2,399 | 1,806 ~~2,345~~ | ~~408~~ | 6.6 | 5.6 | | | | 6.74 ~~3.42~~ | 300 | | | | ~~2~~ | | | | |
| | Sub-Total Sec. I | | | | | | | ~~88~~ | | | | ~~427~~ | | | | | | | | | | |
| | PROJECT TOTAL | | 2 ~~5~~ | | 7379 ~~4,483~~ | 5032 ~~4,709~~ | ~~408~~ | 1,664.6 ~~2,116~~ | 1,412.6 ~~1,209~~ | | | ~~427~~ | 220.64 ~~11.92~~ | 18,343 | 11 | | | ~~2~~ | | ~~12~~ | | 580 L.F. Structual Pipe Arch |

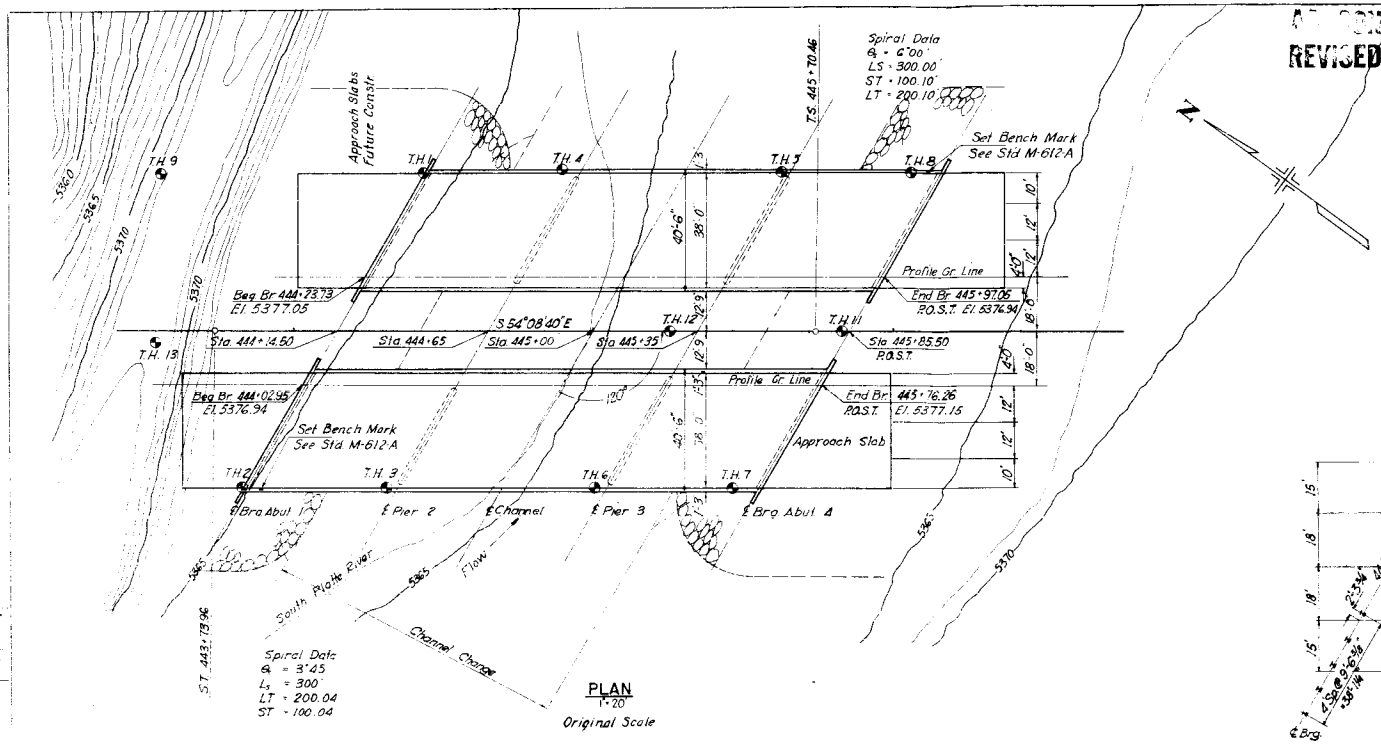
* Included in Bid

REVISIONS

AS CONSTRUCTED

REVISED DATE NOV 1 8 1969

| FEDERAL ROAD REGION No. | DIVISION | PROJECT No. | SHEET No. |
|---|---|---|---|
| 9 | COLORADO | CC 10-0075-05 | 5 |




## PLAN

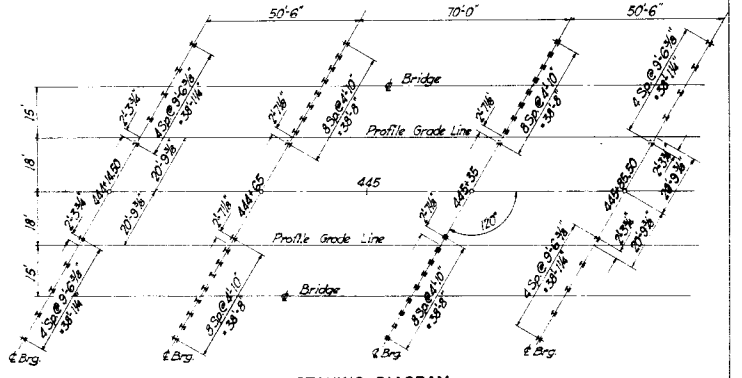
1"=20'

Original Scale

## SUMMARY OF QUANTITIES (1 Structure) 264

| | Item | Description | Unit | Super-struct. | Abut. No. 1 | Pier No. 2 | Pier No. 3 | Abut. No. 4 | Total |
|---|---|---|---|---|---|---|---|---|---|
| | 206 | Structure Excavation | Cu. Yd. | ~~5867~~ | ~~5665~~ | ~~5665~~ | ~~5867~~ | ~~22067~~ | |
| | 206 | Structure Backfill (Class 3) | Cu. Yd. | | 18 | ~~21485~~ | ~~21485~~ | 18 | 76117 |
| ③ | 502 | Steel Piling 10BP42 | L.F. | | ~~295~~ | ~~405~~ | ~~405~~ | ~~295~~ | ~~1400~~ |
| | 506 | Heavy Riprap | Cu. Yd. | | ~~135~~ | ~~280~~ | ~~280~~ | ~~135~~ | ~~830~~ |
| ① | 509 | Structural Steel (Galv.) | L.S. | | | | | 13982 | L.S. |
| | 513 | Drain Pipe (d"4" × 1'-0") | Ea. | 6 | 728 | | 728 | ~~560~~ | 6 |
| | 516 | Dampproofing (Linseed Oil) | S.Y. | ~~843~~ | ~~3566~~ | | | ~~382~~ | ~~4845~~ |
| | 601 | Concrete Class 'D' | Cu. Yd. | ~~384~~ | 12.7 | | | 12.7 | ~~384~~ |
| | 601 | Concrete Class 'A' | Cu. Yd. | | ~~145~~ | 49.0 | 49.0 | ~~145~~ | ~~19798~~ |
| | 602 | Reinf. Steel | Lbs. | 101,383 | 1009 | 3382 | 3382 | 1009 | 110,165 |
| ② | | ½" Exp. Jt. Mat'l. AASHTO M-153-54 Type III | Sq. Ft. | | | 65 | 65 | | 130 |
| | | | | | | | | | |
| | | | | | | | | | |

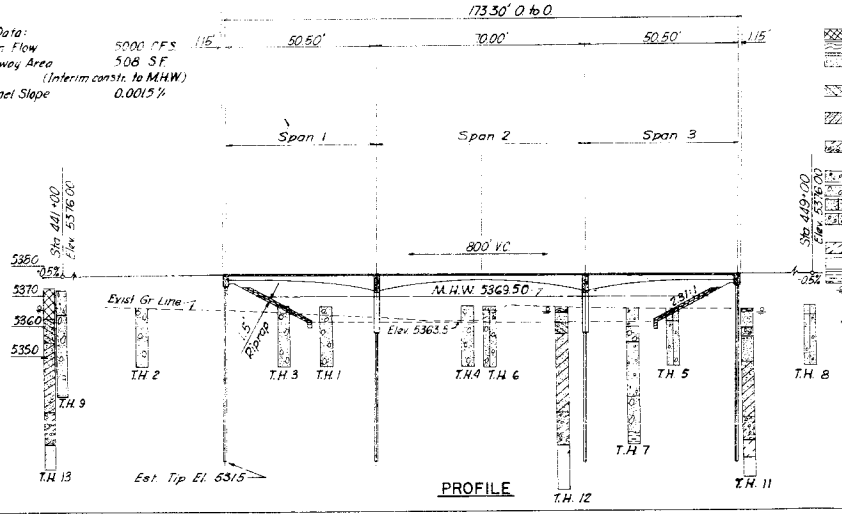
① Design Weight 11,650 Lbs.
② To be included in Bid Price for Item 601 - Concrete
③ 10 WF 45 may be used in lieu of 10 BP42.




## PILE STAKING DIAGRAM

Schematic

River Data:
Design Flow 5000 CFS
Waterway Area 508 S.F.
(Interim constr. to M.H.W.)
Channel Slope 0.0015 ft/ft




## PROFILE

## TEST HOLE DATA

- Fill, loose, silt and fine grained sand
- Topsoil
- Sand, Loose medium to coarse grained clean to slightly silty, brown, with some fine gravel (SP).
- Sand, loose to very loose, silty, fine grained, wet, occasional gravel, gray to brown (SM).
- Sand loose, interlayed clean coarse grained and silty fine grained occasional coarse gravel wet gray to tan (SP-SM).
- Gravel, medium dense to dense, sandy, clayey to clean, fine to coarse, wet, tan to brown (GC-GF)
- Sand and gravel
- Sand and gravel few small 3-4 in. cobbles
- Sand coarse, saturated
- Sand and gravel, coarse, saturated and small rocks (3-5 in. boulders)
- Claystone, sandstone interlayed medium hard, gray
- Claystone, sandstone, same as above but hard to very hard
- Shale
- Free water level and number of hours after drilling that measurement was taken.
- Gradual change in materials, exact strata change is not located

FEB 1968 BRIDGE SECT. B. O. H.

Revised P.C. 2-9-68

## GENERAL NOTES

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

All concrete shall be Class 'A' or Class 'D'.

All reinforcing steel shall be intermediate grade steel of a deformed type. Each bar shall be tagged with the bar designation and station number of the project.

If, by permission of the Engineer primary bars are spliced, they shall lap a minimum of 40 diameters for bars near tops of beams having more than 12 inches of concrete under the bars, and 24 diameters for bars near bottom of members. Secondary bars when spliced shall lap 24 diameters of the bar.

Dimensions for reinforcing steel not shown as clear shall be to the centerline of the bar.

Soundings and depth of footings 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.

For details of structural excavation and structure backfill, see Standard M-206-A.

All concrete surfaces marked with the symbol f as shown on Sheet No. 12 shall receive Class 2 Surface Finish.

All corners to be chamfered ¾" unless otherwise noted.

LOADING DATA.
Live Load = A.A.S.H.O. HS 20-44
Dead Load = Assumes 15 lbs./sq. ft. additional wearing surface which includes the ½ inch concrete monolithic wearing surface shown.

DESIGNING DATA.
A.A.S.H.O. 1965 Unit Stresses except as noted.
Reinf. steel fs = 20,000 lbs/sq. in.

Concrete fc = 1200 lbs/sq. in
n = 10

Beg. Br. 444+23.73 - End Br. 445+97.05 SBL F-16-HV
Beg. Br. 444+02.95 - End Br. 445+76.26 NBL F-16-HW

**COLORADO**
**DEPARTMENT OF HIGHWAYS**

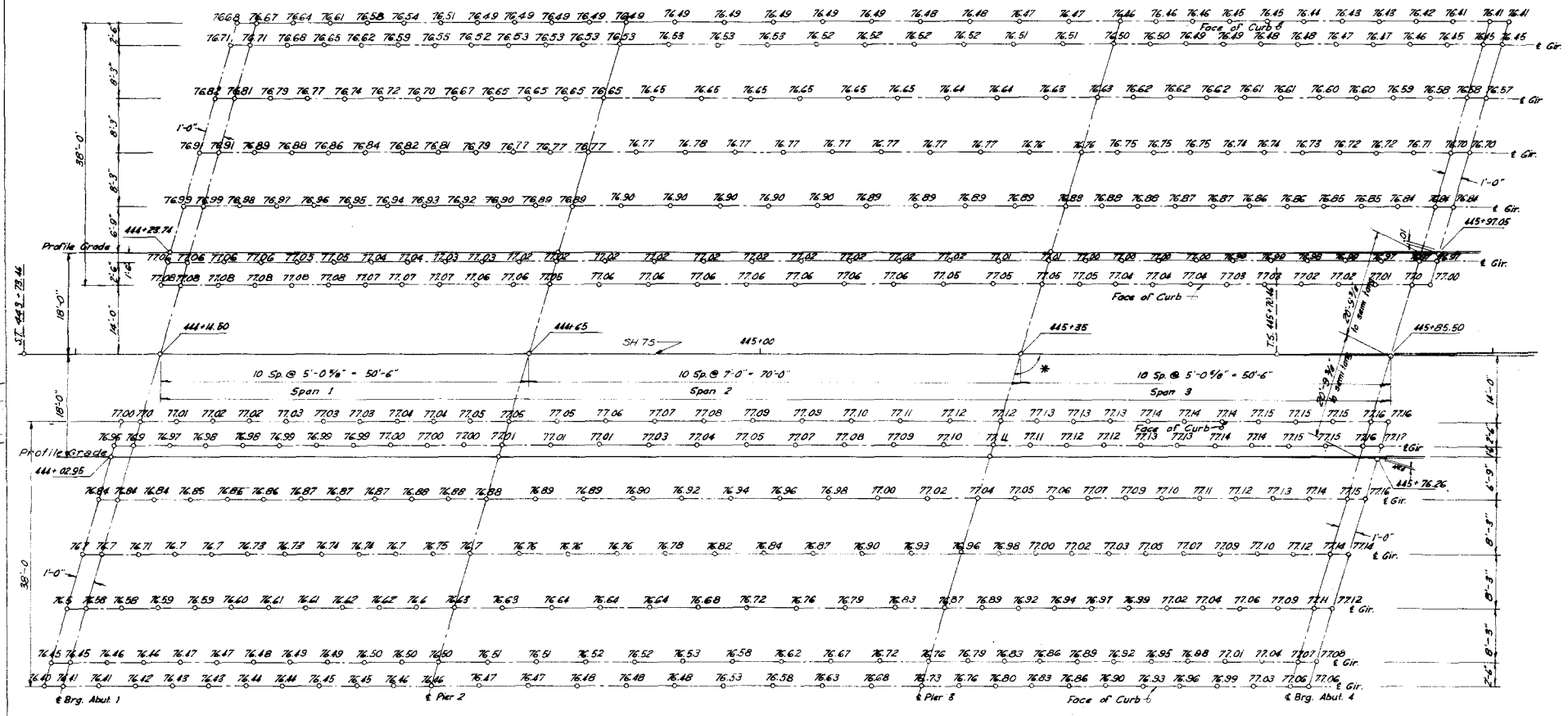
3 SPAN CONTINUOUS
(50'-6" — 70'-0" — 50'-6")
CONC. SLAB & GIRDER
38' RDWY. 1'-3" CURB 60° SKEW

Across South Platte River
Sta. 445+00
Near Littleton Sec. 31 T. 5S. R. 68W

Designed by B.S.M.H.
Made by L.J.S.
Checked by W.A.H.
Approved by
Bridge Engineer
Date: 19

REVISIONS

| FEDERAL ROAD REGION No. | DIVISION | PROJECT No. | SHEET No. |
|---|---|---|---|
| 9 | COLORADO | CC 10-0015-05 | 6 |




## ERECTION DIAGRAM

*Finish Grade Elevations on Deck*

* Note: SCHEMATIC DIAGRAM ONLY - Not to scale or skew angle.

STRUCTURE NO. SBL F-16-HV
NBL F-16-HW

**COLORADO**
**DEPARTMENT OF HIGHWAYS**

**ERECTION DIAGRAM**

Across So. Platte River
Sta. 445+00
Near Littleton Sec. 31 T. 5S R. 68W

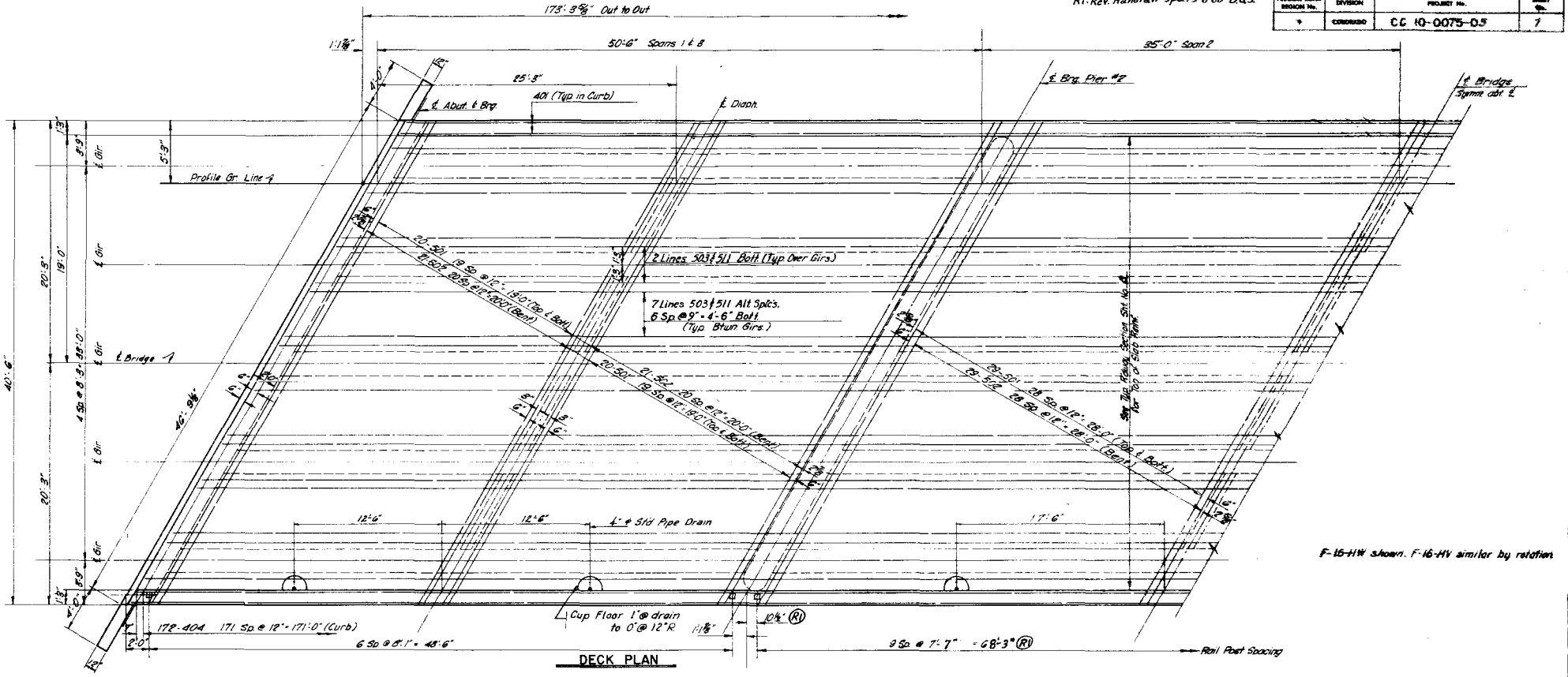
Designed by B.S.A.H.
Made by D.J.V.
Checked by

Approved by
Bridge Engineer
Date: 19

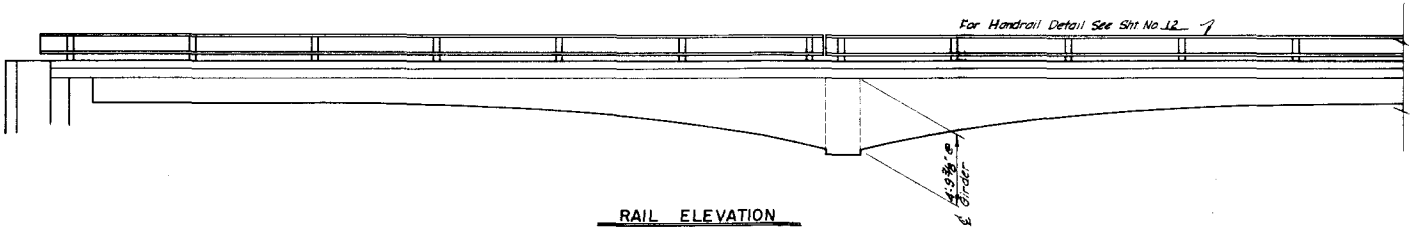
REVISIONS

R1: Rev. Handrail Spa. 5-6-68 D.L.S.

| FEDERAL ROAD REGION No. | DIVISION | PROJECT No. | SHEET No. |
|---|---|---|---|
| 9 | COLORADO | CC 10-0075-03 | 7 |




DECK PLAN




RAIL ELEVATION

COLORADO
DEPARTMENT OF HIGHWAYS

DECK PLAN
RAIL ELEVATION

Stream: Sq. Platte River
Near: Littleton Sec. 51 T. 5 S. R. 68 W.

Designed by: B.S.M.W.
Made by: D.C.K.
Checked by:

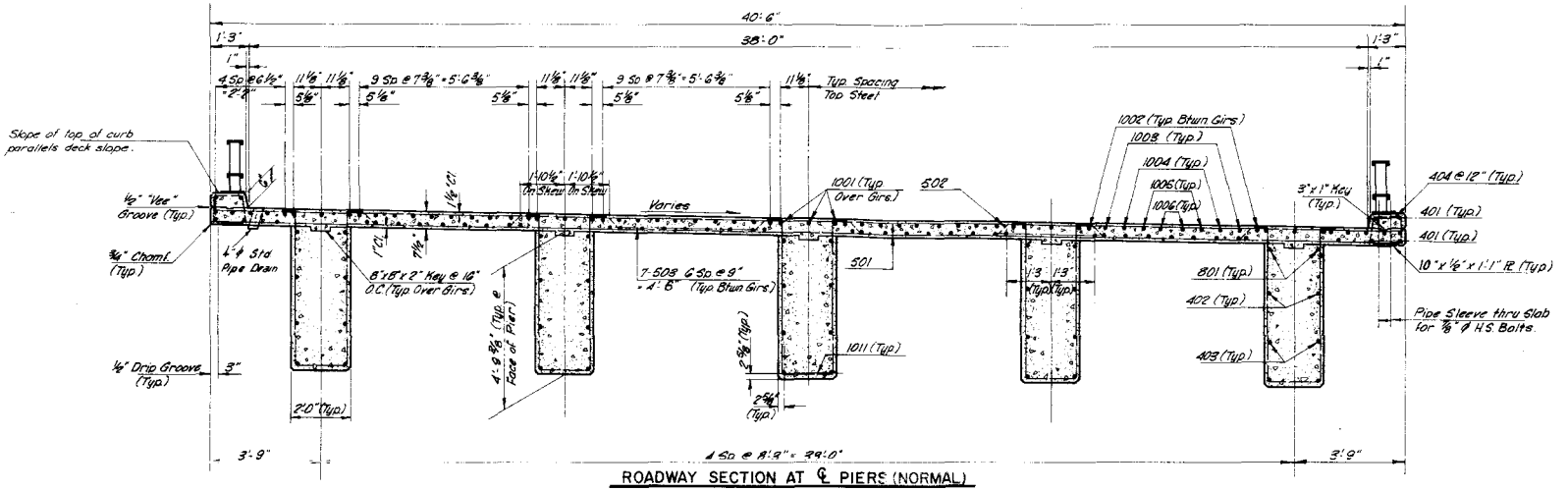
Approved by:
Bridge Engineer
Date:

SBL F-16-HV
STRUCTURE NO. ~~SBL F-16-HW~~

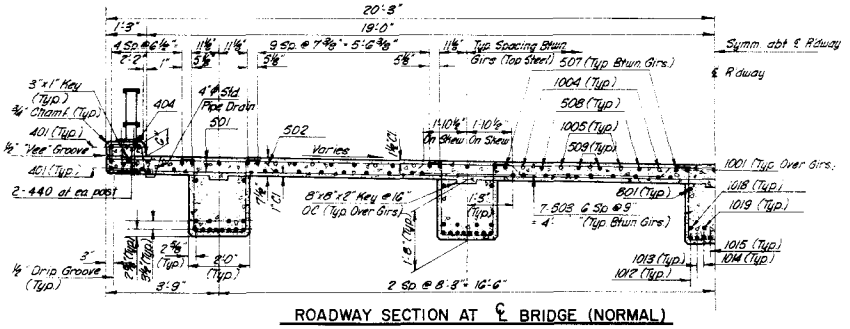
115-1

REVISIONS

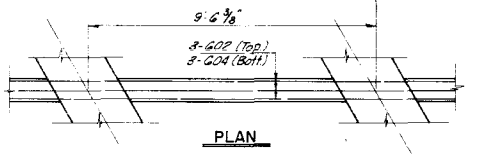
| FEDERAL ROAD REGION No. | DIVISION | PROJECT No. | SHEET No. |
|---|---|---|---|
| 9 | COLORADO | CC 10-0075-05 | 8 |



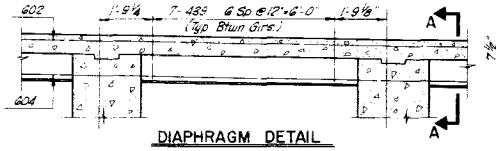

ROADWAY SECTION AT ℄ PIERS (NORMAL)



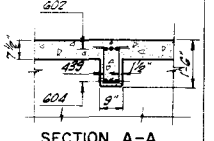

ROADWAY SECTION AT ℄ BRIDGE (NORMAL)




PLAN




DIAPHRAGM DETAIL




SECTION A-A

COLORADO
DEPARTMENT OF HIGHWAYS
TYPICAL SECTIONS

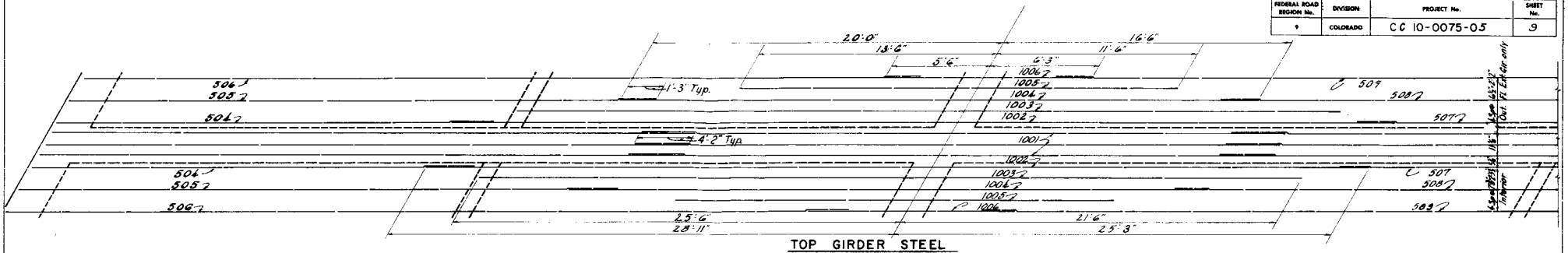
Across South Platte River
Sta. 445+00
Near Littleton Sec. 31 T. 5S R. 68W

Designed by B.S.M.H.
Made by D.C.K.
Checked by
Approved by
Bridge Engineer
Date: 19

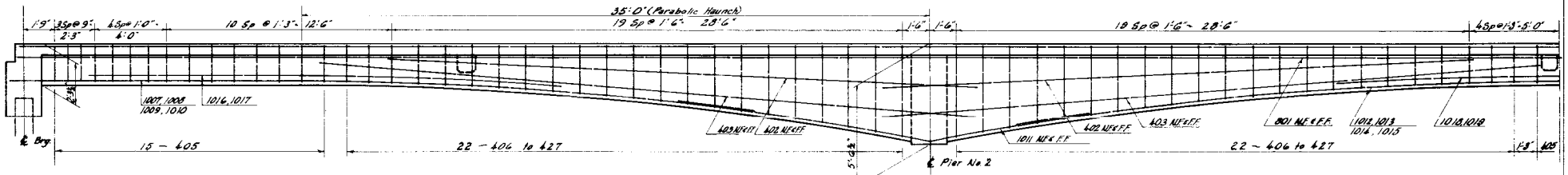
STRUCTURE NO. SBL F-16-HV
NBL F-16-HW

REVISIONS

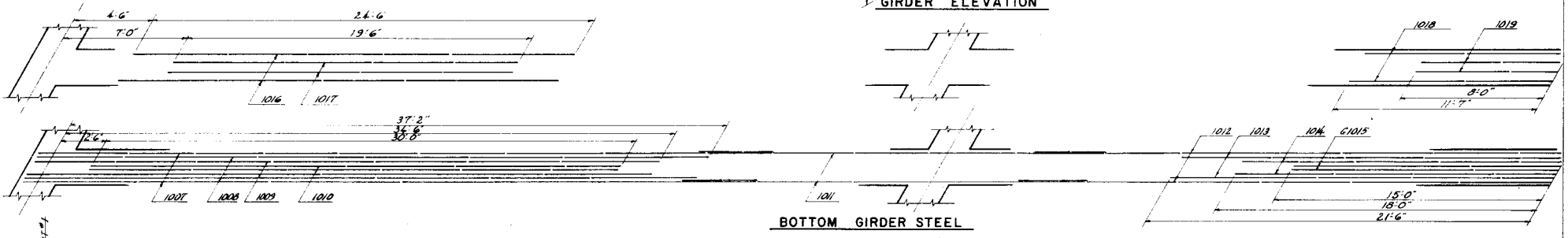
| FEDERAL ROAD REGION No. | DIVISION | PROJECT No. | SHEET No. |
|---|---|---|---|
| 9 | COLORADO | CC 10-0075-05 | 9 |



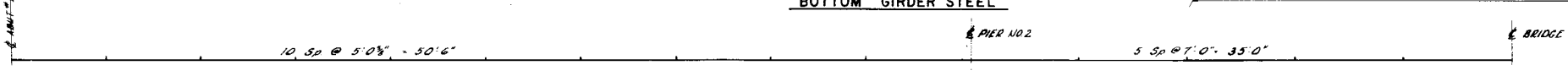

TOP GIRDER STEEL




GIRDER ELEVATION




BOTTOM GIRDER STEEL




| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2'-3½" | 2'-3½" | 2'-3½" | 2'-3½" | 2'-4¼" | 2'-6⅝" | 2'-10⅝" | 3'-4⅛" | 3'-11¾" | 4'-8¾" | 5'-6½" | 4'-5⅛" | 3'-5⅜" | 2'-9⅜" | 2'-5⅛" | 2'-3½" | Dist. ft. Top of Slab to Bott. of Girder |
| | 0.155" | 0.273" | 0.335" | 0.332" | 0.276" | 0.195" | 0.113" | 0.048" | 0.012" | | 0.027" | 0.106" | 0.225" | 0.342" | 0.394" | D.L. Δ Correction |

Notes:
Girder shoring shall remain in place full length until all pours have reached a min. strength of 2,400 psi, and the slab shall not be poured until the Girder pours have reached a min strength of 2,400 psi.

STRUCTURE NO. SBL F-16-HV
NBL F-16-HW

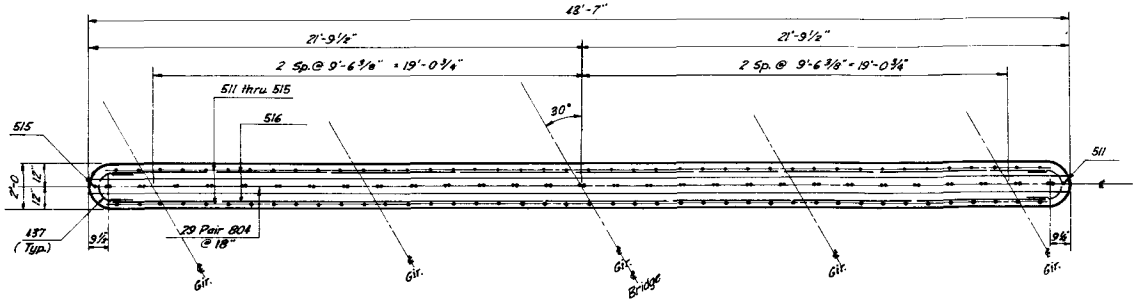
COLORADO
DEPARTMENT OF HIGHWAYS
GIRDERS

Across South Platte River
Sta. 445+00
Near Littleton Sec. 31 T. 5S R. 68W

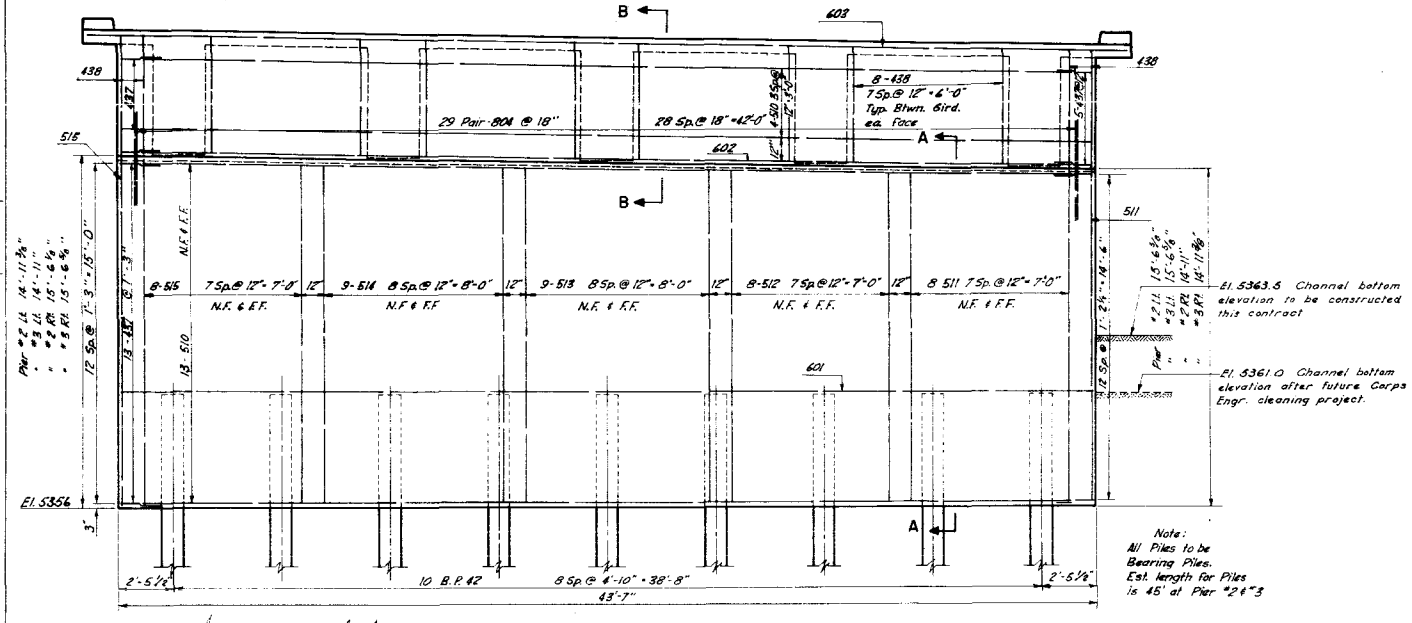
Designed by B.S.M.H.
Made by D.D.L.
Checked by
Approved by
Bridge Engineer
Date: 19

REVISIONS

| FEDERAL ROAD REGION No. | DIVISION | PROJECT No. | SHEET No. |
|---|---|---|---|
| 4 | COLORADO | CC 10-0075-05 | 10 |

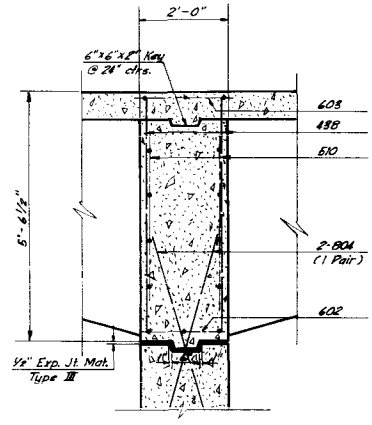



PLAN

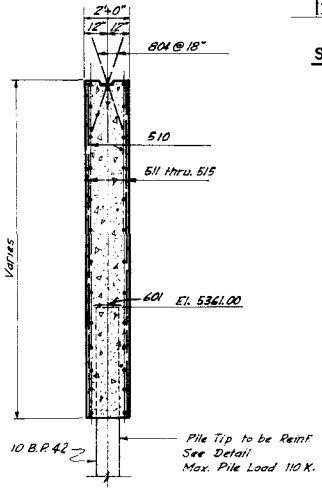



Note:
All Piles to be Bearing Piles.
Est. length for Piles is 45' at Pier #2 & #3

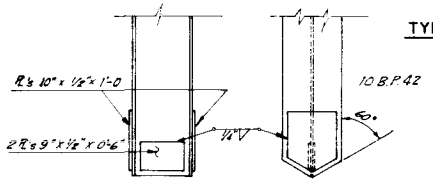
TYP. ELEVATION PIER NOS. 2 & 3




SECTION B – B




SECTION A – A




PILE TIP REINFORCEMENT

Cost of pile reinforcement to be included in unit bid price of Item 502.

COLORADO
DEPARTMENT OF HIGHWAYS

PIERS

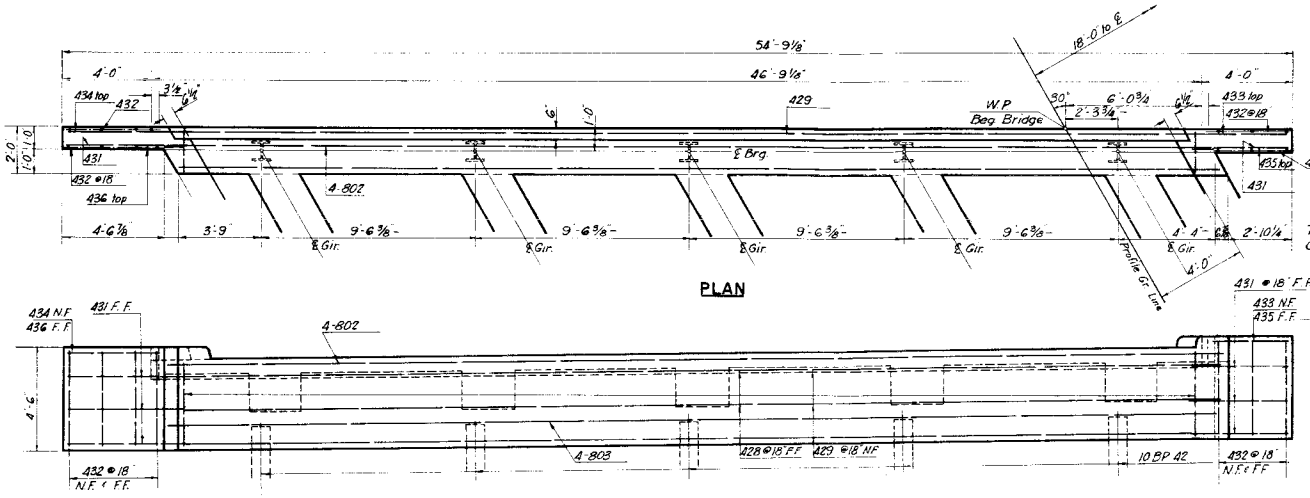
Across South Platte River
Sta. 445+00
Near Littleton Sec. 31 T. 5 S. R. 68 W

Designed by B.S.M.H. Approved by
Made by D.J.V. Bridge Engineer
Checked by Date: 19

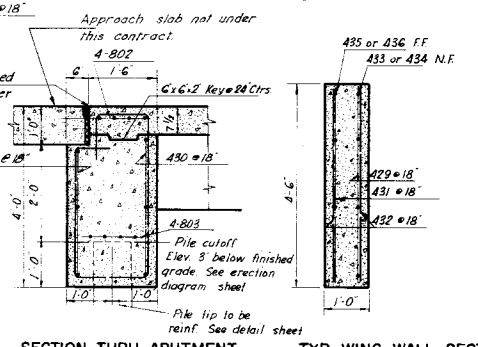
STRUCTURE NO. SBL F-16-HV
NBL F-16-HW

REVISIONS

| FEDERAL ROAD REGION No. | DIVISION | PROJECT No. | SHEET No. |
|---|---|---|---|
| 9 | COLORADO | CC 10-0075-05 | 11 |




PLAN




SECTION THRU ABUTMENT

TYP WING WALL SECTION

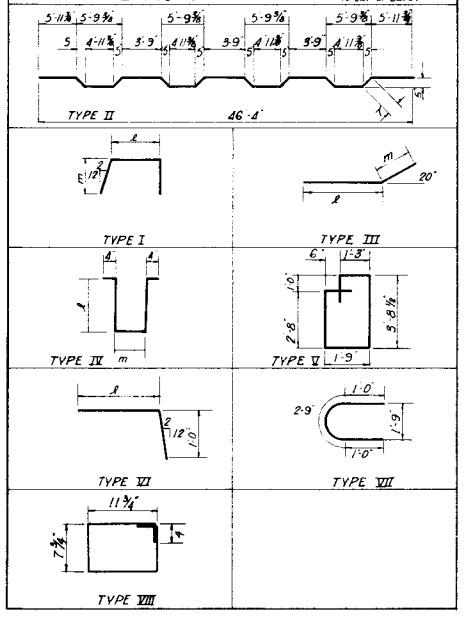
## TYPICAL ELEVATION OF ABUTMENT

Abutment No. 1 Rt. Shown,
Abutment No. 1 Lt., No. 4 Rt. & No. 4 Lt., Similar

Note:
Abutment Cap & Girders to be Poured Monolithic.

Note:
All Piles to be bearing Piles
Estimated length for Piles 59 ft.
Max. Pile load 99 K

## BENDING DIAGRAMS (Dimensions are out to out of bars)




## BAR LIST-SUPERSTRUCT. (2 Req'd)

| Mark | Size | Length | No. Req'd | Type | Dimensions ℓ | Dimensions m |
|---|---|---|---|---|---|---|
| 401 | 4 | 35'-4" | 40 | Str. | | |
| 402 | | 33'-0" | 40 | Str. | | |
| 403 | | 36'-0" | 40 | Str. | | |
| 404 | | 2'-6" | 384 | I | 0'-11" | 0'-10" |
| 405 | | 6'-5" | 160 | IV | 2'-0½" | 1'-9" |
| 406 | | 6'-6" | 20 | IV | 2'-0¾" | 1'-9" |
| 407 | | 6'-7" | 20 | IV | 2'-1" | 1'-9" |
| 408 | | 6'-7" | 20 | IV | 2'-1¼" | 1'-9" |
| 409 | | 6'-9" | 20 | IV | 2'-2" | 1'-9" |
| 410 | | 6'-10" | 20 | IV | 2'-2½" | 1'-9" |
| 411 | | 7'-0" | 20 | IV | 2'-3½" | 1'-9" |
| 412 | | 7'-2" | 20 | IV | 2'-4½" | 1'-9" |
| 413 | | 7'-4" | 20 | IV | 2'-5½" | 1'-9" |
| 414 | | 7'-7" | 20 | IV | 2'-7" | 1'-9" |
| 415 | | 7'-9" | 20 | IV | 2'-8¼" | 1'-9" |
| 416 | | 8'-1" | 20 | IV | 2'-10" | 1'-9" |
| 417 | | 8'-4" | 20 | IV | 2'-11¾" | 1'-9" |
| 418 | | 8'-8" | 20 | IV | 3'-1½" | 1'-9" |
| 419 | | 9'-0" | 20 | IV | 3'-3½" | 1'-9" |
| 420 | | 9'-4" | 20 | IV | 3'-5¾" | 1'-9" |
| 421 | | 9'-9" | 20 | IV | 3'-8" | 1'-9" |
| 422 | | 10'-2" | 20 | IV | 3'-10½" | 1'-9" |
| 423 | | 10'-7" | 20 | IV | 4'-1¼" | 1'-9" |
| 424 | | 11'-1" | 20 | IV | 4'-4" | 1'-9" |
| 425 | | 11'-7" | 20 | IV | 4'-7" | 1'-9" |
| 426 | | 11'-11" | 20 | IV | 4'-9" | 1'-9" |
| 427 | | 12'-7" | 20 | IV | 5'-1" | 1'-9" |
| 437 | | 4'-9" | 20 | VII | | |
| 438 | | 5'-3" | 144 | Str. | | |
| 439 | 4 | 8'-6" | 84 | IV | 1'-2¼" | 0'-6" |
| 440 | 4 | 3'-11" | 96 | VIII | | |
| | | | | | | |
| 501 | 5 | 46'-4" | 276 | Str. | | |
| 502 | | 47'-8" | 142 | II | | |
| 503 | | 35'-4" | 95 | Str. | | |
| 504 | | 23'-0" | 20 | Str. | | |
| 505 | 5 | 32'-0" | 20 | Str. | | |

## BAR LIST-SUPERSTRUCT. (Cont.)

| Mark | Size | Length | No. Req'd | Type | Dimensions ℓ | Dimensions m |
|---|---|---|---|---|---|---|
| 506 | 5 | 24'-0" | 40 | Str. | | |
| 507 | | 22'-0" | 10 | Str. | | |
| 508 | | 39'-6" | 10 | Str. | | |
| 509 | | 30'-8" | 20 | Str. | | |
| 510 | 5 | 41'-7" | 16 | Str. | | |
| 511 | 5 | 18'-4" | 190 | Str. | | |
| | | | | | | |
| 602 | 6 | 41'-7" | 15 | Str. | | |
| 603 | 6 | 46'-4" | 6 | Str. | | |
| 604 | 6 | 39'-7" | 9 | Str. | | |
| | | | | | | |
| 801 | 8 | 36'-6" | 50 | Str. | | |
| 802 | 8 | 46'-4" | 8 | Str. | | |
| | | | | | | |
| 1001 | 10 | 37'-8" | 75 | Str. | | |
| 1002 | | 54'-2" | 20 | Str. | | |
| 1003 | | 47'-0" | 20 | Str. | | |
| 1004 | | 36'-6" | 20 | Str. | | |
| 1005 | | 25'-0" | 20 | Str. | | |
| 1006 | | 11'-9" | 20 | Str. | | |
| 1007 | | 41'-0" | 20 | Str. | | |
| 1008 | | 38'-1" | 20 | Str. | | |
| 1009 | | 35'-5" | 20 | Str. | | |
| 1010 | | 30'-0" | 20 | Str. | | |
| 1011 | | 21'-10" | 20 | III | 13'-11" | 7'-11" |
| 1012 | | 60'-0" | 10 | Str. | | |
| 1013 | | 43'-0" | 10 | Str. | | |
| 1014 | | 36'-0" | 10 | Str. | | |
| 1015 | | 30'-0" | 10 | Str. | | |
| 1016 | | 24'-6" | 20 | Str. | | |
| 1017 | | 19'-6" | 20 | Str. | | |
| 1018 | | 23'-2" | 10 | Str. | | |
| 1019 | 10 | 16'-0" | 10 | Str. | | |
| | | | | | | |
| | | | | | | |

## BAR LIST-SUPERSTRUCT. (Cont.)

| Mark | Size | Length | No. Req'd | Type | Dimensions ℓ | Dimensions m |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

### BAR SUMMARY

11404.338 Lin. Ft. #4 @ .668 P.L.F. = 7618
8047.000 Lin. Ft. #5 @ 1.043 P.L.F. = 8,388
1268.000 Lin. Ft. #6 @ 1.502 P.L.F. = 1890
2195.666 Lin. Ft. #8 @ 2.670 P.L.F. = 5862
12601.666 Lin. Ft. #10 @ 4.303 P.L.F. = 54225
Total = 101383

## BAR LIST ABUT. (4 Req'd)

| Mark | Size | Length | No. Req'd | Type | Dimensions ℓ | Dimensions m |
|---|---|---|---|---|---|---|
| 428 | 4 | 23'-8" | 6 | Str. | | |
| 429 | | 27'-10" | 6 | Str. | | |
| 430 | | 11'-6" | 31 | V | | |
| 431 | | 5'-7" | 6 | Str. | | |
| 432 | | 4'-2" | 12 | Str. | | |
| 433 | | 4'-5" | 1 | VI | 5'-5½" | |
| 434 | | 4'-7" | 1 | VI | 3'-7½" | |
| 435 | | 5'-2" | 1 | VI | 4'-2½" | |
| 436 | 4 | 6'-9" | 1 | VI | 5'-9" | |
| | | | | | | |
| | | | | | | |
| 803 | 8 | 46'-4" | 4 | Str. | | |
| | | | | | | |

### BAR SUMMARY

769.916 Lin. Ft. #4 @ .668 P.L.F. = 514
185.333 Lin. Ft. #8 @ 2.670 P.L.F. = 495
Total = 1009

## BAR LIST-ONE PIER (4 Req'd)

| Mark | Size | Length | No. Req'd | Type | Dimensions ℓ | Dimensions m |
|---|---|---|---|---|---|---|
| 457 | 4 | 4'-9" | 26 | VII | | |
| | | | | | | |
| 510 | 5 | 41'-7" | 26 | Str. | | |
| 511 | | 14'-6" | 17 | Str. | | |
| 512 | | 14'-8" | 16 | Str. | | |
| 513 | | 14'-9" | 18 | Str. | | |
| 514 | | 14'-11" | 18 | Str. | | |
| 515 | 5 | 15'-0" | 17 | Str. | | |
| | | | | | | |
| | | | | | | |
| 601 | 6 | 41'-7" | 2 | Str. | | |
| | | | | | | |
| | | | | | | |
| 804 | 8 | 4'-8" | 58 | Str. | | |

### BAR SUMMARY

173.500 Lin. Ft. #4 @ .668 P.L.F. = 82
2351.333 Lin. Ft. #5 @ 1.043 P.L.F. = 2452
83.166 Lin. Ft. #6 @ 1.502 P.L.F. = 125
270.666 Lin. Ft. #8 @ 2.670 P.L.F. = 723
Total = 3382

STRUCTURE NO. SBL F-16-HV
NBL F-16-HW

COLORADO
DEPARTMENT OF HIGHWAYS
ABUTMENTS
REINFORCING

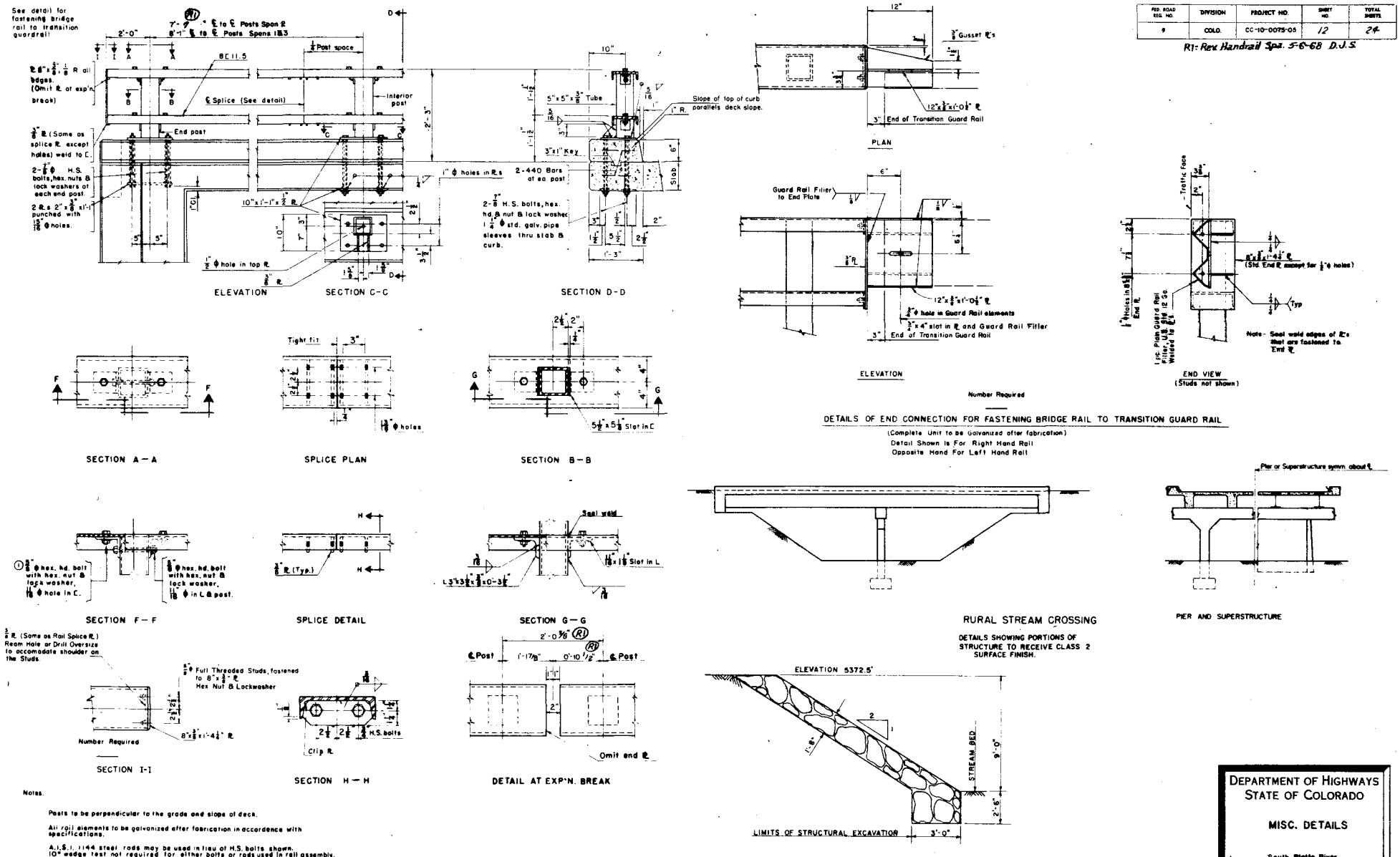
Across South Platte River
Sta. 445+00
Near Littleton Sec. 31 T. 5 S. R. 68 W

Designed by B.S.M.H.
Made by L.J.S.
Checked by
Approved by
Bridge Engineer
Date: 19

REVISIONS

| FED. ROAD REG. NO. | DIVISION | PROJECT NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLO. | CC-10-0075-05 | 12 | 24 |

R1: Rev. Handrail Spa. 5-6-68 D.J.S.




Notes.

Posts to be perpendicular to the grade and slope of deck.

All rail elements to be galvanized after fabrication in accordance with specifications.

A.I.S.I. 1144 steel rods may be used in lieu of H.S. bolts shown. 10° wedge test not required for either bolts or rods used in rail assembly.

(1) 5/8" ϕ standard full threaded studs welded to the channel may be used increase size of slot in the angle to 13/16"x1 1/4".

Channels to be continuous over 3 or 4 posts before splicing.

NOTES:
TRANSITION ENDS OF RIPRAP MAY BE MODIFIED BY THE ENGINEER TO FIT CONDITIONS ENCOUNTERED IN THE FIELD.

STRUCTURE NO. SBLF-16-HV / NBLF-16-HW

GALVANIZED STEEL HANDRAIL DETAILS

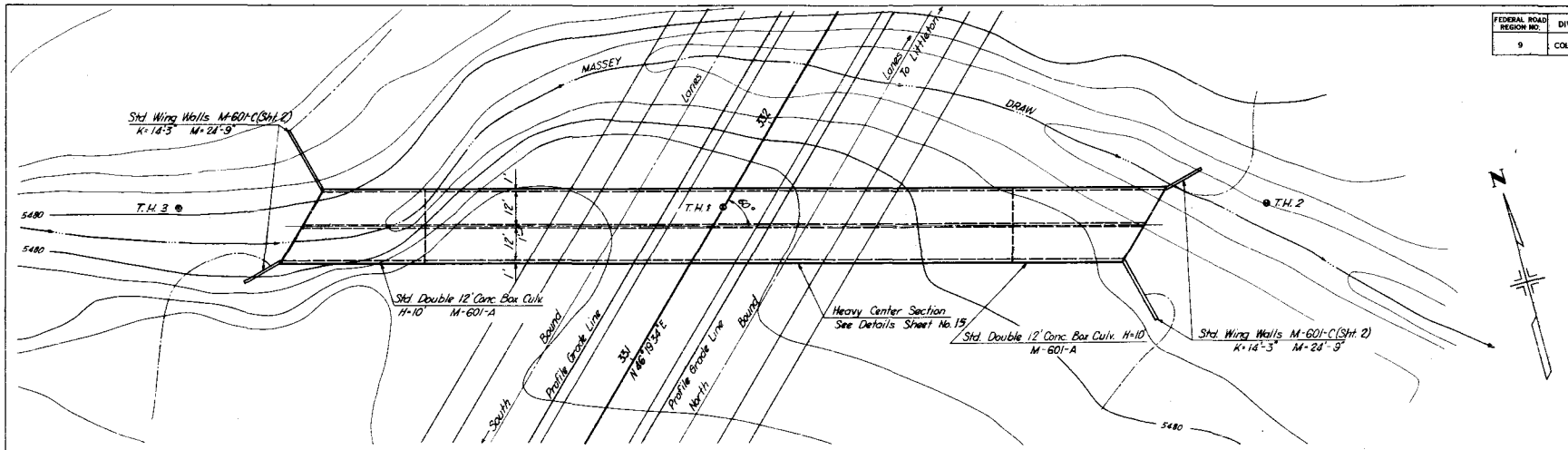
DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

MISC. DETAILS

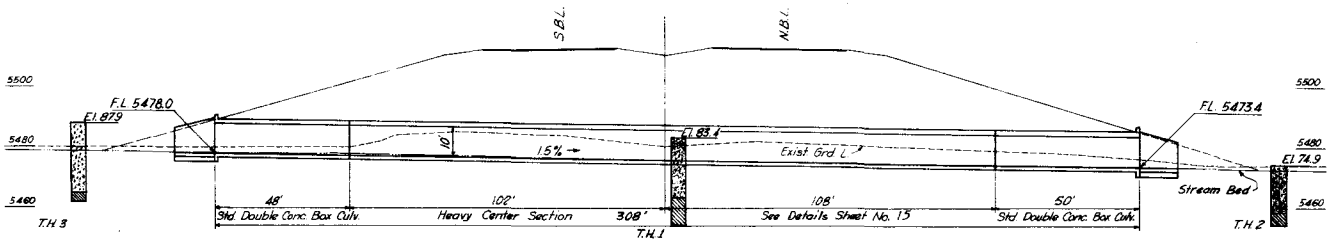
Across South Platte River
Sta. 445+00
Near Littleton Sec. 31 T. 5 S. R. 68 W.

Designed by
Made by
Checked by
Approved by Bridge Engineer
Date: 19

| FEDERAL ROAD REGION NO. | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | CC 10-0075-05 | 13 | 24 |




PLAN OF 308' DOUBLE CONC. BOX CULV. (12 x 12 x 10)
STA. 331 + 57 (MASSEY DRAW)




PROFILE OF 308' DOUBLE CONC. BOX CULV. (12 x 12 x 10)
STA. 331 + 57 (MASSEY DRAW)

## TEST HOLE DATA

- Sand, Gravel, Few small Boulders
- Dry Sandy Black Soil
  Dry Sandy Clay, Some Fine Gravel
- Dry Sandy Gravel, Rock Gravel, Boulders Sand.
- Gravel, Sand
  Gravel, Few Boulders
- Blue Shale

## QUANTITIES

| Item | 203 Uncl. Exc. Cu. Yd. | 206 Str. Exc. Cu. Yd. | 206 Str. Bkfill Cl. "3" Cu. Yd. | 601 Conc. Cl. "A" Cu. Yd. | 602 Reinf. Steel Lbs. | Preformed Jt. Filr. Sq. Ft. |
|---|---|---|---|---|---|---|
| 98 L.F. 12.12.C Conc. Box Culv. | | | | 378.3 | 40,789 | 48 |
| 2 Conc. Headwalls | | | | 11.4 | 908 | |
| 4 Std. Wings | | | | 47.7 | 2,946 | |
| 210 L.F. Heavy Center Sec. | | | | 810.8 | 140,417 | |
| | | | | | | |
| TOTALS | 1600 | 345 | 862 | 1,248.2 | 185,010 | 48* |

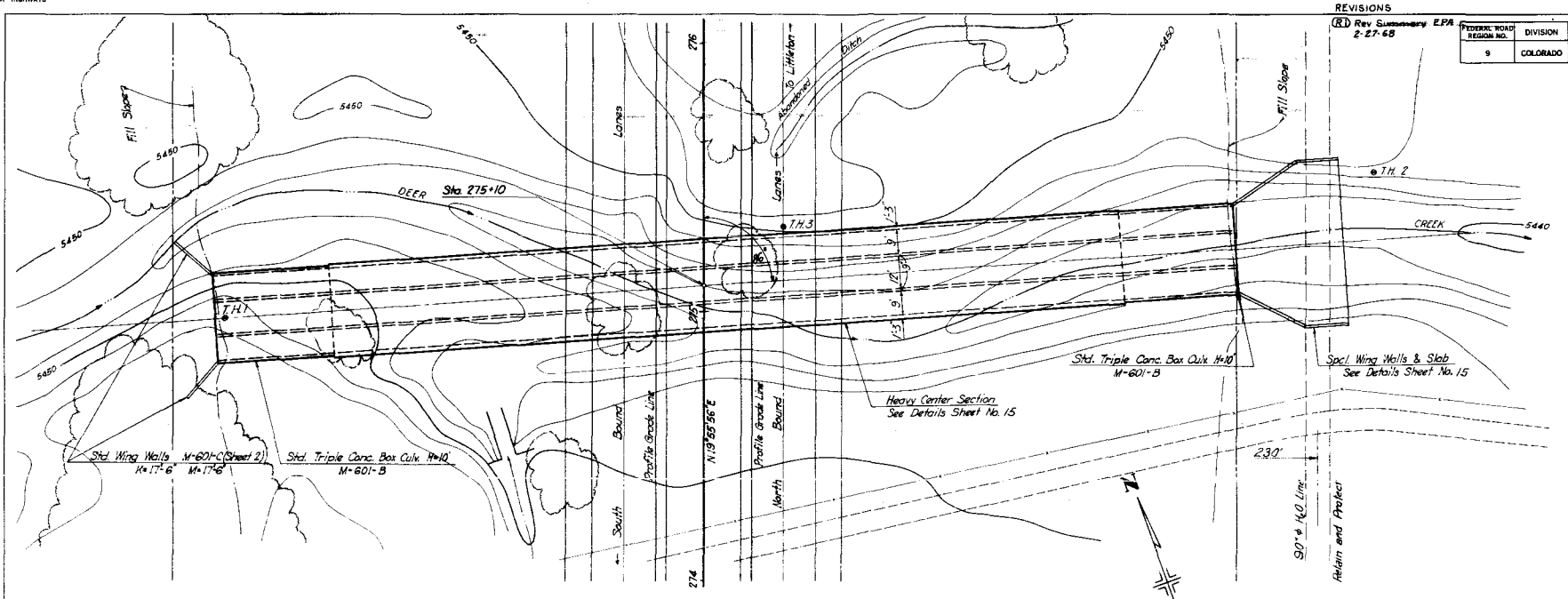
* Preformed joint filler to be included in price of Item 601

STRUCTURE NO. F-16-HY

DEPARTMENT OF HIGHWAYS
H 126

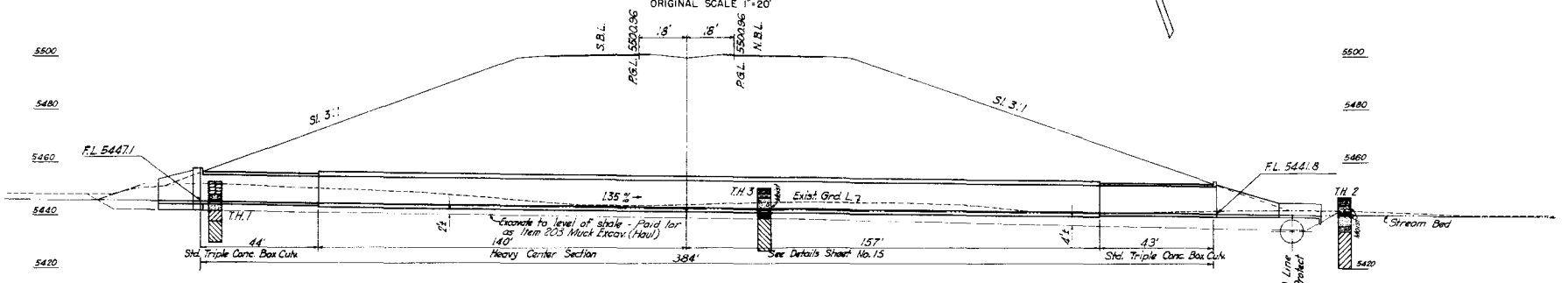
REVISIONS
(R1) Rev Summary E.P.A. 2-27-68

| FEDERAL ROAD REGION NO. | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | CC 10-0075-05 | 14 | 24 |




## PLAN OF 384' TRIPLE CONC. BOX CULV. (9-12-9x10)
## STA. 275+10 (DEER CREEK)

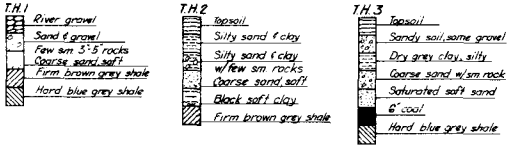
ORIGINAL SCALE 1"=20'




## PROFILE OF 384' TRIPLE CONC. BOX CULV. (9-12-9x10)
## STA. 275+10 (DEER CREEK)

ORIGINAL SCALE 1"=20'

### TEST HOLE DATA




### QUANTITIES

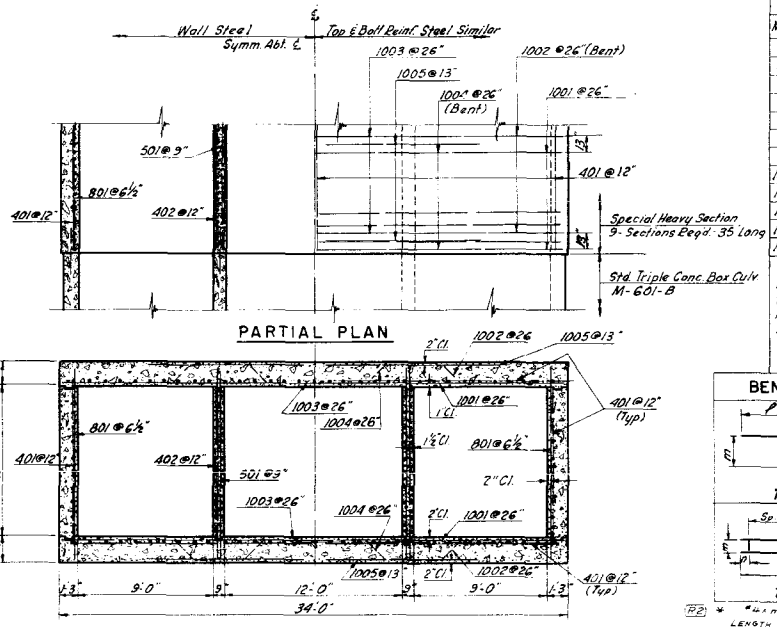
| Item | 203 Muck Exc. Cu. Yd. | 206 Str. Bkfill Cl. 'B' Cu. Yd. | 601 Conc. Cl. 'A' Cu. Yd. | 602 Reinf. Steel Lbs. | Preformed Jt. Filler Sq. Ft. |
|---|---|---|---|---|---|
| 8 L.F. 9-12-C Triple Conc. Box Culv. | | | 337.5 | 41,334 | 50 |
| 2 Conc. Headwalls | | | 13.1 | 1,047 | |
| 2 Std. Wings | | | 21.4 | 1,330 | |
| 297 L.F. Heavy Center Sec. | | | 1,656.0 | 252,914 (R1) | |
| Spcl. Wings & Slab | | | 13.0 | 4172 | |
| TOTALS | 3850 | 2700 | 2,041.0 | 300,797 (R1) | 50* |

* Preformed joint filler to be included in price of Item 601

STRUCTURE NO. F-16-HZ

REVISIONS
(R1) Remove 802 Bars EPA 2-27-68
(R2) Rev. Type III Bar 9-5-68 EHH

| FEDERAL ROAD REGION NO. | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | C010 0075-05 | 15 | 24 |




TYPICAL BARREL SECTION
DEER CREEK CULVERT DETAILS

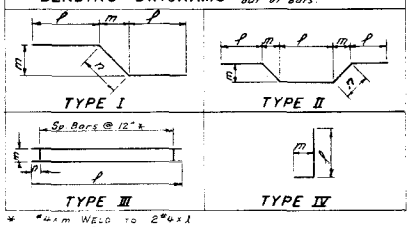
## BAR LIST
### DEER CREEK BOX CULV. HEAVY SECT.

| Mark | Size | No. Req'd. | Length | Type | Dimension ℓ | m | n |
|---|---|---|---|---|---|---|---|
| 401 | #4 | 860 | 30'-6" | Str. | | | |
| 402 | #4 | 200 | 30'-6" | III | 30'-6 | 7" | 9" |
| 501 | #5 | 1,588 | 12'-11" | Str. | | | |
| 801 | #8 | 1,098 | 12'-11" | Str. | | | |
| 1001 | #10 | 550 | 13'-0" | Str. | | | |
| 1002 | | 546 | 16'-6" | I | 7'-4" | 1'-4" | 1'-10½" |
| 1003 | | 273 | 17'-10" | Str. | | | |
| 1004 | | 275 | 23'-4" | II | 6'-6⅞" | 1'-4" | 1'-10½" |
| 1005 | #10 | 1,096 | 10'-1" | Str. | | | |

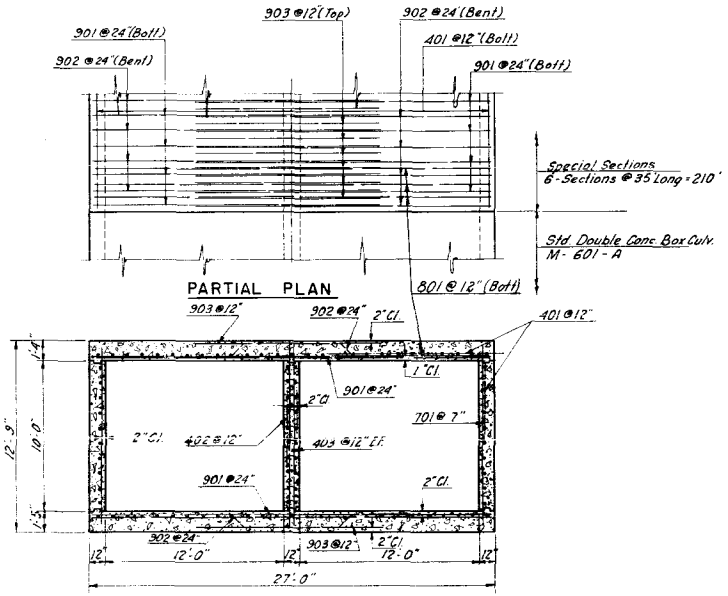
### BAR SUMMARY

41,928.00 Lin. Ft. #4 @ .668 P.L.F. = 28,008
20,512.20 Lin. Ft. #5 @ 1.043 P.L.F. = 21,394
14,182.90 Lin. Ft. #8 @ 2.670 P.L.F. = 37,868
38,494.95 Lin. Ft. #10 @ 4.303 P.L.F. = 165,644
Total 252,914 (R1)

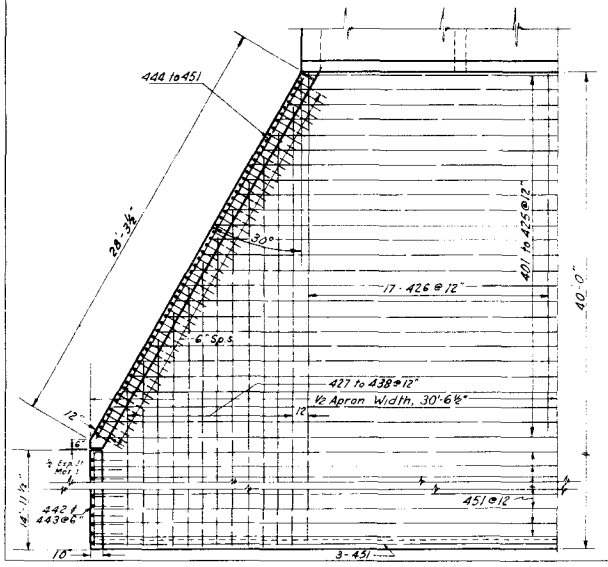
### BENDING DIAGRAMS
Dimensions are out to out of bars.

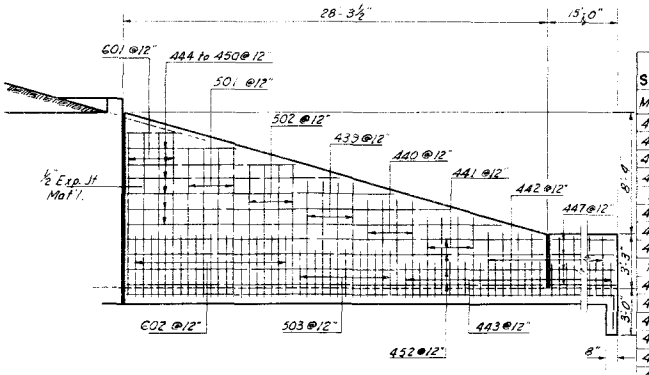



(R2) * #4 x m Weld to 2" x 1
Length of Bar is incl. in Summary

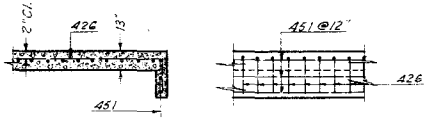



TYPICAL BARREL SECTION
MASSEY DRAW CULVERT DETAILS




ELEVATION OF WING




SECTION A-A

## BAR LIST
### SPECIAL APRON - DEER CREEK CULV.

| Mark | Size | No. Reqd. | Length | Type | Dimensions ℓ | m | n |
|---|---|---|---|---|---|---|---|
| 401 | #4 | 1 | 33'-3" | Str. | | | |
| 402 | | 1 | 34'-5" | Str. | | | |
| 403 | | 1 | 35'-7" | Str. | | | |
| 404 | | | 19'-0" | Str. | | | |
| To | | 2 EA | 84'-6⅞" | | | | |
| 425 | | | 31'-0" | Str. | | | |
| 426 | | 34 | 41'-11" | IV | 39'-8" | 2'-3" | |
| 427 | | | 40'-4" | IV | 38'-2 | 2'-3" | |
| To | | 2 EA | 84'-1-8⅞" | | 84'-1-8⅞" | | |
| 438 | | | 21'-3" | IV | 19'-04" | 2'-3" | |
| 439 | | 8 | 10'-10" | IV | 7'-4" | 3'-6" | |
| 440 | | 8 | 9'-10" | IV | 6'-4" | 3'-6" | |
| 441 | | 8 | 8'-6" | IV | 5'-0" | 3'-6" | |
| 442 | | 40 | 7'-6" | IV | 4'-0" | 3'-6" | |
| 443 | | 52 | 5'-6" | IV | 2'-0" | 3'-6" | |
| 444 | | 2 | 3'-11" | Str. | | | |
| 445 | | 2 | 7'-4" | Str. | | | |
| 446 | | 2 | 10'-9" | Str. | | | |
| 447 | | 10 | 14'-2" | Str. | | | |
| 448 | | 2 | 17'-6" | Str. | | | |
| 449 | | 2 | 20'-11" | Str. | | | |
| 450 | | 2 | 24'-4" | Str. | | | |
| 451 | | 26 | 30'-6" | Str. | | | |
| 452 | #4 | 8 | 27'-11" | Str. | | | |
| 501 | #5 | 8 | 13'-4" | IV | 9'-10" | 3'-6" | |
| 502 | #5 | 8 | 12'-1" | IV | 8'-7" | 3'-6" | |
| 503 | #5 | 14 | 6'-6" | IV | 3'-0" | 3'-6" | |

## BAR LIST
### MASSEY DRAW BOX CULV. HEAVY SECT.

| Mark | Size | No. Reqd. | Length | Type | Dimensions ℓ | m | n |
|---|---|---|---|---|---|---|---|
| 401 | #4 | 518 | 31'-0" | Str. | | | |
| 402 | #4 | 70 | 31'-0" | III | 31'-0" | 8" | 6" |
| 403 | #4 | 420 | 12'-5" | Str. | | | |
| 701 | #7 | 722 | 12'-5" | Str. | | | |
| 801 | #8 | 418 | 26'-6" | Str. | | | |
| 901 | #9 | 420 | 15'-6" | Str. | | | |
| 902 | #9 | 420 | 20'-2" | I | 9'-4 | 1'-1" | 1'-6⅞" |
| 903 | #9 | 418 | 12'-10" | Str. | | | |

### BAR SUMMARY

27,059.67 Lin. Ft. #4 @ .668 P.L.F. = 18,076
8,924.83 Lin. Ft. #7 @ 2.044 P.L.F. = 18,324
21,894.33 Lin. Ft. #9 @ 3.400 P.L.F. = 74,441
11,077 Lin. Ft. #8 @ 2.670 P.L.F. 29,576
Total 140,417

## BAR LIST
### APRON - DEER CREEK CULV. (CONT'D)

| Mark | Size | No. Reqd. | Length | Type | Dimensions ℓ | m | n |
|---|---|---|---|---|---|---|---|
| 601 | #6 | 8 | 14'-4" | IV | 10'-10" | 3'-6" | |
| 602 | #6 | 22 | 7'-6" | IV | 4'-0" | 3'-6" | |

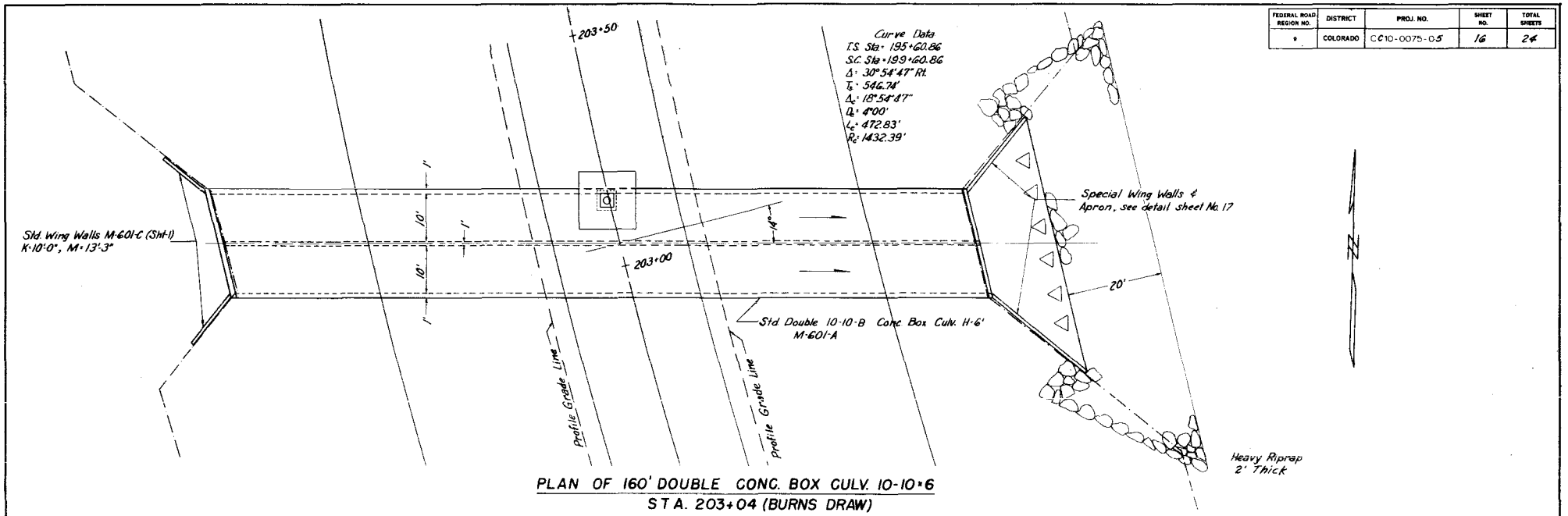
### BAR SUMMARY

5,157.24 Lin. Ft. #4 @ .668 P.L.F. = 3,445
294.33 Lin. Ft. #5 @ 1.043 P.L.F. = 307
279.66 Lin. Ft. #6 @ 1.502 P.L.F. = 420
TOTAL 4,172

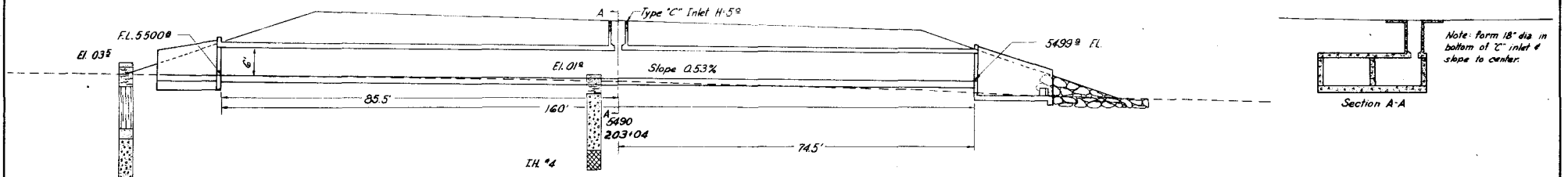
STRUCTURE NO. F-16-HZ & F-16-HY

TMENT OF HIGHWAYS—STATE OF COLORADO
B. O. H. 136
1 1964

| FEDERAL ROAD REGION NO. | DISTRICT | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | CC10-0075-05 | 16 | 24 |




PLAN OF 160' DOUBLE CONC. BOX CULV. 10-10×6
STA. 203+04 (BURNS DRAW)




PROFILE OF 160' DOUBLE CONC. BOX CULV. 10-10×6
STA. 203+04 (BURNS DRAW)

## QUANTITIES

| Item | 203 Uncl Excav Cu Yd | 206 Str Excav Cu Yd | 206 Str Bkfl. Cl-3 Cu Yd | 601 Conc Cl A Cu Yd | 602 Reinf Steel lbs. | 603 18" C.S.P Lin Ft | 506 Hvy Riprap Cu Yd | Preformed Jt. Fllr. Sq Ft |
|---|---|---|---|---|---|---|---|---|
| 160 L.F. 10-10-B Conc. Box Culv. | | 240 | 440 | 390.72 | 38,800 | | | |
| 2 Conc Head walls | | | | 8.20 | 740 | | | |
| 2 Std Wing Walls | | | | 8.07 | 480 | | | 13 |
| Special Outlet Control | | | | 43.14 | 2542 | | 140 | 18 |
| TOTALS | | 240 | 440 | 450.13 | 42,562 | | 140 | 31* |

*Preformed joint filler to be included in price of Item 601

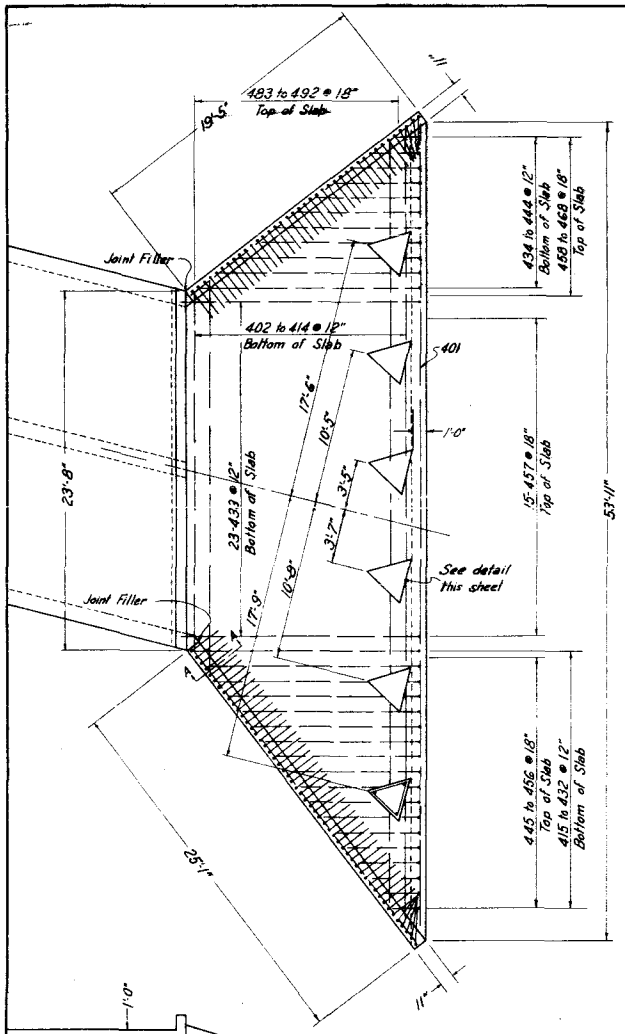
Note: Test holes were drilled at sta 204+60 of the staked ℄

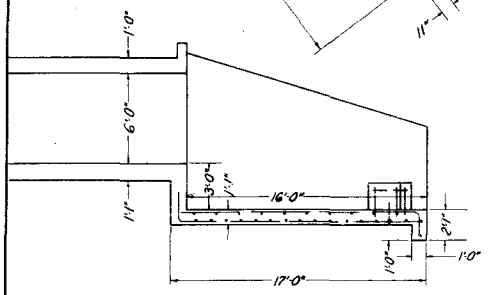
- Dry Sand
- Silty Sand & Clay
- Dry Red Sand & Fine Gravel
- Small Rock & Gravel
- Broken Gray Shale
- Sandy Silty Clay

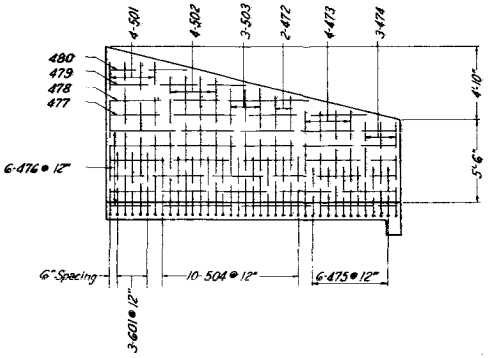
STRUCTURE NO. F-16-IA

STATE OF COLORADO
I. D. O. N. 726
JN 1964

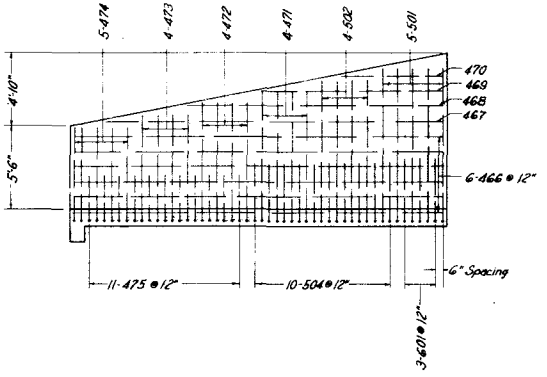
| FEDERAL ROAD REGION NO. | DISTRICT | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | C010-0075-05 | 17 | 24 |

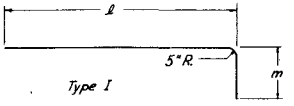


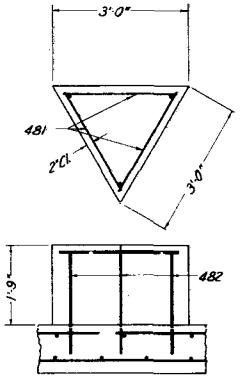

Scale: 1/4" = 1'-0"



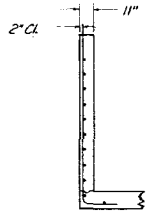




Type I

Bending Diagram




Details of Energy Dissipaters
Scale 3/4" = 1'-0"
(To be poured monolithically with apron.)




Section A-A

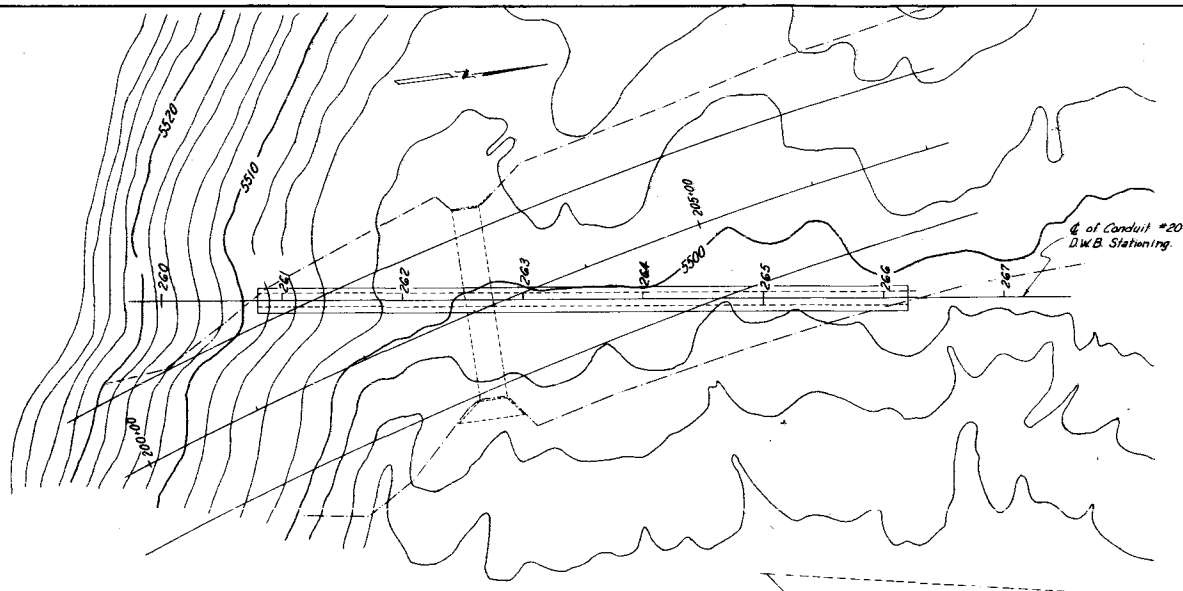
BAR LIST

| Mark | Size | No. Reqd. | Type | ℓ Dim. | m Dim. | Length |
|---|---|---|---|---|---|---|
| 401 | 4 | 2 | Str. | | | 52'-11" |
| 402 | ↑ | | | | | 23'-9" |
| to | | 13 | Str. | | | By 2'-4 3/4" |
| 414 | | | | | | 52'-6" |
| 415 | | | | | | 2'-0" |
| to | | 19 | Str. | | | By 0'-8 3/4" |
| 432 | | | | | | 15'-0" |
| 433 | | 23 | I | 16'-0" | 2'-0" | 18'-0" |
| 434 | | | | | | 14'-6" |
| to | | 11 | Str. | | | By 1'-3 3/4" |
| 444 | | | | | | 1'-9" |
| 445 | | | | 2'-0" | 1'-6" | 3'-6" |
| to | | 12 | I | By 1'-1" | | |
| 456 | | | | 14'-0" | 1'-6" | 15'-6" |
| 457 | | 15 | I | 16'-0" | 1'-6" | 17'-6" |
| 458 | | | | 15'-0" | 1'-6" | 16'-6" |
| to | | 8 | I | By 1'-10 3/4" | | |
| 465 | | | | 1'-9" | 1'-6" | 3'-3" |
| 466 | | 6 | Str. | | | 24'-6" |
| 467 | | 1 | Str. | | | 22'-6" |
| 468 | | 1 | Str. | | | 17'-0" |
| 469 | | 1 | Str. | | | 12'-0" |
| 470 | | 1 | Str. | | | 6'-8" |
| 471 | | 4 | I | 8'-5" | 2'-3" | 10'-8" |
| 472 | | 6 | I | 7'-9" | 2'-3" | 10'-0" |
| 473 | | 8 | I | 7'-0" | 2'-3" | 9'-3" |
| 474 | | 8 | I | 6'-1" | 2'-3" | 8'-4" |
| 475 | | 17 | I | 3'-1" | 2'-3" | 5'-4" |
| 476 | | 6 | Str. | | | 19'-0" |
| 477 | | 1 | Str. | | | 17'-0" |
| 478 | | 1 | Str. | | | 13'-3" |
| 479 | | 1 | Str. | | | 9'-2" |
| 480 | | 1 | Str. | | | 5'-2" |
| 481 | | 18 | Str. | | | 2'-6" |
| 482 | | 18 | Str. | | | 2'-3" |
| 483 | | | | | | 22'-0" |
| to | ↓ | 10 | Str. | | | By 3'-1 3/4" |
| 492 | 4 | | | | | 50'-3" |
| 501 | 5 | 9 | I | 9'-11" | 2'-3" | 12'-2" |
| 502 | ↑ | 8 | I | 9'-2" | 2'-3" | 11'-5" |
| 503 | ↓ | 3 | I | 8'-5" | 2'-3" | 10'-8" |
| 504 | 5 | 20 | I | 3'-11" | 2'-3" | 6'-2" |
| 601 | 6 | 6 | I | 4'-2" | 2'-3" | 6'-5" |

STRUCTURE NO. F-16-1 A

STATE OF HIGHWAYS—STATE OF COLORADO
L. B. O. N. 126
N 1964

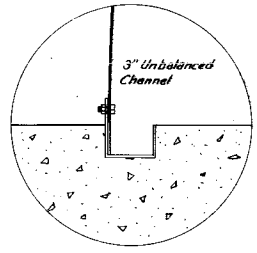
| FEDERAL ROAD REGION NO. | DISTRICT | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | C 010-0075-05 | 18 | 24 |



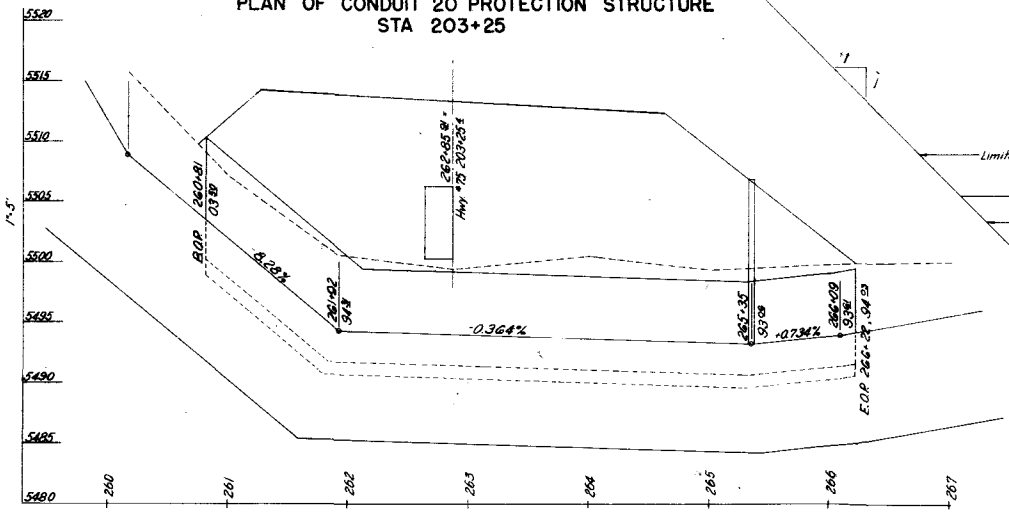

PLAN OF CONDUIT 20 PROTECTION STRUCTURE
STA 203+25

| Item No. | Description | Quantity |
|---|---|---|
| 203 | Uncl Excav. | 4453 Cu Yd |
| 203 | Emb Std. | 2363 Cu Yd |
| 206 | Str Excav. | 2116 Cu Yd |
| 206 | Str Bkfl. (Cl 3) | 1209 Cu Yd |
| 510 | Str P.A. (15') | 580 Lin Ft |
| | *Str Steel (Galv) | 6844 lbs. |
| 601 | Concrete, Cl A | 213.92 Cu Yd |
| 602 | Reinf Steel | 18,043 lbs. |
| 619 | 8" Cast Iron Pipe | 12 Lin. Ft. |

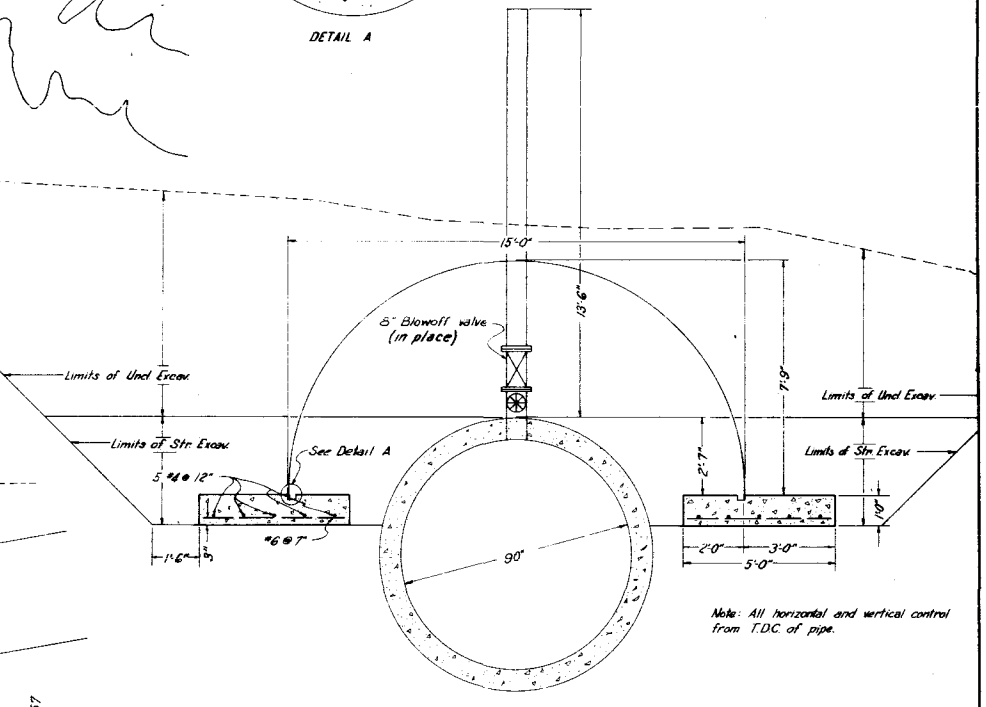
* This item to be included in the price of Item 510 Str P.A.




DETAIL A



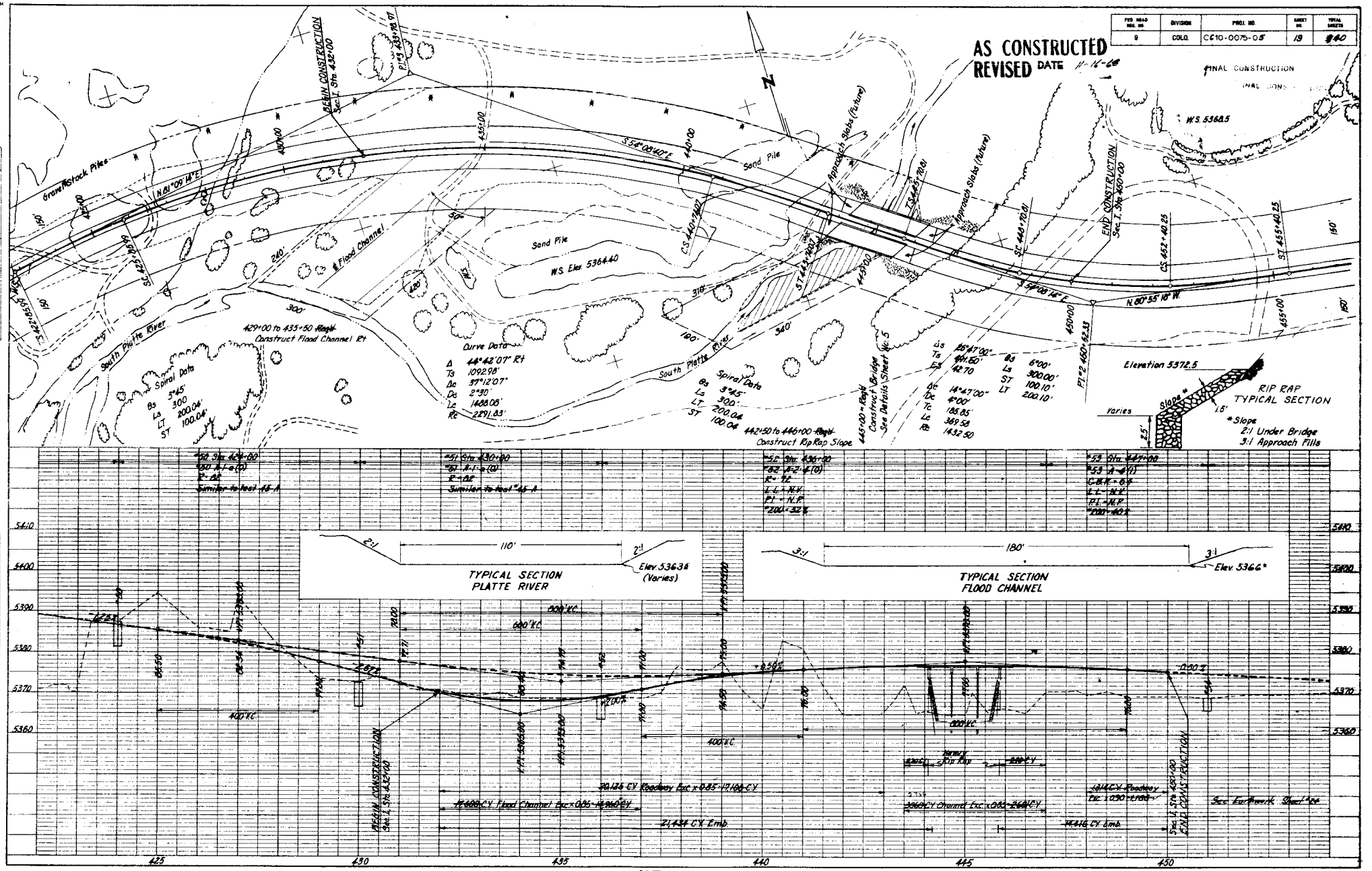

PROFILE OF CONDUIT 20 PROTECTION STRUCTURE
STA 203+25




Section at Sta. 265+35

| FED. ROAD REG. NO. | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLO. | CC10-0075-05 | 19 | #40 |

AS CONSTRUCTED
REVISED DATE 11-16-66

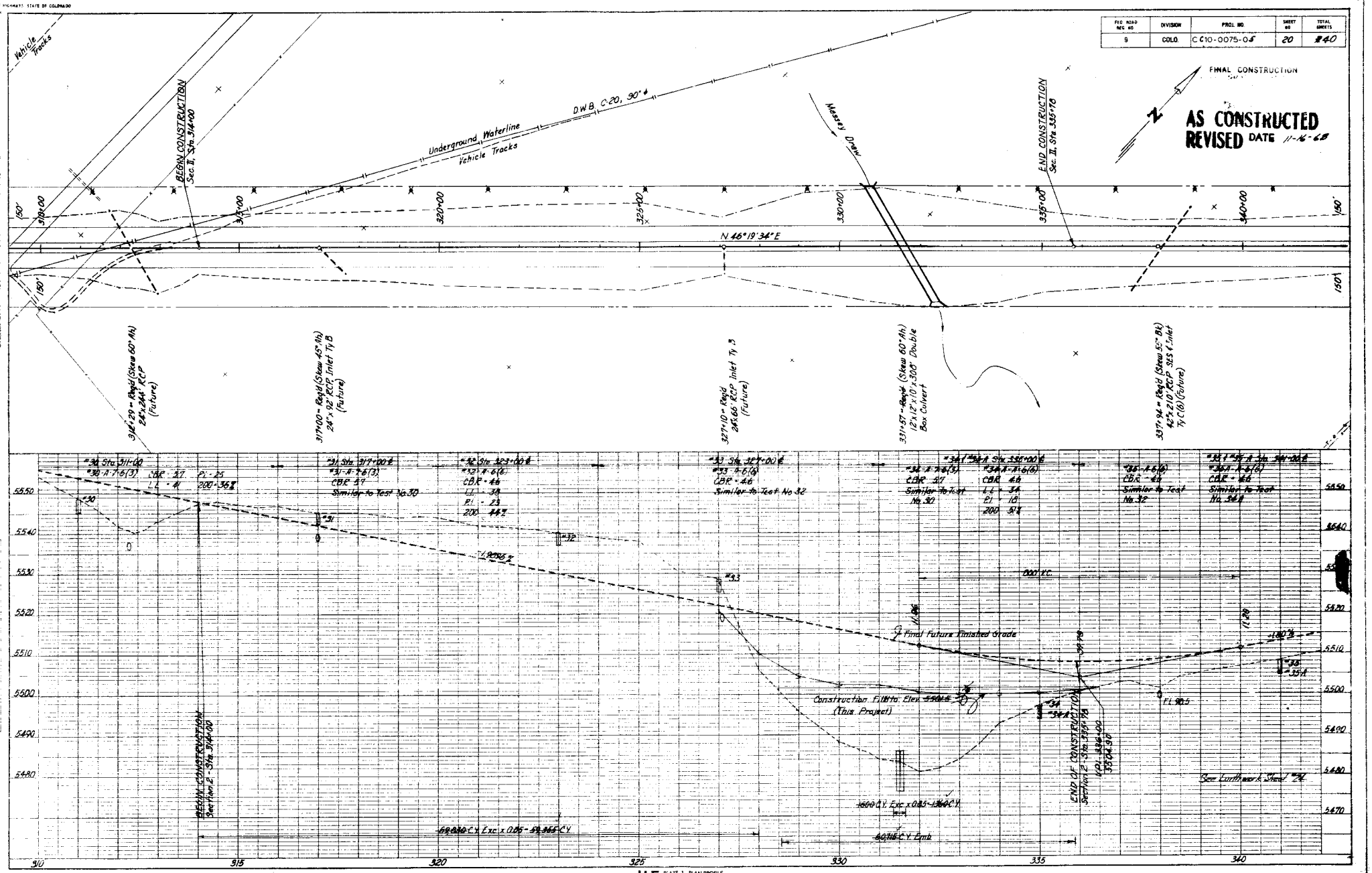



K+E PLATE 1. PLAN-PROFILE
KEUFFEL & ESSER CO.

| FED. ROAD REG. NO. | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLO. | C C10-0075-05 | 20 | #40 |

FINAL CONSTRUCTION

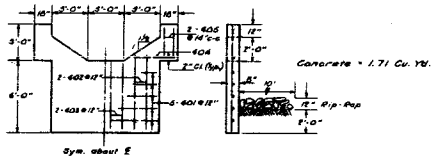
**AS CONSTRUCTED**
**REVISED** DATE 11-16-68




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

DEPARTMENT OF HIGHWAYS STATE OF COLORADO
Form D 0 7 134
Aug 1965

| BAR LIST | | | | |
|---|---|---|---|---|
| Mark | Size | No. Reqd | Type | Length |
| 401 | #4 | 10 | Str. | 8'-8" |
| 402 | " | 8 | " | 6'-4" |
| 403 | " | 8 | " | 3'-8" |
| 404 | " | 8 | " | 3'-11" |
| 405 | #4 | 4 | Str. | 2'-8" |
| BAR SUMMARY | | | | |
| 229.66 L.Ft. #4 = 0.668#/L.Ft. = 150 Lbs. | | | | |




235+12 to 276+75 — Installed Comb. wire fence — 4274 Lin. Ft.

| FED. ROAD REG. NO. | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLO. | CC10-0075-05 | 21 | 140 |

FINAL CONSTRUCTION

AS CONSTRUCTED
REVISED DATE 11-4-68

DETAIL — DITCH CHECKS

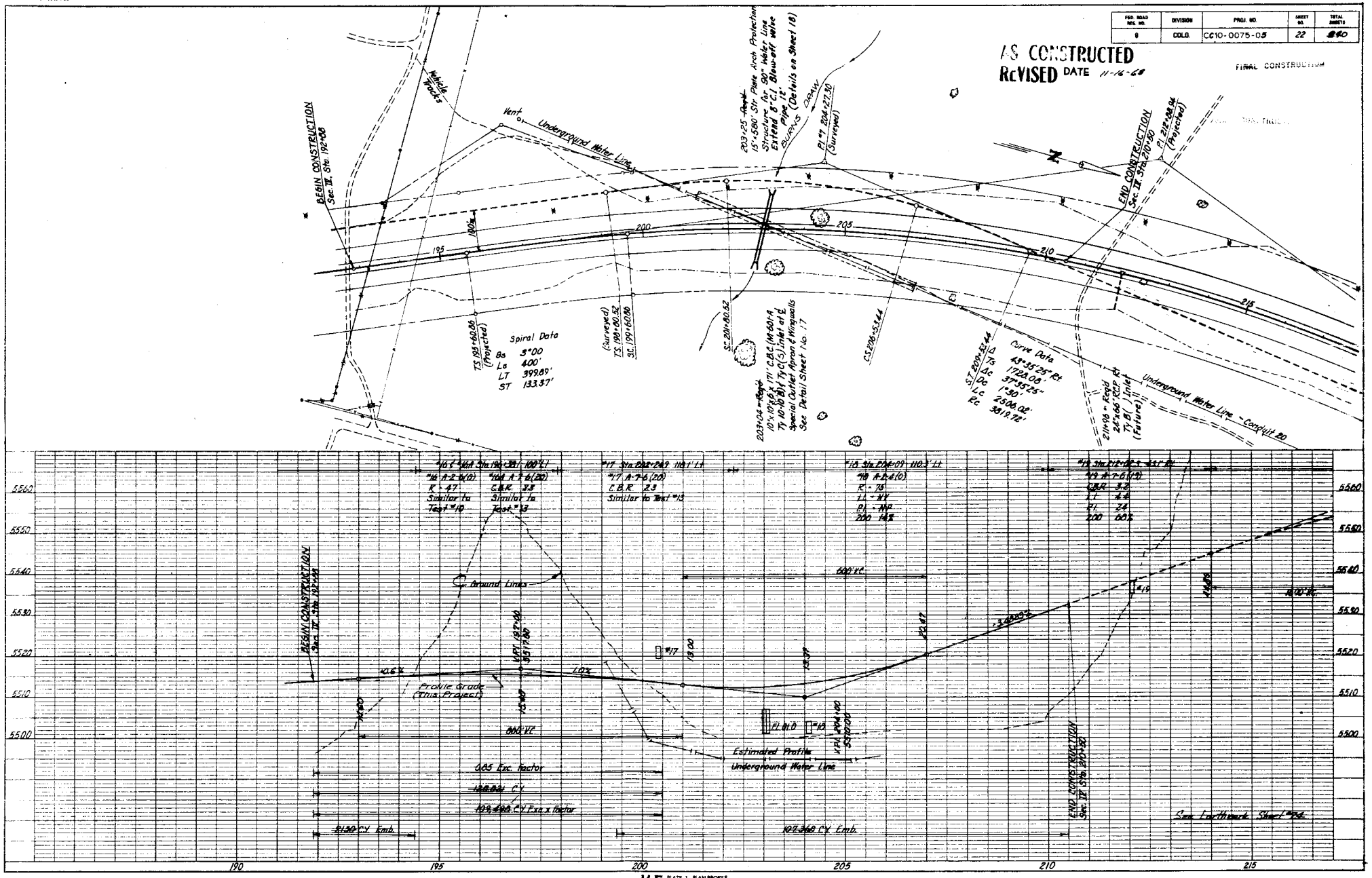
Projected Line
Surveyed Line
Well
Dike
C-20
20'±1830' Const. Easement
HR #16 5553.80
HR #13 5535.49
253+55 42" Rcp w/ End Sect.
257+40 to 275+10 Irr. Channel Chng. 800' Pl.
Consir. Dike 278' Pl.
50' to Water Line
280' to ℄
Typ. Irr. Ditch Section
Headgate
Check
PROFILE - CHANNEL CHANGE
800' V.C.
S = 0.0028'/Ft.
+0.80%
-0.3636%
-0.50%
Construct Fill to this elevation this Project
Ditch Check
See Footwork Sheet #14
665.070 C.Y. Emb.
666.780 C.Y. Borrow Pit No. 1 × 0.85 = 565.870

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

| FED. ROAD REG. NO. | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLO. | C010-0075-05 | 22 | 40 |

AS CONSTRUCTED
REVISED DATE 11-16-68

FINAL CONSTRUCTION



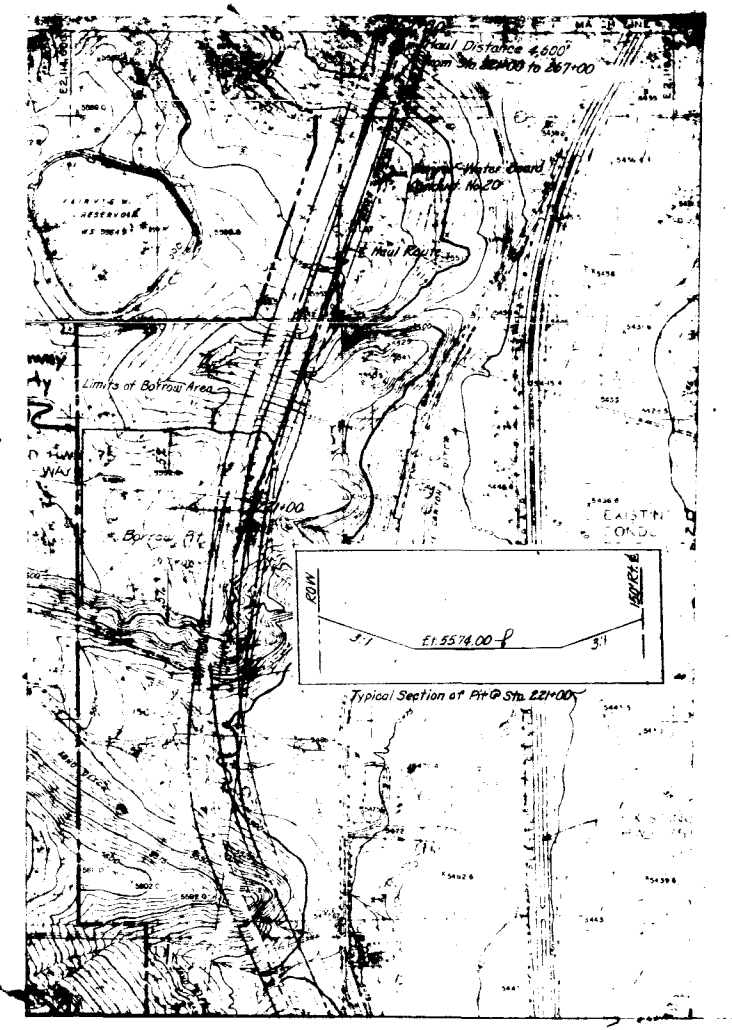

K+E PLATE 1, PLAN-PROFILE KEUFFEL & ESSER CO.

TMENT OF HIGHWAYS—STATE OF COLORADO
O. O. H. 126
4-1964

| FEDERAL ROAD REGION NO. | DISTRICT | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | CC 10-0075-05 | 23 | 24 |

# PIT No. 1

Note: Pit shall be worked from Easterly Right-of-Way Line Westward. Pit floor sloped to drain as shown.



| Excavation Cu. Yds. | Excavation Area | Embankment Area | Embankment Cu. Yds. | Excavation Cu. Yds. | Excavation Area | Embankment Area | Embankment Cu. Yds. |
|---|---|---|---|---|---|---|---|

| FED. ROAD REGION | DIVISION | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLO | CC 19-0075-05 | 24 | 24 |

(R-1) 2-27-63 D.H.H.

# SUMMARY OF EARTHWORK QUANTITIES (R-1)

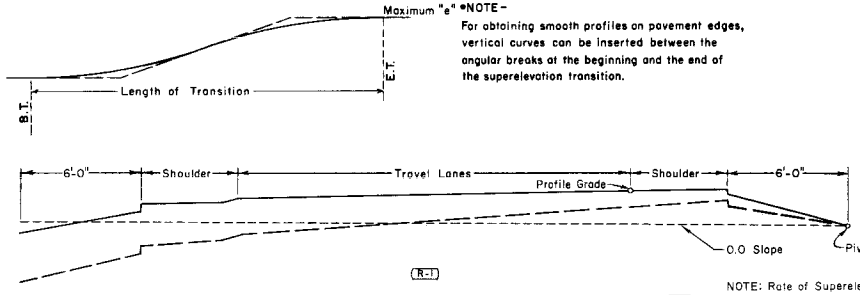
| COUNTY | DOUGLAS | ARAPAHOE | JEFFERSON | | | TOTAL |
|---|---|---|---|---|---|---|
| SECTION | SEC. 1 | SEC. 1 | SEC. 2 | SEC. 3 | SEC. 4 | |
| **UNCLASSIFIED EXCAVATION** | | | | | | |
| ROADWAY | 1,314 | 20,125 | 63,830 | | 128,821 | 214,090 |
| FROM CHANNEL CHANGE | 3,060 | 17,600 | | | | 20,660 |
| FROM MAJOR STRUCTURES | | | 1,600 | | | 1,600 |
| STRUCTURE QUANTITIES AS EXCAVATION | | | | | 4,453 | 4,453 |
| STRUCTURE QUANTITIES AS EMBANKMENT | | | | 2,345 | 2,363 | 4,708 |
| STRUCTURE QUANTITIES AS DITCH | | | | 408 | | 408 |
| ESTIMATE FOR CUT SLOPE TREATMENT | | 100 | 300 | | 200 | 600 |
| TOTAL | 4,374 | 37,825 | 71,730 | 2,753 | 135,837 | 252,519 |
| **BORROW** | | | | | | |
| FROM BORROW PIT NO. 1 (R-1) | | | | 865,730 | | 865,730 |
| **ROCK EXCAVATION** | | | | | | |
| C.E.C. | | | | 3,850 | | 3,850 |
| TOTAL | | | | 3,850 | | 3,850 |
| **EMBANKMENT (STANDARD) (MOISTURE AND DENSITY CONTROL)** | | | | | | |
| ROADWAY | 14,416 | 21,434 | 60,715 | 565,870 | 109,498 | 771,953 |
| STRUCTURE QUANTITIES AS EMBANKMENT | | | | 2,345 | 2,363 | 4,708 |
| BASE OF CUTS AND FILLS | 2,200 | 5,300 | 5,900 | 4,200 | 5,800 | 23,400 |
| TOTAL | 16,616 | 26,734 | 66,615 | 572,415 | 117,661 | 800,041 |

| SHEET TOTALS | | |
|---|---|---|
| | EXCAVATION | CU. YDS. |
| | EXCAVATION | CU. YDS. |
| | EMBANKMENT | CU. YDS. |

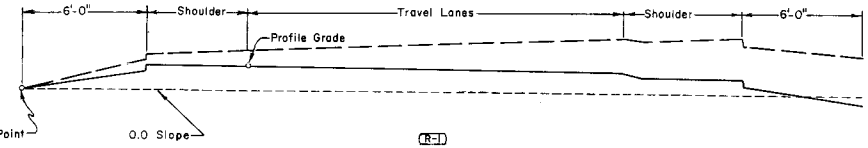
# STANDARD M-203-A-1

(JULY 1, 1965)

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

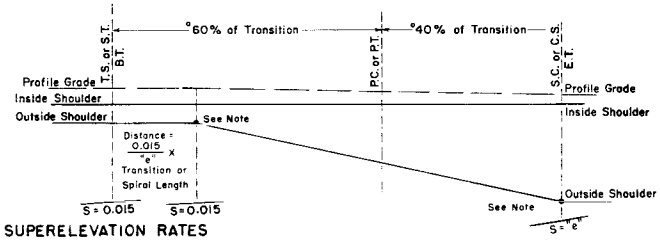



**NOTE –** For obtaining smooth profiles on pavement edges, vertical curves can be inserted between the angular breaks at the beginning and the end of the superelevation transition.

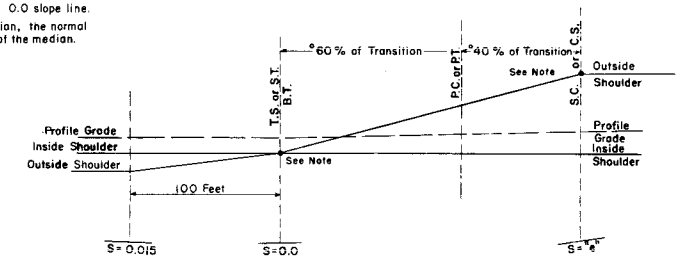



NOTE: Rate of Superelevation is applied from 0.0 slope line. In case of narrow (non-depressed) median, the normal location of pivot point will be at the centerline of the median.

R-2




° When Curve is Not Spiralled




| REVISIONS | | | |
|---|---|---|---|
| R-1 | 5-26-67 | Supered Template | M.R.H. |
| R-2 | 7-26-67 | Median note | R.S.M. |

## SUPERELEVATION RATES FOR FOUR LANE DIVIDED SECTION

TABLE 1

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

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

## SUPERELEVATION RATES FOR SPECIAL CASES ◪

TABLE 2

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

| Degree of Curve | 45 M.P.H. | | | 50 M.P.H. | | | 55 M.P.H. | | | 60 M.P.H. | | | Degree of Curve |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Required Super. Rate Ft./Ft. | | Minimum Length of Transition or Spiral | Required Super. Rate Ft./Ft. | | Minimum Length of Transition or Spiral | Required Super. Rate Ft./Ft. | | Minimum Length of Transition or Spiral | Required Super. Rate Ft./Ft. | | Minimum Length of Transition or Spiral | |
| | 0.08 | 0.10 | | 0.08 | 0.10 | | 0.08 | 0.10 | | 0.08 | 0.10 | | |
| 0° 15' | N S | N S | 0 | N S | N S | 0 | N S | N S | 0 | N S | N S | 0 | 0° 15' |
| 0° 30' | N S | N S | 0 | R C | R C | 150' | R C | R C | 200' | R C | R C | 200' | 0° 30' |
| 0° 45' | R C | R C | 150' | R C | R C | 150' | .016 | .016 | 200' | .018 | .018 | 200' | 0° 45' |
| 1° 00' | .016 | .016 | 150' | .018 | .018 | 150' | .021 | .021 | 200' | .022 | .022 | 200' | 1° 00' |
| 1° 30' | .023 | .024 | 150' | .027 | .027 | 150' | .031 | .031 | 200' | .035 | .034 | 200' | 1° 30' |
| 2° 00' | .030 | .032 | 150' | .035 | .036 | 150' | .041 | .042 | 200' | .047 | .046 | 200' | 2° 00' |
| 2° 30' | .036 | .039 | 150' | .043 | .045 | 150' | .050 | .052 | 200' | .057 | .059 | 200' | 2° 30' |
| 3° 00' | .042 | .046 | 150' | .050 | .054 | 150' | .057 | .062 | 200' | .066 | .070 | 250' | 3° 00' |
| 3° 30' | .048 | .053 | 150' | .056 | .063 | 200' | .064 | .072 | 250' | .072 | .081 | 300' | 3° 30' |
| 4° | .053 | .060 | 150' | .062 | .070 | 200' | .069 | .079 | 250' | .076 | .090 | 300' | 4° |
| 5° | .062 | .071 | 200' | .070 | .083 | 250' | .077 | .091 | 300' | .080 | .099 | 350' | 5° |
| 6° | .069 | .080 | 200' | .076 | .093 | 250' | .080 | .098 | 300' | | .100 | 350' | 6° |
| 7° | .074 | .088 | 250' | .079 | .097 | 300' | | .100 | 300' | | | | 7° |
| 8° | .078 | .094 | 250' | .080 | .100 | 300' | | | | | | | 8° |
| 9° | .080 | .097 | 300' | | | | | | | | | | 9° |
| 10° | | .100 | 300' | | | | | | | | | | 10° |
| 11° | | | | | | | | | | | | | 11° |
| 12° | | | | | | | | | | | | | 12° |
| 13° | | | | | | | | | | | | | 13° |
| 14° | | | | | | | | | | | | | 14° |

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

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

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

**SUPERELEVATION OF CURVES DIVIDED HIGHWAYS**

Designed by S.B.L.
Made by S.B.L.
Checked by L.E.O.
Approved by L. E. Olson
Staff Design Engr.
Date July 1, 1965

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

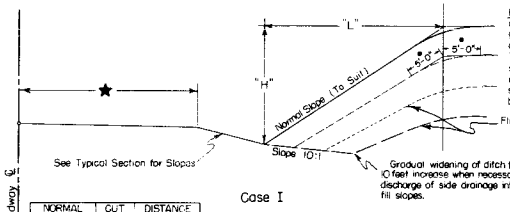
# STANDARD M-203-B

(JULY 1, 1965)

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

| REVISIONS | | | |
|---|---|---|---|
| (R-1) | 2-6-68 | Median Cross Over | MRH |

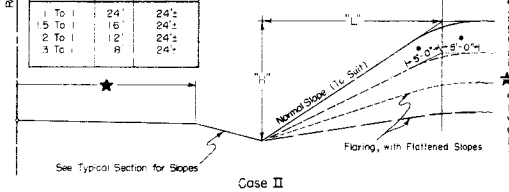
## GENERAL DETAILS FOR FLARING OF EARTH CUTS, CUT SLOPE TREATMENT & WIDENING AT BRIDGES




Case I

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

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.

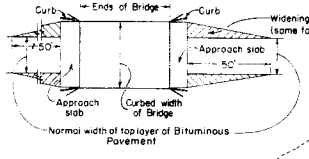



Case II

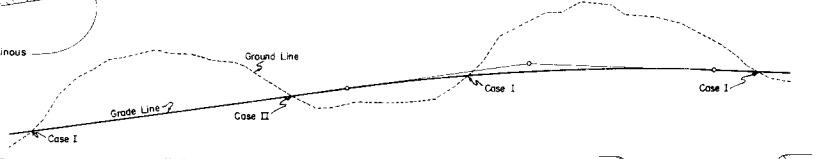
*CUT SLOPE TREATMENT IN EARTH CUTS: The intersection of cut slopes with the existing ground shall be rounded in earth cuts, beginning 5 ft. outside the slope stake and extending 5 ft. down the cut slope. Where the cut slope is less than 5 ft. reduce each of the above widths of slope treatment to the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

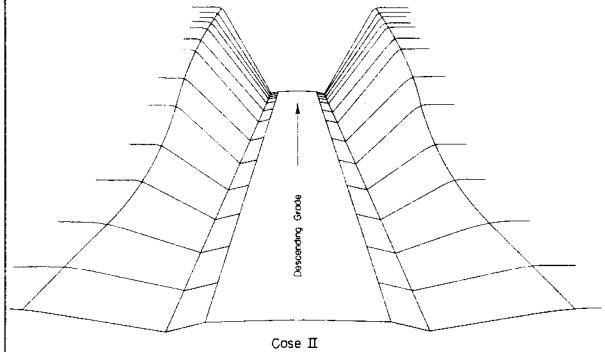
★ WIDENING AT BRIDGE APPROACHES: Roadway embankment at bridge approaches shall be so constructed that base of surfacing at shoulder point is a Min. of 2 ft. beyond the outside edge of bridge deck. Where widening of the section is necessary to achieve this result it shall take place gradually over a distance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

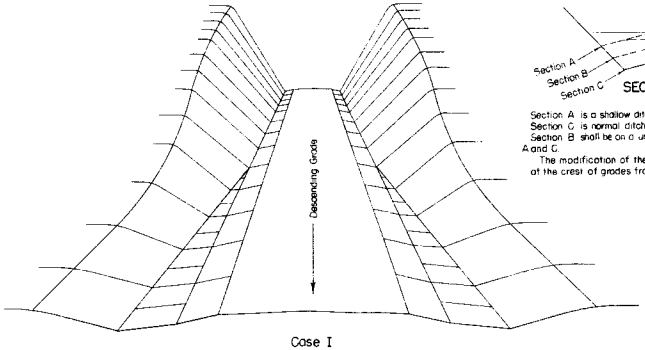



## PLAN OF FLARING IN EARTH CUTS




Case II



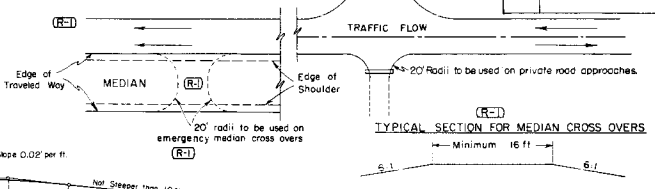

Case I

## TYPICAL PLANS FOR SIDE APPROACH ROADS AND EMERGENCY MEDIAN CROSS OVERS

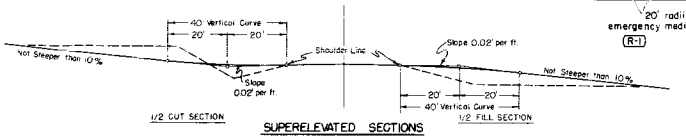
(R-1)

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

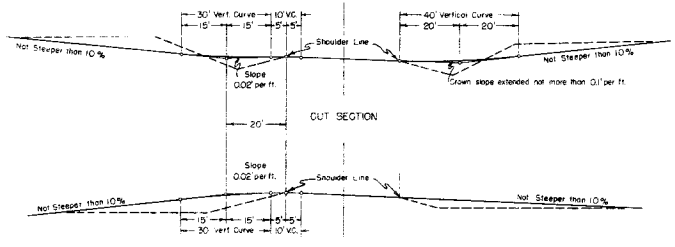



(R-1)

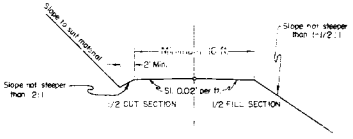
TYPICAL SECTION FOR MEDIAN CROSS OVERS




SUPERELEVATED SECTIONS




TYPICAL SECTION FOR APPROACH

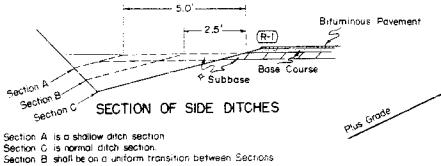



NOTE:
Road Approaches shall conform to the above details unless otherwise indicated on plans. The width of the crowned section shall not be less than the width of the crowned section of the existing approach road and the new construction shall not be less than 16 feet in width.

## DETAILS FOR DITCH & WIDENED SHOULDERS AT CREST OF GRADES

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

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




SECTION OF SIDE DITCHES

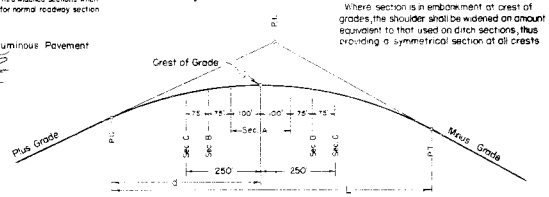
Section A is a shallow ditch section
Section C is normal ditch section.
Section B shall be on a uniform transition between Sections A and C.
The modification of the ditch indicated shall be used only at the crest of grades from which drainage breaks both ways.

Formula for finding the Crest of Grade

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

NOTE

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




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

## GENERAL NOTES

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

All side approach roads to the Project shall be Gravel Surfaced with a 4 inch thickness of Aggregate Base Course extending approximately to the Right of Way Line. Estimated tonnage and class of material required for this operation are shown in the Aggregate Base Course Plan.

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

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

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

| | |
|---|---|
| Designed by A.Z. | Approved by [signature] |
| Made by SJM & ABH | Staff Design Engr. |
| Checked by C.R.S. | Date: July 1, 1965 |

# STANDARD M-206-A

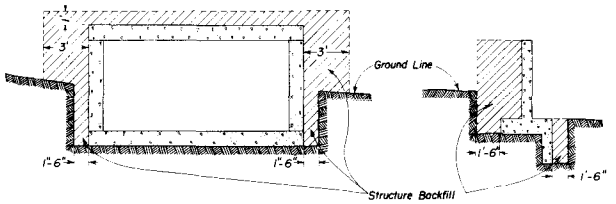
(JULY 1, 1965)

(SHEET 1 OF 2 SHEETS)

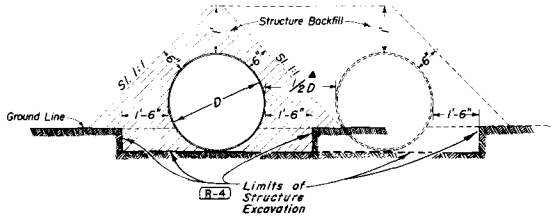
| FED. ROAD REGION NO. | DIVISION | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 9 | COLO. | | |

| 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. |

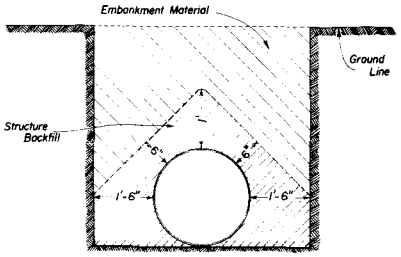
## CONCRETE BOX CULVERTS & WINGWALLS




## CIRCULAR CONDUIT

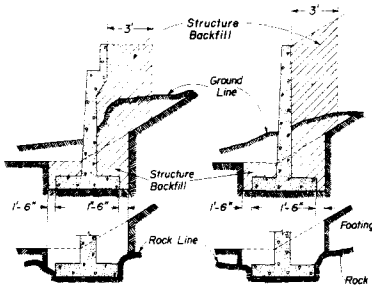


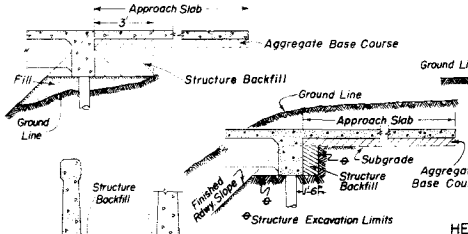

## SIPHONS OR CONDUIT IN TRENCH



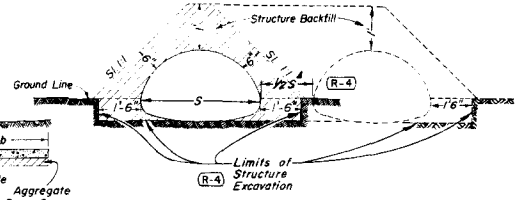

## PIERS, ABUTMENTS, RETAINING WALLS ETC.

*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 1/2 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.*

## GENERAL NOTES

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

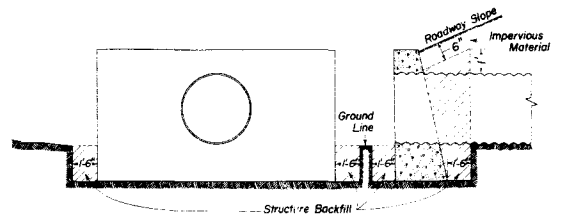
*Where the roadway cross section is in fill, excavation for concrete footings (except those in rock or those on piles) and for box culverts shall be done according to the following:*

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

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

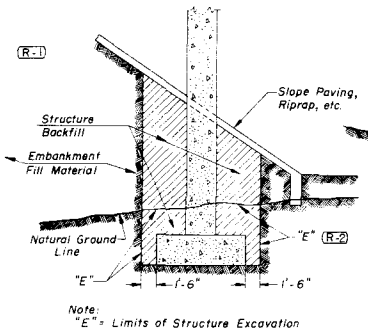
R-4 *Excavation for structure installation shall be classified as "Structure Excavation" unless otherwise shown on plans.*

## HEADWALLS AND END OF CULVERTS

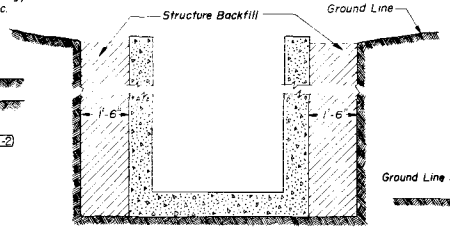


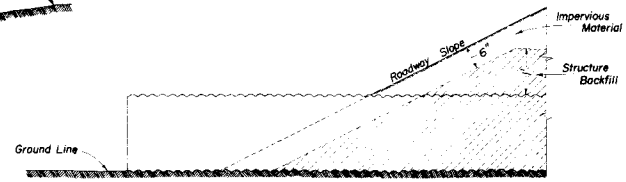

## DROP INLETS, DIVISION BOXES, INTERCEPTING HEADWALLS, ETC.

R-1

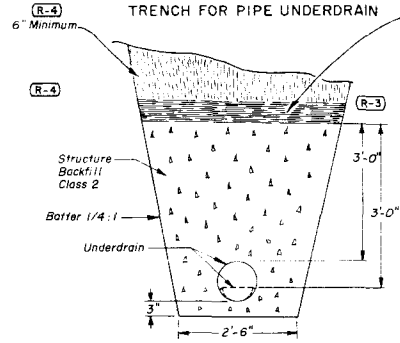



Note:
"E" = Limits of Structure Excavation




## TRENCH FOR PIPE UNDERDRAIN




DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

**EXCAVATION AND BACKFILL FOR STRUCTURES**

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

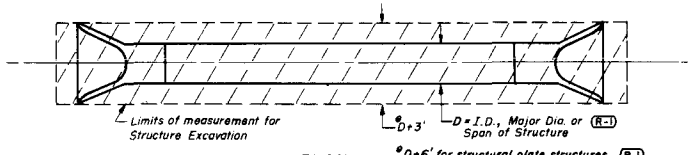
| FEDERAL ROAD REGION NO. | DISTRICT | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | | | |

# STANDARD M-206-A

(SHEET 2)
(JULY 1, 1965)

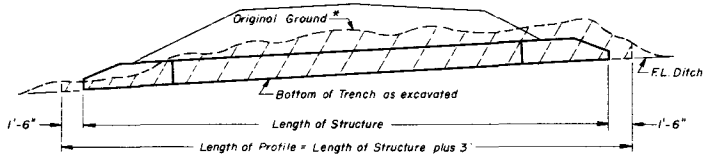
| | REVISIONS: | |
|---|---|---|
| R-1 3-17-67 | I. D. on Pipe Culvert Span or D. | M.R.H. |

## STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS



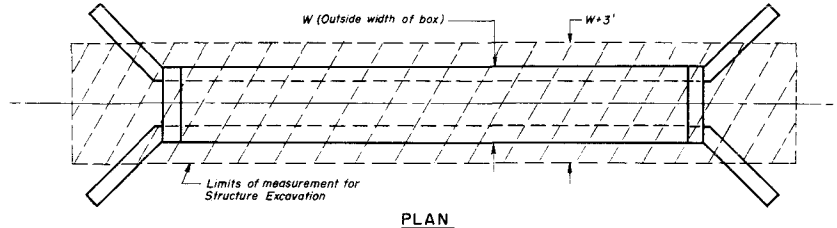

PLAN

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



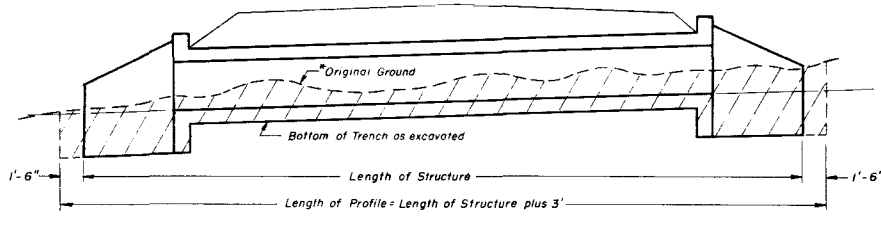

PROFILE

## STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS



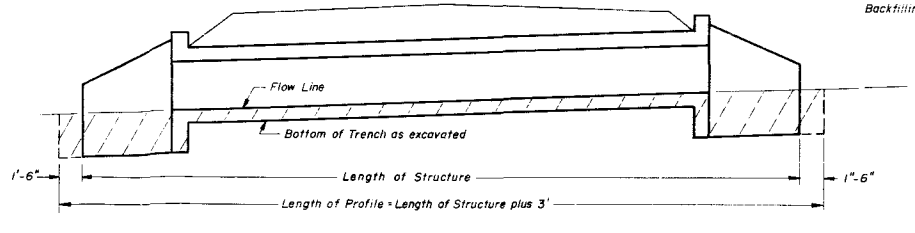

PLAN

*Without Channel Change or Channel Improvement*




PROFILE

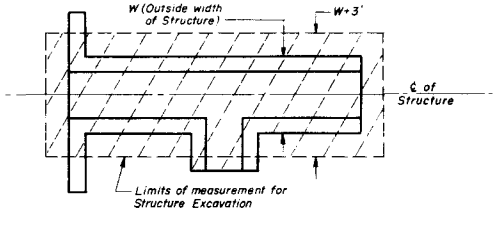
*With Channel Change or Channel Improvement*



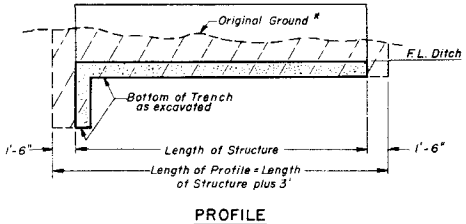

PROFILE

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

EXCAVATION AND BACKFILL FOR STRUCTURES

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

# STANDARD M-500-A

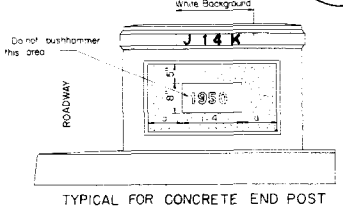
(JULY 1, 1965)

| FED. ROAD REG. NO. | DIVISION | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 8 | COLO. | | |

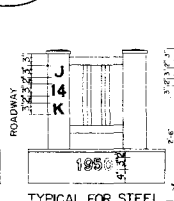
abcdefghijklmnopqrstuvwxyz

SAMPLE BRIDGE NUMBER

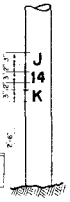
SAMPLE YEAR NUMBER



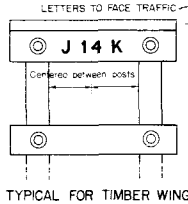

TYPICAL FOR CONCRETE END POST



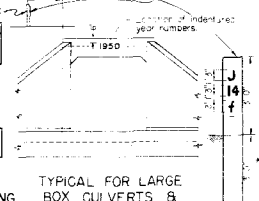

TYPICAL FOR STEEL HANDRAIL END POST




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 TO A MINIMUM AS SHOWN INTO THE HANDLE 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 END POST AS SHOWN IN 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 SIGN THE NUMBER SHALL BE PLACED ON SIGN POSTS ON THE RIGHT HAND SIDE OF THE ROADWAY.

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

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

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

AFTER THE WHITE BACKGROUND HAS DRIED SUFFICIENTLY, THE CORRECT STRUCTURE NUMBER SHALL BE CAREFULLY STENCILED WITH EXTERIOR BLACK PAINT. AS SPECIFIED IN SECTION 708 PAINTING OR AN ACCEPTABLE EQUIVALENT. THE BRACES OF THE STENCILED LETTERS AND FIGURES SHALL BE CAREFULLY FILLED IN BY HAND TO MAKE SOLID FIGURES.

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

THE COST OF PAINTING OF STRUCTURE NUMBERS AND FURNISHING AND PLACING POSTS FOR STRUCTURE NUMBERS SHALL BE CONSIDERED SUBSIDARY WORK AND SHALL BE INCLUDED IN THE ORIGINAL CONTRACT ITEMS AND WILL NOT 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 OF WALLS SHALL BE CONSIDERED AND CLEAR SPAN MEASURED FROM WALL TO FACE OF WALL.

IN ADDITION TO THE REQUIREMENTS STATED ABOVE, STRUCTURE NUMBERS FOR HIGHWAYS PASSING UNDER CROSSROADS ARE TO BE PLACED AT THE FOLLOWING POINTS:

1. FOR SINGLE STRUCTURES OF 4 OR MORE SPANS, THE STRUCTURE NUMBER SHALL BE STENCILED, FACING TRAFFIC, ON THE OUTSIDE FACE OF THE END COLUMN OF THE RIGHT HAND PIER.
2. (8) FOR 2-SPAN STRUCTURES, THE STRUCTURE NUMBER SHALL BE STENCILED, FACING TRAFFIC, ON THE OUTSIDE FACE OF EACH END COLUMN, IN THE CENTER PIER.

STRUCTURE NO.

| REVISIONS |
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| |

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

LETTERS AND FIGURES FOR STRUCTURE NUMBERS

| | |
|---|---|
| Designed by<br>Made by<br>Checked by | Approved by L. R. Marshall<br>Bridge Engineer<br>Date: July 1, 1965 |

# STANDARD M-510-AA

(SHEET 1 OF 2 SHEETS)
(MARCH 20, 1967)

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

| REVISIONS | | |
|---|---|---|
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## FILL HEIGHT AND MINIMUM GAGE TABLES

### TABLE I
CORRUGATED STEEL PIPE – 6" x 2" CORRUGATIONS – BOLTED FABRICATION

| PIPE DIAMETER (Inches) | MINIMUM COVER (Inches) Excluding Pavement | HEIGHT OF FILL OVER TOP OF PIPE IN FEET | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min. 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 65 | 65+ to 70 | 70+ to 80 | 80+ to 90 | 90+ to 93 |
| | | GAGE | | | | | | | | | | | | | | |
| 60 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 10 | 10 | 10 | 8 | 7 | 5 | 3 | 1 | 7 |
| 72 | 12 | 12 | 12 | 12 | 12 | 10 | 8 | 10 | 10 | 8 | 8 | 8 | 7 | 5 | 5 | 5 |
| 84 | 12 | 12 | 12 | 12 | 10 | 10 | 10 | 10 | 8 | 8 | 7 | 7 | 5 | 3 | 1 | |
| 96 | 12 | 12 | 12 | 12 | 10 | 10 | 8 | 8 | 8 | 7 | 5 | 3 | 1 | | | |
| 108 | 24 | 12 | 12 | 10 | 10 | 10 | 8 | 8 | 7 | 3 | 1 | | | | | |
| 120 | 24 | 12 | 12 | 10 | 10 | 8 | 8 | 7 | 3 | 1 | | | | | | |
| 132 | 24 | 12 | 10 | 10 | 8 | 8 | 7 | 5 | 1 | | | | | | | |
| 144 | 24 | 12 | 10 | 10 | 8 | 7 | 5 | 1 | | | | | | | | |
| 156 | 24 | 12 | 10 | 8 | 8 | 7 | 5 | 1 | | | | | | | | |
| 168 | 24 | 12 | 10 | 8 | 7 | 5 | 3 | | | | | | | | | |
| 180 | 24 | 12 | 10 | 8 | 7 | 5 | 3 | | | | | | | | | |
| 192 | 24 | 10 | 8 | 8 | 7 | 5 | 3 | | | | | | | | | |
| 204 | 36 | 10 | 8 | 7 | 5 | 3 | | | | | | | | | | |
| 216 | 36 | 8 | 8 | 5 | 3 | 1 | | | | | | | | | | |
| 228 | 36 | 8 | 5 | 3 | 1 | | | | | | | | | | | |
| 240 | 36 | 7 | 3 | 1 | | | | | | | | | | | | |
| 252 | 36 | 5 | 3 | 1 | | | | | | | | | | | | |

*Pipes with gages to the right of or below the heavy dashed line shall be elongated 5 percent on the vertical axis as installed.*

*Fill heights above 93 feet shall be used only after thorough investigation of foundation material.*

### TABLE II
CORRUGATED STEEL ARCH PIPE 6" x 2" CORRUGATIONS
BOLTED FABRICATION

| PIPE DIAMETER Span – Rise | CORNER RADIUS (Inches) | MINIMUM COVER (Inches) Excluding Pavement | HEIGHT OF FILL OVER TOP OF PIPE IN FEET | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min. to 5 | 5+ to 6 | 6+ to 7 | 7+ to 8 | 8+ to 9 | 9+ to 10 | 10+ to 11 | 11+ to 12 | 12+ to 13 | 13+ to 14 | 14+ to 15 |
| | | | GAGE | | | | | | | | | | |
| 6'1" x 4'7" | 18 | 18 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 7'0" x 5'1" | 18 | 18 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 7'11" x 5'7" | 18 | 18 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | | |
| 8'10" x 6'1" | 18 | 24 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | | | |
| 9'9" x 6'7" | 18 | 24 | 12 | 12 | 12 | 12 | 12 | 12 | | | | | |
| 10'11" x 7'1" | 18 | 24 | 12 | 12 | 12 | 12 | 12 | | | | | | |
| 11'10" x 7'7" | 18 | 24 | 12 | 12 | 12 | | | | | | | | |
| 12'10" x 8'4" | 18 | 24 | 12 | 12 | | | | | | | | | |
| 14'1" x 8'9" | 18 | 24 | 12 | | | | | | | | | | |
| 13'3" x 9'4" | 31 | 24 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | |
| 14'2" x 9'10" | 31 | 24 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | | |
| 15'4" x 10'4" | 31 | 24 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | | | |
| 16'3" x 10'10" | 31 | 36 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | | | |
| 17'2" x 11'4" | 31 | 36 | 10 | 10 | 10 | 10 | 10 | 10 | | | | | |
| 18'1" x 11'10" | 31 | 36 | 8 | 8 | 8 | 8 | 8 | | | | | | |
| 19'3" x 12'4" | 31 | 36 | 8 | 8 | 8 | 8 | 8 | | | | | | |
| 19'11" x 12'10" | 31 | 36 | 8 | 8 | 8 | 8 | | | | | | | |
| 20'7" x 13'2" | 31 | 36 | 7 | 7 | 7 | | | | | | | | |

*Maximum fill heights for bearing pressures exceeding 2 tons/square foot are not included.*

*Arch pipe with equal periphery and with span and rise dimensions approximately equal to those required by plans will be permitted.*

## GENERAL NOTES

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

*Not less than 4 bolts shall be used per foot of longitudinal seam. Where ends are skewed and hook bolts are required, 3/4 inch hook bolts on not more than 19 inch centers shall be used to anchor the plates to headwalls.*

*When the skew angle exceeds 20 degrees and the pipe or arch pipe has the ends cut to fit a slope, the ends shall be reinforced.*

*Details for beveled or mitered ends shall be as shown on the layout for the structure on the plans.*

*For pipes and arch pipes, protective coatings or bottom plates of heavier gage shall be used when site investigations indicate corrosive and/or abrasive conditions.*

*For sizes of pipe and arch pipe between those in the tables, the gage shall be interpolated where possible; otherwise the gage of the next larger size shall be used.*

*Where multiple lines of pipe or arch pipes are used, they shall be spaced so that adjacent sides of the pipe shall be at least one-half diameter or one-half span apart to permit careful tamping of the backfill material, except that the clear distance between adjacent sides need not be more than 3 feet.*

*Bolts, nuts and washers differing from those shown on sheet 2 of this Standard must be approved by the Engineer prior to use.*

H-20 LIVE LOAD

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

**STRUCTURAL PLATE CULVERT DETAILS**

| | |
|---|---|
| Designed by M.R.H.<br>Made by J.R.B.<br>Checked by R.S.M. | Approved by<br>Staff Design Engineer<br>Date: |

# STANDARD M-510-AA

(SHEET 2)
(MARCH 20, 1967)

| FED. ROAD REG. NO. | DIVISION | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 5 | COLORADO | | |

| REVISIONS | | |
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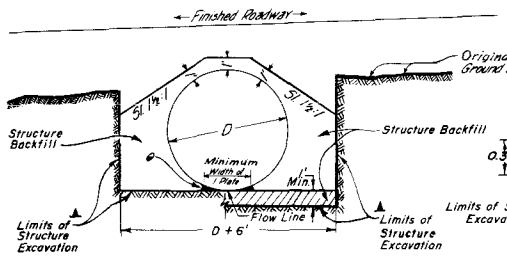
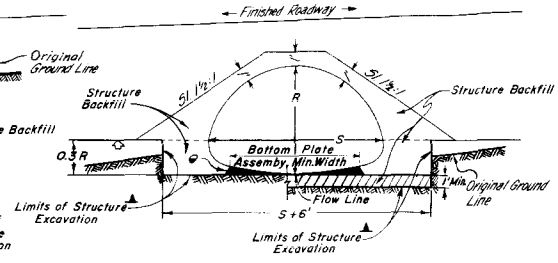
## TYPICAL CROSS SECTIONS SHOWING EXCAVATION AND BACKFILL FOR STRUCTURAL PLATE CULVERTS

### PIPE IN TRENCH




### ARCH PIPE IN FILL




NOTES:

▲ When soil below the proposed flow line of the culvert is suitable for foundation material, Structure Excavation shall extend downward only to the flow line. When soil below the flow line is not suitable for foundation material, Structure Excavation shall extend downward to the depth below flow line as indicated.

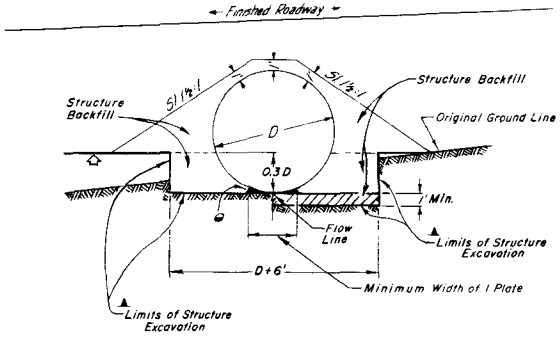
Structure Backfill shall be compacted in accordance with Section 206.

NOTE:

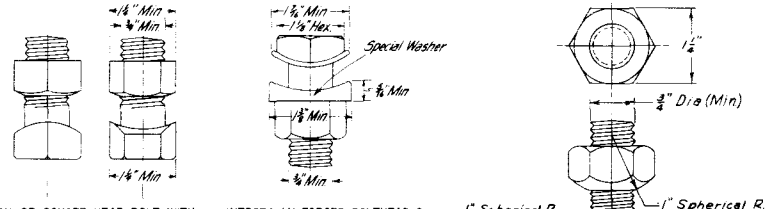
◇ When flow line of culvert is less than 0.3 Diameter or Rise below the Original Ground Line, embankment shall be built up to 0.3 Diameter or Rise above the flow line and the trench excavated to the flow line or as indicated.

● Hand tamped under haunches.

### PIPE IN FILL




## TYPICAL SECTIONAL PLATE BOLTS, NUTS & WASHER ASSEMBLIES




HEXAGON OR SQUARE HEAD BOLT WITH HALF ROUND BEARING SURFACE

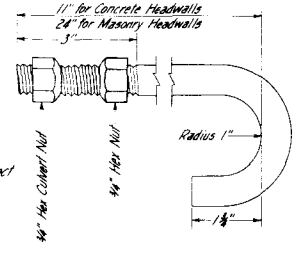
INTEGRALLY FORGED BOLTHEAD & WASHER WITH HALF ROUND BEARING SURFACE

## DETAILS OF ANCHOR BOLTS

( WHERE REQUIRED BY PLANS )

Holes for Anchor Bolts to be punched at not more than 19 inch centers depending upon the circumference of the pipe. All Anchor Bolts, Nuts & Washers are to be hot dip galvanized. Anchor Bolts are to be furnished with the pipe. Cost of Anchor Bolts to be included in bid price per linear foot of pipe.

Anchor bolts, nuts and wasners shall be of the type designated, or an acceptable equivalent, subject to approval by the Department.




H-20 LIVE LOAD

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

STRUCTURAL PLATE CULVERT DETAILS

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

# STANDARD M-601-A

(JULY 1, 1965)

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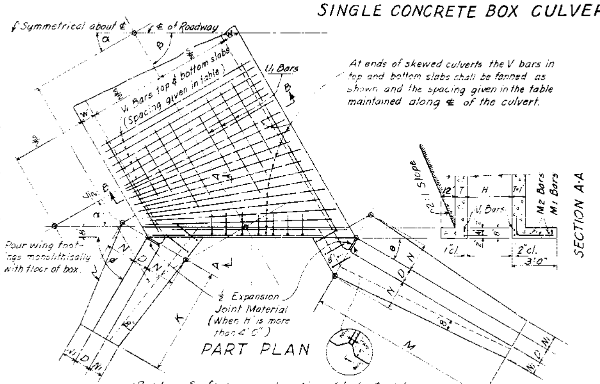
| 9 | COLORADO | | |

## SINGLE CONCRETE BOX CULVERT

### Dimensions & Quantities (see Wingwall Standard for Wings)

| Height of Fill Allowed | Type | Span S | Height H | Slab T | Wall W | $V_1$ Size | $V_1$ Spa | $W_1$ Size | $W_1$ Spa | No. bars required $U_1$ | No. bars required $M_1$ | Quantities for One Lin Ft of Box: Concrete Cu Yds | Quantities for One Lin Ft of Box: Steel Lbs | Quantities for Two Headwalls: Concrete Cu Yds | Quantities for Two Headwalls: Steel Lbs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35'0" | 2A | 2'0" | 2'0" | 6 | 8" | 3/4φ | 12" | 1/2φ | 12" | 8 | 8 | 0.232 | 17.5 | 1.30 | 81 |
| 30'0" | 3A | 3'0" | 2'0" | 7" | 8" | 7/8φ | 12" | 1/2φ | 12" | 10 | Cos α | 0.299 | 26.3 | 1.50 | 112 |
| | | | 3'0" | | | | | | | 12 | | 0.349 | 29.0 | 1.65 | 123 |
| 20'0" | 4A | 4'0" | 2'0" | 7½ | 8" | 7/8φ | 12" | 1/2φ | 12" | 12 | 10/Cos α | 0.362 | 31.8 | 1.75 | 150 |
| | | | 3'0" | | | | | | | 14 | | 0.412 | 34.6 | 1.90 | 154 |
| | | | 4'0" | | | | | | | 16 | | 0.461 | 37.3 | 2.10 | 158 |
| 16'0" | 5A | 5'0" | 3'0" | 8" | 8 | 3/4φ | 8" | 1/2φ | 8" | 16 | 12/Cos α | 0.481 | 45.3 | 2.20 | 153 |
| | | | 4'0" | | | | | | | 18 | | 0.530 | 48.7 | 2.40 | 157 |
| | | | 5'0" | | | | | | | 20 | | 0.579 | 52.0 | 2.60 | 161 |
| 20'0" | 5B | 5'0" | 3'0" | 8½ | 8" | 3/4φ | 8 | 1/2φ | 8" | 16 | 12/Cos α | 0.500 | 45.5 | 2.20 | 153 |
| | | | 4'0" | | | | | | | 18 | | 0.549 | 48.8 | 2.40 | 157 |
| | | | 5'0" | | | | | | | 20 | | 0.598 | 52.2 | 2.60 | 161 |
| 14'0" | 6A | 6'0" | 4'0" | 8½ | 8" | 3/4φ | 8" | 1/2φ | 8" | 20 | 14/Cos α | [illegible] | 54.7 | 2.65 | 180 |
| | | | 5'0" | | | | | | | 22 | | 0.654 | 58.1 | 2.85 | 184 |
| | | | 6'0" | | | | | | | 24 | | 0.704 | 61.4 | 3.00 | 188 |
| | | | 7'0" | | | | | | | 26 | | 0.753 | 64.9 | 3.30 | 192 |
| 20'0" | 6B | 6'0" | 4'0" | 10" | 8" | 7/8φ | 8 | 5/8φ | 8 | 20 | 14/Cos α | 0.671 | 72.4 | 2.70 | 223 |
| | | | 5'0" | | | | | | | 22 | | 0.720 | 76.9 | 2.90 | 228 |
| | | | 6'0" | | | | | | | 24 | | 0.771 | 81.4 | 3.10 | 234 |
| | | | 7'0" | | | | | | | 26 | | 0.820 | 85.9 | 3.35 | 239 |
| 12'0" | 7A | 7'0" | 4'0" | 9 | 9 | 3/4φ | 7 | 1/2φ | 7 | 22 | 16/Cos α | 0.720 | 68.2 | 3.05 | 208 |
| | | | 5'0" | | | | | | | 24 | | 0.776 | 71.9 | 3.25 | 212 |
| | | | 6'0" | | | | | | | 26 | | 0.832 | 75.5 | 3.40 | 216 |
| | | | 7'0" | | | | | | | 28 | | 0.887 | 79.2 | 3.70 | 220 |
| 15'0" | 7B | 7'0" | 4'0" | 10 | 9 | 7/8φ | 8 | 5/8φ | 8 | 22 | 16/Cos α | 0.772 | 81.0 | 3.05 | 257 |
| | | | 5'0" | | | | | | | 24 | | 0.827 | 85.5 | 3.25 | 262 |
| | | | 6'0" | | | | | | | 26 | | 0.883 | 90.0 | 3.45 | 268 |
| | | | 7'0" | | | | | | | 28 | | 0.938 | 94.5 | 3.75 | 273 |
| 20'0 | 7C | 7'0 | 4'0" | 11 | 9 | 7/8φ | 7" | 5/8φ | 7" | 22 | 16/Cos α | 0.826 | 91.1 | 3.10 | 257 |
| | | | 5'0" | | | | | | | 24 | | [illegible] | 96.0 | 3.30 | 263 |
| | | | 6'0" | | | | | | | 26 | | 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" | 3/4φ | 7" | 1/2φ | 7" | 24 | 18/Cos α | 0.844 | 75.8 | 3.40 | 235 |
| | | | 5'0" | | | | | | | 26 | | 0.905 | 79.5 | 3.60 | 239 |
| | | | 6'0" | | | | | | | 28 | | 0.966 | 83.2 | 3.80 | 243 |
| | | | 7'0" | | | | | | | 30 | | 1.027 | 86.8 | 4.10 | 247 |
| | | | 8'0" | | | | | | | 32 | | 1.089 | 90.5 | 4.40 | 251 |
| 16'0" | 8B | 8'0 | 4'0" | 11½ | 10 | 7/8φ | 7 | 5/8φ | 7" | 24 | 18/Cos α | 0.963 | 100.9 | 3.50 | 292 |
| | | | 5'0" | | | | | | | 26 | | 1.025 | 105.9 | 3.70 | 297 |
| | | | 6'0" | | | | | | | 28 | | 1.086 | 110.8 | 3.90 | 303 |
| | | | 7'0" | | | | | | | 30 | | 1.148 | 115.8 | 4.20 | 308 |
| | | | 8'0" | | | | | | | 32 | | 1.210 | 120.8 | 4.45 | 314 |
| 20'0" | 8C | 8'0" | 4'0" | 12½ | 10" | 7/8φ | 6" | 5/8φ | 6" | 24 | 18/Cos α | 1.023 | 115.8 | 3.55 | 292 |
| | | | 5'0" | | | | | | | 26 | | 1.084 | 121.4 | 3.75 | 298 |
| | | | 6'0" | | | | | | | 28 | | [illegible] | [illegible] | [illegible] | [illegible] |
| | | | 7'0" | | | | | | | 30 | | 1.208 | 132.5 | 4.25 | 309 |
| | | | 8'0" | | | | | | | 32 | | 1.270 | 138.1 | 4.50 | 315 |
| 7'0" | 9A | 9'0" | 5'0" | 10" | 11" | 7/8φ | 8 | 5/8φ | 8" | 28 | 20/Cos α | 1.040 | 102.7 | 4.00 | 326 |
| | | | 6'0" | | | | | | | 30 | | 1.108 | 107.[illegible] | 4.20 | 331 |
| | | | 7'0" | | | | | | | 32 | | 1.176 | 111.6 | 4.50 | 337 |
| | | | 8'0" | | | | | | | 34 | | 1.244 | 116.1 | 4.80 | 342 |
| | | | 9'0" | | | | | | | 36 | | 1.311 | 120.7 | 5.15 | 348 |
| 14'0" | 9B | 9'0" | 5'0" | 12 | 11" | 7/8φ | 6 | 5/8φ | 6" | 28 | 20/Cos α | 1.174 | 131.9 | 4.10 | 327 |
| | | | 6'0" | | | | | | | 30 | | 1.242 | 137.5 | 4.30 | 333 |
| | | | 7'0" | | | | | | | 32 | | 1.310 | 143.1 | 4.60 | 338 |
| | | | 8'0" | | | | | | | 34 | | 1.378 | 148.6 | 4.90 | 344 |
| | | | 9'0" | | | | | | | 36 | | 1.445 | 154.2 | 5.25 | 349 |
| 20'0" | 9C | 9'0" | 5'0" | 14" | 11" | 1"φ | 7" | 3/4φ | 7" | 28 | 20/Cos α | 1.309 | 150.4 | 4.20 | 401 |
| | | | 6'0" | | | | | | | 30 | | 1.377 | 156.9 | 4.40 | 408 |
| | | | 7'0" | | | | | | | 32 | | [illegible] | 163.4 | 4.70 | 416 |
| | | | 8'0" | | | | | | | 34 | | [illegible] | 170.0 | 5.00 | 423 |
| | | | 9'0" | | | | | | | 36 | | 1.581 | 176.6 | 5.35 | 430 |
| 5'0" | 10A | 10'0" | 6'0" | 10½" | 12 | 7/8φ | 8 | 1/2φ | 8 | 32 | 22/Cos α | 1.260 | 107.7 | 4.60 | 355 |
| | | | 7'0" | | | | | | | 34 | | 1.334 | 111.0 | 4.90 | 358 |
| | | | 8'0" | | | | | | | 36 | | 1.408 | 114.4 | 5.20 | 363 |
| | | | 9'0" | | | | | | | 38 | | 1.483 | 117.8 | 5.60 | 367 |
| | | | 10'0" | | | | | | | 40 | | [illegible] | [illegible] | 5.95 | 371 |
| 10'0" | 10B | 10'0 | 6'0" | 12 | 12" | 7/8φ | 7" | 5/8φ | 7 | 32 | 22/Cos α | 1.369 | 130.4 | 4.70 | 367 |
| | | | 7'0" | | | | | | | 34 | | 1.443 | 135.4 | 5.00 | 372 |
| | | | 8'0" | | | | | | | 36 | | 1.517 | 140.4 | 5.30 | 378 |
| | | | 9'0" | | | | | | | 38 | | 1.591 | 145.3 | 5.65 | 383 |
| | | | 10'0" | | | | | | | 40 | | 1.665 | 150.3 | 6.05 | 388 |
| 16'0" | 10C | 10'0" | 6'0" | 14 | [illegible] | [illegible] | 8" | 3/4φ | 8" | 32 | 22/Cos α | 1.518 | 150.7 | 4.80 | 442 |
| | | | 7'0" | | | | | | | 34 | | 1.593 | 156.6 | 5.10 | 456 |
| | | | 8'0" | | | | | | | 36 | | 1.666 | 162.5 | 5.40 | 464 |
| | | | 9'0" | | | | | | | 38 | | 1.741 | 168.4 | 5.80 | 471 |
| | | | 10'0" | | | | | | | 40 | | 1.815 | 174.3 | 6.15 | 478 |
| 5'0" | 11A | 11'0" | 6'0" | 11" | 12" | 7/8φ | 7" | 1/2φ | 7" | 34 | 24/Cos α | 1.367 | 128.6 | 4.95 | 383 |
| | | | 7'0" | | | | | | | 36 | | [illegible] | 132.2 | 5.25 | 387 |
| | | | 8'0" | | | | | | | 38 | | 1.515 | 135.9 | 5.55 | 391 |
| | | | 9'0" | | | | | | | 40 | | 1.589 | 139.6 | 5.90 | 395 |
| | | | 10'0" | | | | | | | 42 | | 1.664 | 143.1 | 6.25 | 399 |
| 9'0" | 11B | 11'0" | 6'0" | 12½ | 12" | 1"φ | 8" | 5/8φ | 8" | 34 | 24/Cos α | 1.490 | 148.3 | 5.00 | 467 |
| | | | 7'0" | | | | | | | 36 | | 1.564 | 152.8 | 5.30 | 472 |
| | | | 8'0" | | | | | | | 38 | | 1.638 | 157.3 | 5.65 | 478 |
| | | | 9'0" | | | | | | | 40 | | 1.712 | 161.8 | 6.00 | 483 |
| | | | 10'0" | | | | | | | 42 | | 1.783 | 166.4 | 6.35 | 489 |
| 13'0" | 11C | 11'0" | 6'0" | 14" | 12" | 7/8φ | 6" | 5/8φ | 6" | 34 | 24/Cos α | 1.608 | 159.5 | 5.10 | 396 |
| | | | 7'0" | | | | | | | 36 | | 1.682 | 165.1 | 5.40 | 401 |
| | | | 8'0" | | | | | | | 38 | | 1.756 | 170.7 | 5.70 | 407 |
| | | | 9'0" | | | | | | | 40 | | 1.830 | 176.2 | 6.10 | 412 |
| | | | 10'0" | | | | | | | 42 | | 1.904 | 181.8 | 6.45 | 418 |
| 5'0 | 12A | 12'0 | 6'0" | 12" | 12" | 7/8φ | 7 | 1/2φ | 7" | 36 | 26/Cos α | 1.525 | 137.4 | 5.25 | 411 |
| | | | 7'0" | | | | | | | 38 | | 1.599 | 141.0 | 5.60 | 415 |
| | | | 8'0" | | | | | | | 40 | | 1.673 | 144.7 | 5.90 | 419 |
| | | | 9'0" | | | | | | | 42 | | 1.747 | 148.4 | 6.25 | 423 |
| | | | 10'0" | | | | | | | 44 | | 1.821 | 152.0 | 6.60 | 427 |
| 10'0" | 12B | 12'0" | 6'0" | 14 | 12" | 1"φ | 7" | 5/8φ | 7 | 36 | 26/Cos α | 1.697 | 177.7 | 5.40 | 502 |
| | | | 7'0" | | | | | | | 38 | | 1.772 | 182.7 | 5.70 | 508 |
| | | | 8'0" | | | | | | | 40 | | 1.846 | 187.7 | 6.00 | 513 |
| | | | 9'0" | | | | | | | 42 | | 1.920 | 192.6 | 6.40 | 519 |
| | | | 10'0" | | | | | | | 44 | | 1.994 | 197.6 | 6.70 | 524 |
| 4'0" | 13A | 13'0" | 6'0" | 12½ | 12" | 7/8φ | 7 | 1/2φ | 7" | 38 | 28/Cos α | 1.645 | 146.0 | 5.60 | 442 |
| | | | 7'0" | | | | | | | 40 | | 1.720 | 149.7 | 5.90 | 446 |
| | | | 8'0" | | | | | | | 42 | | 1.794 | 153.3 | 6.20 | 450 |
| | | | 9'0" | | | | | | | 44 | | 1.868 | 157.0 | 6.55 | 454 |
| | | | 10'0" | | | | | | | 46 | | 1.942 | 160.7 | 6.95 | 458 |
| 8'0 | 13B | 13'0 | 6'0" | 14 | 12" | 1"φ | 7 | 5/8φ | 7" | 38 | 28/Cos α | 1.787 | 188.4 | 5.70 | 538 |
| | | | 7'0" | | | | | | | 40 | | 1.861 | 193.3 | 6.00 | 543 |
| | | | 8'0" | | | | | | | 42 | | 1.935 | 198.3 | 6.30 | 549 |
| | | | 9'0" | | | | | | | 44 | | 2.009 | 203.3 | 6.65 | 555 |
| | | | 10'0" | | | | | | | 46 | | 2.083 | 208.2 | 7.05 | 560 |
| 4'0" | 14A | 14'0 | 6'0" | 13½ | 12" | 1"φ | 8" | 5/8φ | 8" | 40 | 30/Cos α | 1.827 | 177.2 | 5.95 | 571 |
| | | | 7'0" | | | | | | | 42 | | 1.901 | 181.7 | 6.25 | 577 |
| | | | 8'0" | | | | | | | 44 | | 1.975 | 186.2 | 6.55 | 582 |
| | | | 9'0" | | | | | | | 46 | | 2.049 | 190.7 | 6.95 | 588 |
| | | | 10'0" | | | | | | | 48 | | 2.123 | 195.2 | 7.30 | 593 |
| 8'0" | 14B | 14'0" | 6'0" | 15" | 12" | 1"φ | 7 | 5/8φ | 7" | 40 | 30/Cos α | 1.975 | 199.5 | 6.05 | 572 |
| | | | 7'0" | | | | | | | 42 | | 2.049 | 204.5 | 6.40 | 578 |
| | | | 8'0" | | | | | | | 44 | | 2.123 | 209.4 | 6.70 | 583 |
| | | | 9'0" | | | | | | | 46 | | 2.198 | 214.4 | 7.05 | 589 |
| | | | 10'0" | | | | | | | 48 | | 2.270 | 219.4 | 7.40 | 595 |

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




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

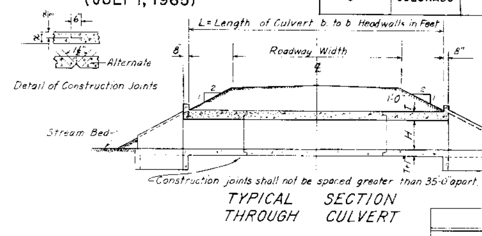
| Mark | Size | No. Req'd. | Type | Length |
|---|---|---|---|---|
| $V_1$ | See table | 10 + 24L/Spa. | I | S+2w-6" |
| $W_1$ | See table | 6 + 24L/Spa. | I | H+2T-5" |
| $U_1$ | ½"φ | See table | I | L + 1'0" |
| $M_1$ | ½"φ | See table | II | 3'6" |
| $M_2$ | ½"φ | 4 | I | (S+2w-6")/Cos α |

Straight — Type I; 2'6", 1'0" — Type II

(Bar dimensions are out to out of bar)

### Possible Combinations (Span & Height)

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

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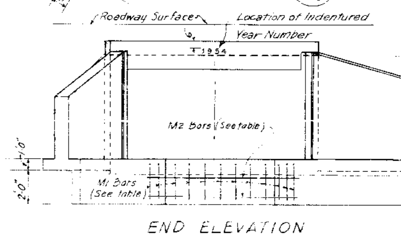
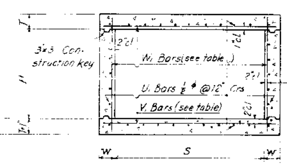



Note: All wing faces to receive Class I finish




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

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

## DOUBLE CONCRETE BOX CULVERT

### Dimensions & Quantities (see Wingwall Standard for Wings)

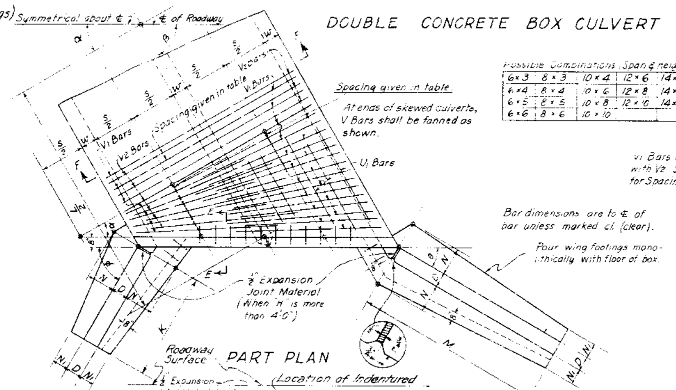
| Height of Fill Allowed | Type | Span S | Height H | Slab T | Wall W | Bar Size & Spacing $V_1$ | $V_2$ | $W_1$ Size | $W_1$ Spac. | No. Bars Required $U_1$ | $M_1$ | Quantities for One Lin Ft of Box: Concrete Cu Yds | Steel Lbs | Quantities for Two Headwalls: Concrete Cu Yds | Steel Lbs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10'0" | 6-6-A | 6'0" | 3'0" | 8½" | 8" | ½"φ, 5½" Spa | 5/8φ | ½"φ | 12" | 48 | 32/Cos α | 1.000 | 112.3 | 3.85 | 327 |
| | | | 4'0" | | | | | | 12" | 52 | | 1.073 | 117.7 | 4.60 | 335 |
| | | | 5'0" | | | | | | 12" | 56 | | 1.148 | 123.1 | 4.85 | 343 |
| | | | 6'0" | | | | | | 12" | 60 | | 1.222 | 128.5 | 5.05 | 351 |
| 15'0" | 6-6-B | 6'0" | 3'0" | 9½" | 8" | ½"φ, 5" Spa. | 5/8φ | ½"φ | 12 | 48 | 32/Cos α | 1.087 | 120.3 | 4.45 | 329 |
| | | | 4'0" | | | | | | 12" | 52 | | 1.161 | 125.7 | 4.65 | 337 |
| | | | 5'0" | | | | | | 12" | 56 | | 1.235 | 131.1 | 4.90 | 346 |
| | | | 6'0" | | | | | | 8" | 60 | | 1.309 | 141.4 | 5.10 | 353 |
| 20'0" | 6-6-C | 6'0" | 3'0" | 10½" | 8" | ½"φ, 4½" Spa. | 5/8φ | ½"φ | 12" | 48 | 32/Cos α | 1.173 | 130.0 | 4.50 | 331 |
| | | | 4'0" | | | | | | 12" | 52 | | 1.247 | 135.4 | 4.75 | 339 |
| | | | 5'0" | | | | | | 10" | 56 | | 1.321 | 142.5 | 4.95 | 347 |
| | | | 6'0" | | | | | | 7" | 60 | | 1.395 | 152.4 | 5.15 | 355 |
| 10'0" | 8-8-A | 8'0" | 3'0" | 10" | 10" | 5/8φ, 6" Spa | ¾φ | ½"φ | 12" | 60 | 40/Cos α | 1.477 | 174.4 | 5.80 | 506 |
| | | | 4'0" | | | | | | 12" | 64 | | 1.569 | 179.8 | 6.05 | 514 |
| | | | 5'0" | | | | | | 12" | 68 | | 1.662 | 185.2 | 6.30 | 522 |
| | | | 6'0" | | | | | | 12" | 72 | | 1.755 | 190.6 | 6.55 | 531 |
| 15'0" | 8-8-B | 8'0" | 3'0" | 11" | 10" | 5/8φ, 5½" Spa. | ¾φ | ½"φ | 12" | 60 | 40/Cos α | 1.592 | 188.6 | 5.90 | 508 |
| | | | 4'0" | | | | | | 12" | 64 | | 1.684 | 192.0 | 6.15 | 516 |
| | | | 5'0" | | | | | | 12" | 68 | | 1.777 | 197.4 | 6.40 | 524 |
| | | | 6'0" | | | | | | 8" | 72 | | 1.869 | 207.9 | 6.65 | 533 |
| 20'0" | 8-8-C | 8'0" | 3'0" | 12½" | 10" | 5/8φ, 5" Spa. | ¾"φ | ½"φ | 12" | 60 | 40/Cos α | 1.763 | 202.0 | 6.00 | 513 |
| | | | 4'0" | | | | | | 12" | 64 | | 1.856 | 207.4 | 6.30 | 521 |
| | | | 5'0" | | | | | | 10" | 68 | | 1.948 | 214.6 | 6.55 | 529 |
| | | | 6'0" | | | | | | 7" | 72 | | 2.041 | 225.7 | 6.75 | 537 |
| 5'0" | 10-10-A | 10'0" | 4'0" | 10" | 12" | 5/8φ, 7" Spa. | 7/8φ | 5/8φ | 15" | 78 | 48/Cos α | 1.935 | 228.3 | 7.40 | 714 |
| | | | 6'0" | | | | | | 15" | 86 | | 2.157 | 239.8 | 7.95 | 733 |
| | | | 8'0" | | | | | | 12" | 94 | | 2.380 | 255.2 | 8.70 | 752 |
| | | | 10'0" | | | | | | 9" | 102 | | 2.602 | 275.5 | 9.55 | 771 |
| 10'0" | 10-10-B | 10'0" | 4'0" | 12" | 12" | 5/8φ, 7" Spa | 7/8φ | 5/8φ | 15" | 78 | 48/Cos α | 2.220 | 231.0 | 7.65 | 721 |
| | | | 6'0" | | | | | | 15 | 86 | | 2.442 | 242.5 | 8.20 | 740 |
| | | | 8'0" | | | | | | 12" | 94 | | 2.664 | 258.0 | 8.90 | 759 |
| | | | 10'0" | | | | | | 8" | 102 | | 2.886 | 282.6 | 9.75 | 778 |
| 15'0" | 10-10-C | 10'0" | 4'0" | 14" | 12" | 5/8φ, 6" Spa. | 7/8φ | 5/8φ | 15" | 78 | 48/Cos α | 2.503 | 260.8 | 7.85 | 727 |
| | | | 6'0" | | | | | | 12" | 86 | | 2.725 | 275.6 | 8.40 | 746 |
| | | | 8'0" | | | | | | 9" | 94 | | 2.947 | 295.0 | 9.15 | 765 |
| | | | 10'0" | | | | | | 6" | 102 | | 3.170 | 325.5 | 10.00 | 784 |
| 5'0" | 12-12-A | 12'0" | 6'0" | 17" | 12" | 5/8φ, 7" Spa. | 7/8φ | 5/8φ | 15" | 98 | 56/Cos α | 2.751 | 278.9 | 9.35 | 857 |
| | | | 8'0" | | | | | | 12" | 106 | | 2.973 | 294.5 | 10.05 | 876 |
| | | | 10'0" | | | | | | 9" | 114 | | 3.195 | 315.0 | 10.90 | 895 |
| 10'0" | 12-12-B | 12'0" | 6'0" | 14" | 12" | 5/8φ, 6" Spa. | 7/8φ | 5/8φ | 15" | 98 | 56/Cos α | 3.083 | 313.5 | 9.60 | 864 |
| | | | 8'0" | | | | | | 12" | 106 | | 3.305 | 329.2 | 10.30 | 883 |
| | | | 10'0" | | | | | | 8" | 114 | | 3.528 | 354.1 | 11.15 | 902 |
| 15'0" | 12-12-C | 12'0" | 6'0" | 16" | 12" | 5/8φ, 5" Spa. | 7/8φ | 5/8φ | 12" | 98 | 56/Cos α | 3.416 | 365.1 | 9.85 | 870 |
| | | | 8'0" | | | | | | 9" | 106 | | 3.638 | 384.7 | 10.55 | 889 |
| | | | 10'0" | | | | | | 6" | 114 | | 3.860 | 415.7 | 11.40 | 908 |
| 5'0" | 14-14-A | 14'0" | 6'0" | 15" | 12" | 5/8φ, 6" Spa. | 7/8φ | 5/8φ | 15" | 110 | 64/Cos α | 3.633 | 356.2 | 10.95 | 984 |
| | | | 8'0" | | | | | | 12" | 118 | | 3.855 | 372.0 | 11.60 | 1003 |
| | | | 10'0" | | | | | | 9" | 126 | | 4.077 | 392.9 | 12.50 | 1023 |
| 10'0" | 14-14-B | 14'0" | 6'0" | 16" | 12" | 5/8φ, 5" Spa. | 7/8φ | 5/8φ | 15" | 110 | 64/Cos α | 3.824 | 409.4 | 11.05 | 988 |
| | | | 8'0" | | | | | | 12" | 118 | | 4.046 | 425.2 | 11.75 | 1007 |
| | | | 10'0" | | | | | | 8" | 126 | | 4.269 | 450.5 | 12.65 | 1026 |

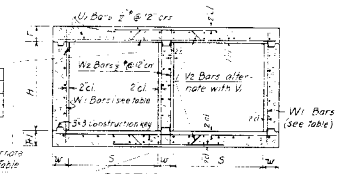
Quantities for one culvert shall be (quantity for one lin. ft of box times L) plus (quantity for two head walls) plus (quantities for four wings).

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

### Possible Combinations (Span & Height)

| | | | | |
|---|---|---|---|---|
| 6×3 | 8×3 | 10×4 | 12×6 | 14×6 |
| 6×4 | 8×4 | 10×6 | 12×8 | 14×8 |
| 6×5 | 8×5 | 10×8 | 12×10 | 14×10 |
| 6×6 | 8×6 | 10×10 | | |



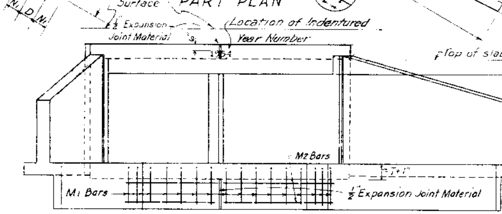

### Bar List for Culvert and Two Headwalls (See Wingwall Std for Wings)

| Mark | Size | Number Required | Type | ℓ | Total Length |
|---|---|---|---|---|---|
| $V_1$ | See Table | 24(L+2)/Spacing | I | S+1.5w+4" | ℓ |
| $V_2$ | See Table | 24(L+2)/Spacing | II | 0.75S+4" | 2ℓ+m |
| $W_1$ | See Table | 24(L+2)/Spacing | I | H+2T-4" | ℓ |
| $W_2$ | ½"φ | 2(L+2) | I | H+2T-4" | ℓ |
| $U_1$ | ½"φ | See Table | I | L+12" | ℓ |
| $M_1$ | ½"φ | See Table | III | | 3'6" |
| $M_2$ | ½"φ | 8 | I | (S+1.5w)/Cos α | ℓ |

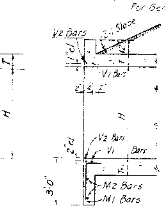
Type I; Type II (n = T-3", m = 1.41n); Type III (2'6", 1'0")

(Bar dimensions are out to out of bar)

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




Note: All wing faces to receive Class I finish.




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

| | |
|---|---|
| Designed by: WWD | Approved by: [signature] |
| Made by: WWD | Bridge Engineer |
| Checked by: TJM | Date: July 1, 1965 |

# STANDARD M-601-B

(JULY 1, 1965)

| FED. ROAD REG. NO. | DIVISION | PROJECT NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLO. | | | |

| REVISIONS | | |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

## Dimensions & Quantities (See Wingwall Standard for Wings)

| Height of Fill Allowed | Type | Clear Spans S1 | Clear Spans S2 | Height H | Slab T | Size of Bars V1 or V3 | Spacing of Bars V | Spacing of Bars W1 | No. Bars Required U1 | No. Bars Required M1 | Quantities for One Lin. Ft. of Box Concrete Cu.Yds. | Quantities for One Lin. Ft. of Box Steel Lbs. | Quantities for Two Headwalls Concrete Cu.Yds. | Quantities for Two Headwalls Steel Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5'-0" | 9-12-A | 9' | 12' | 6'-0" | 10" | 7/8" φ | 7½" | 15" | 136 | 68 Cosco | 2.948 | 4089 | 11.05 | 1177 |
| | | | | 8'-0" | | | | 15" | 148 | | 3.207 | 4256 | 11.79 | 1204 |
| | | | | 10'-0" | | | | 11" | 160 | | 3.467 | 4491 | 12.66 | 1231 |
| 10'-0" | 9-12-B | 9' | 12' | 6'-0" | 11" | ½" φ | 7" | 15" | 136 | 68 Cosco | 3.156 | 3484 | 11.23 | 988 |
| | | | | 8'-0" | | | | 12" | 148 | | 3.415 | 3880 | 12.02 | 1015 |
| | | | | 10'-0" | | | | 8" | 160 | | 3.674 | 3988 | 12.83 | 1042 |
| 15'-0" | 9-12-C | 9' | 12' | 6'-0" | 12" | ½" φ | 5½" | 15" | 136 | 68 Cosco | 3.363 | 4125 | 11.41 | 993 |
| | | | | 8'-0" | | | | 9" | 148 | | 3.622 | 4399 | 12.23 | 1020 |
| | | | | 10'-0" | | | | 6" | 160 | | 3.881 | 4751 | 13.06 | 1047 |
| 5'-0" | 11-14-A | 11' | 14' | 6'-0" | 11" | ¾" φ | 6" | 15" | 156 | 80 Cosco | 3.581 | 5139 | 12.98 | 1282 |
| | | | | 8'-0" | | | | 15" | 168 | | 3.841 | 5306 | 13.70 | 1309 |
| | | | | 10'-0" | | | | 11" | 180 | | 4.100 | 5543 | 14.51 | 1336 |
| 10'-0" | 11-14-B | 11' | 14' | 6'-0" | 12½" | ½" φ | 5½" | 15" | 156 | 80 Cosco | 3.948 | 4771 | 13.23 | 1152 |
| | | | | 8'-0" | | | | 12" | 168 | | 4.207 | 4978 | 14.11 | 1179 |
| | | | | 10'-0" | | | | 8" | 180 | | 4.467 | 5276 | 14.92 | 1206 |
| 15'-0" | 11-14-C | 11' | 14' | 6'-0" | 14" | ½" φ | 5" | 15" | 156 | 80 Cosco | 4.315 | 5156 | 13.55 | 1160 |
| | | | | 8'-0" | | | | 9" | 168 | | 4.574 | 5435 | 14.34 | 1187 |
| | | | | 10'-0" | | | | 6" | 180 | | 4.833 | 5791 | 15.24 | 1214 |
| 5'-0" | 13-16-A | 13' | 16' | 6'-0" | 12½" | ¾" φ | 5½" | 15" | 176 | 92 Cosco | 4.430 | 6266 | 14.95 | 1466 |
| | | | | 8'-0" | | | | 15" | 188 | | 4.689 | 6433 | 15.84 | 1493 |
| | | | | 10'-0" | | | | 10" | 200 | | 4.948 | 6598 | 16.72 | 1520 |
| 10'-0" | 13-16-B | 13' | 16' | 6'-0" | 14" | ½" φ | 5" | 15" | 176 | 92 Cosco | 4.852 | 5839 | 15.50 | 1316 |
| | | | | 8'-0" | | | | 12" | 188 | | 5.111 | 6048 | 16.09 | 1343 |
| | | | | 10'-0" | | | | 8" | 200 | | 5.370 | 6347 | 17.12 | 1370 |
| 15'-0" | 13-16-C | 13' | 16' | 6'-0" | 15½" | ½" φ | 4" | 15" | 176 | 92 Cosco | 5.270 | 6973 | 15.96 | 1324 |
| | | | | 8'-0" | | | | 9" | 188 | | 5.530 | 7254 | 16.45 | 1351 |
| | | | | 10'-0" | | | | 6" | 200 | | 5.788 | 7613 | 17.35 | 1378 |

Note: This design not to be used when height of fill exceeds the allowed amount tabulated. Quantities for one culvert shall be (quantity for one lin. ft of box times L) plus (quantity for two headwalls) plus (quantity for four wings).

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

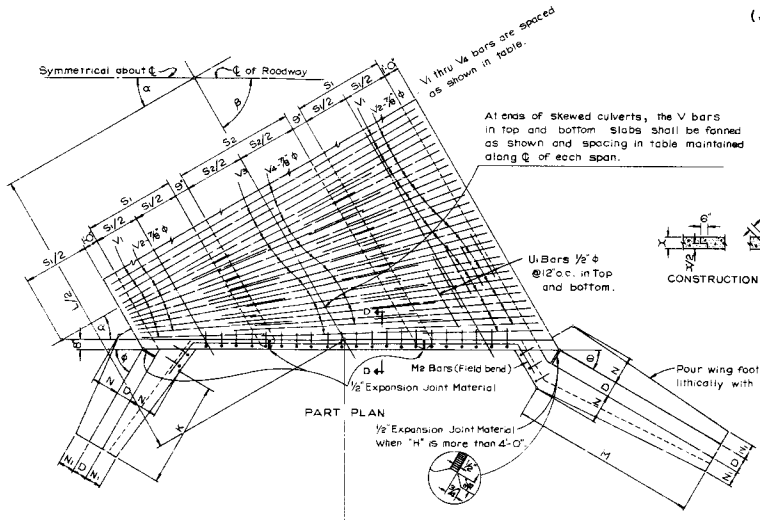
| Mark | Size | Number Required | Type | ℓ | Total Length |
|---|---|---|---|---|---|
| V1 | See Table | 24(L+2) Spacing | I | S1+21" | ℓ |
| V2 | ⅞" φ | | II | 0.61 S2 | 2ℓ+m |
| W1 | ⅞" φ | | I | H+2T-4" | ℓ |
| V3 | See Table | 12(L+2) Spacing | I | S2+22" | ℓ |
| V4 | ⅞" φ | | IV | 0.726 S1 | 3ℓ+2m |
| W2 | ½" φ | 4(L+2) | I | H+2T-4" | ℓ |
| U1 | ½" φ | See Table | I | L+12" | ℓ |
| M1 | ½" φ | | III | | 3'-6" |
| M2 | ½" φ | 12 | I | $\frac{S2+4"}{\cos\alpha}$ | ℓ |

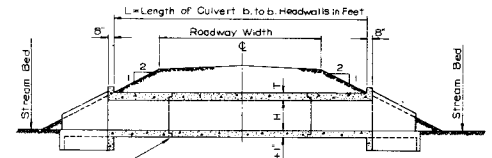
Type I, Type II, Type III, Type IV (n=T-3", m=1.41n)

(Bar dimensions are out to out of bar.)

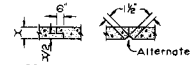
## Possible Combinations (Span and Height)

| | | |
|---|---|---|
| (9'-12'-9') x 6' | (11'-14'-11') x 6' | (13'-16'-13') x 6' |
| " x 8' | " x 8' | " x 8' |
| " x 10' | " x 10' | " x 10' |

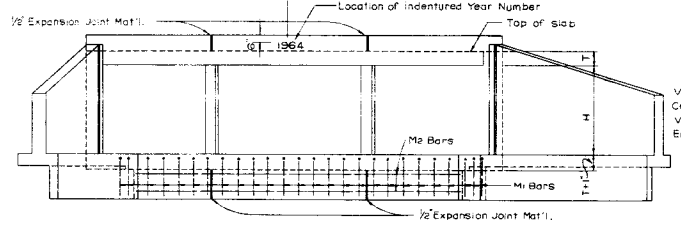



TYPICAL SECTION THROUGH CULVERT

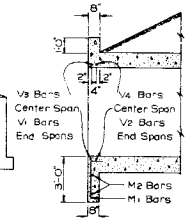



CONSTRUCTION JOINT

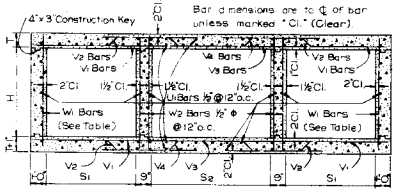



END ELEVATION

Note: All wing faces to receive ordinary surface finish.




SECTION D-D




TYPICAL SECTION THROUGH BOX

Note: K, M, N, N1 and D are dimensioned on Wing Standard.
For General Notes, Loading, and Design Data See Wingwall Standard.

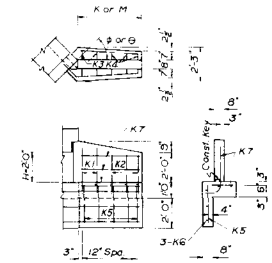
**DEPARTMENT OF HIGHWAYS**
**STATE OF COLORADO**
**TRIPLE**
**CONCRETE BOX CULVERT**
(FOR SIZES SEE TABLE OF POSSIBLE COMBINATIONS)

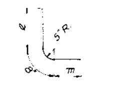
| | |
|---|---|
| Designed by L.D.P. | Approved by [signature] |
| Made by D.S.M. & D.C.L. | Bridge Engineer |
| Checked by P.C. | Date: July 1, 1965 |

# STANDARD M-601-C

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

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



| | ℓ | m | length |
|---|---|---|---|
| K1 | 2'-7" | 5" | 3'-8" |
| K2 | 2'-2" | 4" | 3'-2" |

TYPE I

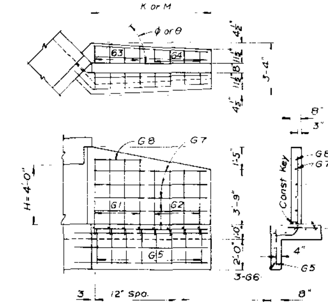
K3 = 1'-5"
K4 = 1'-4"
K5 = 2'-6"

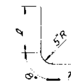
TYPE II

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

| When φ or θ equals | Number of bars required: K1 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 | Length of bars: 3-K6 1/2" φ Type II | 4-K7 1/2" φ Type II | Quantities for One Wing: Concrete Cu.Yd. | Steel Lb. |
|---|---|---|---|---|---|---|---|---|---|
| 22°30' | 4 | 4 | 4 | 4 | 8 | 9'-10" | 7'-8" | 1.47 | 80 |
| 30° | 3 | 3 | 3 | 3 | 6 | 7'-4" | 5'-8" | 1.10 | 59 |
| 37°30' | 3 | 2 | 3 | 2 | 5 | 6'-1" | 4'-8" | 0.92 | 50 |
| 45° | 2 | 3 | 2 | 3 | 5 | 5'-2" | 3'-11" | 0.78 | 45 |
| 52°30' | 2 | 2 | 2 | 2 | 4 | 5'-1" | 3'-5" | 0.69 | 39 |
| 60° | 2 | 2 | 2 | 2 | 4 | 4'-6" | 3'-2" | 0.64 | 37 |
| 67°30' | 2 | 2 | 2 | 2 | 4 | 4'-0" | 2'-11" | 0.60 | 36 |

WING DETAIL WHEN H = 2'-0"



| | ℓ | m | length |
|---|---|---|---|
| G1 | 4'-9" | 1'-0" | 6'-5" |
| G2 | 3'-11" | 9" | 5'-4" |

TYPE I

G3 = 2'-0"
G4 = 1'-10"
G5 = 2'-6"

TYPE II

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

| When φ or θ equals | Number of bars required: G1 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 | Length of bars: 3-G6 1/2" φ Type II | 8-G7 1/2" φ Type II | 1-G8 1/2" φ Type II | Quantities for One Wing: Concrete Cu.Yd. | Steel Lb. |
|---|---|---|---|---|---|---|---|---|---|---|
| 22°30' | 6 | 9 | 6 | 9 | 15 | 17'-4" | 14'-5" | 5'-2" | 3.97 | 219 |
| 30° | 5 | 7 | 5 | 7 | 12 | 13'-2" | 10'-11" | 4'-2" | 3.03 | 170 |
| 37°30' | 4 | 6 | 4 | 6 | 10 | 10'-10" | 8'-11" | 3'-2" | 2.49 | 141 |
| 45° | 4 | 4 | 4 | 4 | 8 | 9'-4" | 7'-8" | 3'-2" | 2.15 | 118 |
| 52°30' | 3 | 5 | 3 | 5 | 8 | 9'-0" | 6'-11" | 2'-2" | 1.95 | 112 |
| 60° | 3 | 4 | 3 | 4 | 7 | 7'-10" | 6'-2" | 2'-2" | 1.75 | 99 |
| 67°30' | 3 | 3 | 3 | 3 | 6 | 7'-0" | 5'-8" | 2'-2" | 1.61 | 88 |

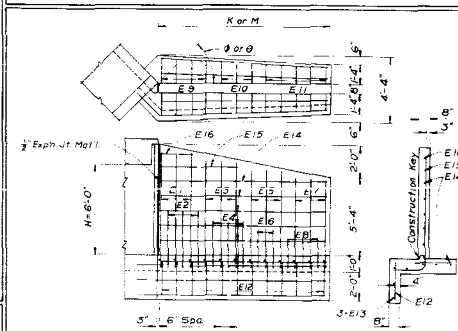
WING DETAIL WHEN H = 4'-0"

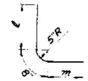
TABLE SHOWING VALUES OF K & M WHEN "β" & "H" ARE GIVEN

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45° | 45° | 67°30' | 22°30' | 3'-3" | 8'-0" | 4'-6" | 11'-0" | 6'-0" | 14'-9" | 7'-6" | 18'-0" | 8'-9" | 21'-0" |
| 60° | 30° | 60° | 30° | 3'-6" | 6'-0" | 5'-0" | 8'-6" | 6'-6" | 11'-3" | 8'-0" | 14'-0" | 9'-3" | 16'-0" |
| 75° | 15° | 52°30' | 37°30' | 3'-9" | 5'-0" | 5'-6" | 7'-0" | 7'-3" | 9'-3" | 8'-9" | 11'-6" | 10'-0" | 13'-3" |
| 90° | 0° | 45° | 45° | 4'-3" | 4'-3" | 6'-0" | 6'-0" | 8'-0" | 8'-0" | 10'-0" | 10'-0" | 11'-6" | 11'-6" |
| 105° | 15° | 37°30' | 52°30' | 5'-0" | 3'-9" | 7'-0" | 5'-6" | 9'-3" | 7'-3" | 11'-6" | 8'-9" | 13'-3" | 10'-0" |
| 120° | 30° | 30° | 60° | 6'-0" | 3'-6" | 8'-6" | 5'-0" | 11'-3" | 6'-6" | 14'-0" | 9'-0" | 16'-0" | 9'-3" |
| 135° | 45° | 22°30' | 67°30' | 8'-0" | 3'-3" | 11'-0" | 4'-6" | 14'-9" | 6'-0" | 18'-0" | 7'-6" | 21'-0" | 8'-9" |

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

EXAMPLE FOR USING THE ABOVE TABLE. Suppose a stream makes an angle of β = 65° with the ℄ of roadway, then, from the table, select the nearest angle, β = 60°, then α, φ, & θ equal 30°, 60° & 30° respectively. If the desired height "H" of culvert is 6'-0", then K & M will be 9'-3" and 16'-0". Locate the WING DETAIL WHEN H = 6'-0" on this sheet.



| | ℓ | m | length |
|---|---|---|---|
| E1 | 7'-0" | 1'-5" | 9'-1" |
| E2 | 3'-4" | 10" | 4'-10" |
| E3 | 6'-6" | 1'-4" | 8'-6" |
| E4 | 2'-8" | 9" | 4'-1" |
| E5 | 6'-0" | 1'-2" | 7'-10" |
| E6 | 2'-2" | 8" | 3'-6" |
| E7 | 5'-6" | 1'-1" | 7'-3" |
| E8 | 1'-8" | 7" | 2'-11" |

TYPE I

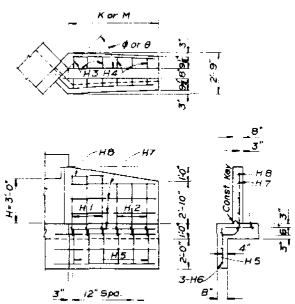
E9 = 2'-6"
E10 = 2'-4"
E11 = 2'-2"
E12 = 2'-6"

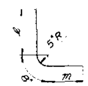
TYPE II

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

| When φ or θ equals | Number of bars required: E1 1/2" φ Type I | E2 5/8" 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 1/2" φ Type I | E8 1/2" φ Type I | E9 1/2" φ Type II | E10 1/2" φ Type II | E11 1/2" φ Type II | E12 1/2" φ Type II | Length of bars: 3-E13 1/2" φ Type II | 9-E14 1/2" φ Type II | 1-E15 1/2" φ Type II | 1-E16 1/2" φ Type II | Quantities for One Wing: Concrete Cu.Yd. | Steel Lb. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22°30' | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 7 | 8 | 21 | 24'-3" | 20'-8" | 10'-2" | 5'-2" | 7.30 | 430 |
| 30° | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 5 | 5 | 6 | 16 | 18'-5" | 15'-8" | 7'-2" | 3'-2" | 5.56 | 326 |
| 37°30' | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 14 | 15'-3" | 12'-11" | 6'-2" | 3'-2" | 4.60 | 278 |
| 45° | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 3 | 5 | 12 | 13'-2" | 11'-2" | 5'-2" | 2'-2" | 3.99 | 240 |
| 52°30' | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 4 | 3 | 10 | 12'-1" | 9'-8" | 4'-2" | 2'-2" | 3.47 | 202 |
| 60° | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 10 | 10'-10" | 8'-11" | 4'-2" | 2'-2" | 3.21 | 194 |
| 67°30' | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 9 | 9'-11" | 8'-5" | 4'-2" | 2'-2" | 3.04 | 180 |

WING DETAIL WHEN H = 6'-0"



| | ℓ | m | length |
|---|---|---|---|
| H1 | 3'-6" | 8" | 4'-10" |
| H2 | 3'-0" | 6" | 4'-2" |

TYPE I

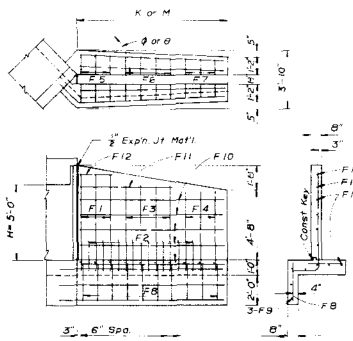
H3 = 1'-9"
H4 = 1'-7"
H5 = 2'-6"

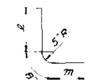
TYPE II

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

| When φ or θ equals | Number of bars required: H1 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 | Length of bars: 3-H6 1/2" φ Type II | 5-H7 1/2" φ Type II | 1-H8 1/2" φ Type II | Quantities for One Wing: Concrete Cu.Yd. | Steel Lb. |
|---|---|---|---|---|---|---|---|---|---|---|
| 22°30' | 6 | 5 | 6 | 5 | 11 | 13-2 | 10-8 | 5-2 | 2.47 | 131 |
| 30° | 5 | 4 | 5 | 4 | 9 | 10-2 | 8-2 | 4-2 | 1.91 | 104 |
| 37°30' | 4 | 3 | 4 | 3 | 7 | 8-4 | 6-8 | 3-2 | 1.57 | 82 |
| 45° | 3 | 3 | 3 | 3 | 6 | 7-1 | 5-8 | 2-2 | 1.35 | 70 |
| 52°30' | 3 | 3 | 3 | 3 | 6 | 7-0 | 5-2 | 2-2 | 1.23 | 68 |
| 60° | 3 | 2 | 3 | 2 | 5 | 6-2 | 4-8 | 2-2 | 1.12 | 59 |
| 67°30' | 3 | 2 | 3 | 2 | 5 | 5-4 | 4-2 | 2-2 | 1.01 | 56 |

WING DETAIL WHEN H = 3'-0"



| | ℓ | m | length |
|---|---|---|---|
| F1 | 6'-0" | 1'-2" | 7'-10" |
| F2 | 2'-3" | 11" | 3'-10" |
| F3 | 5'-4" | 1'-0" | 7'-0" |
| F4 | 4'-10" | 11" | 6'-5" |

TYPE I

F5 = 2'-3"
F6 = 2'-1"
F7 = 2'-0"
F8 = 2'-6"

TYPE II

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

| When φ or θ equals | Number of bars required: 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 | F8 1/2" φ Type II | Length of bars: 3-F9 1/2" φ Type II | 8-F10 1/2" φ Type II | 1-F11 1/2" φ Type II | 1-F12 1/2" φ Type II | Quantities for One Wing: Concrete Cu.Yd. | Steel Lb. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22°30' | 6 | 14 | 7 | 5 | 6 | 7 | 5 | 18 | 20'-11" | 17'-8" | 12'-2" | 5'-2" | 5.61 | 328 |
| 30° | 5 | 11 | 5 | 4 | 5 | 5 | 4 | 14 | 16'-2" | 13'-8" | 9'-2" | 4'-2" | 4.36 | 254 |
| 37°30' | 4 | 9 | 4 | 4 | 4 | 4 | 4 | 12 | 13'-3" | 11'-2" | 7'-2" | 3'-2" | 3.58 | 211 |
| 45° | 3 | 8 | 4 | 3 | 3 | 4 | 3 | 10 | 11'-6" | 9'-8" | 6'-2" | 2'-2" | 3.11 | 180 |
| 52°30' | 3 | 7 | 3 | 3 | 3 | 3 | 3 | 9 | 10'-8" | 8'-5" | 5'-2" | 2'-2" | 2.72 | 160 |
| 60° | 3 | 6 | 2 | 3 | 3 | 2 | 3 | 8 | 9'-6" | 7'-8" | 4'-2" | 2'-2" | 2.49 | 143 |
| 67°30' | 3 | 6 | 3 | 2 | 3 | 3 | 2 | 8 | 8'-7" | 7'-2" | 5'-2" | 2'-2" | 2.33 | 140 |

WING DETAIL WHEN H = 5'-0"

LOADING DATA INTERSTATE ALTERNATE

LIVE LOAD: A.A.S.H.O. (HS 20 - 44)
DEAD LOAD: CONCRETE 150 POUNDS PER CUBIC FOOT
EARTH 84 POUNDS PER CUBIC FOOT

DESIGNING DATA

A.A.S.H.O. 1953 UNIT STRESS, EXCEPT AS NOTED
Reinforcing Steel fs 20000 lbs. per sq. in.
Structural Steel fs 18000 lbs. per sq. in.
fc 1200 lbs. per sq. in.
n 10

GENERAL NOTES

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

ALL CONCRETE SHALL BE CLASS "A".
ALL WING SURFACES TO RECEIVE CLASS I FINISH.
WING FOOTINGS & FLOOR OF BOX SHALL BE POURED MONOLITHICALLY.
FOOTINGS IN ROCK SHALL BE POURED OUT TO ROCK AND NOT FORMED.
SOUNDING AND DEPTH OF FOOTING SHOWN ARE IN ACCORDANCE WITH THE BEST AVAILABLE DATA AND WHEN DIFFERENT CONDITIONS ARE ENCOUNTERED THE BRIDGE ENGINEER WILL INSPECT AND DETERMINE IF RE-DESIGN IS NECESSARY.
ALL REINFORCING STEEL SHALL BE INTERMEDIATE GRADE STEEL OF A DEFORMED TYPE. EACH BAR SHALL BE TAGGED WITH THE NUMBER DESIGNATION AND THE STATION NUMBER OF THE PROJECT. SECONDARY BARS WHEN SPLICED SHALL LAP 17 DIAMETERS OF THE BAR. DIMENSIONS FOR REINFORCING STEEL NOT SHOWN AS CLEAR SHALL BE TO THE CENTER LINE OF THE BAR. OUT TO OUT DIMENSIONS SHALL BE USED ON BAR BENDING DETAILS.
SUPPORTING SOILS FOR ALL CULVERTS MUST BE COMPOSED OF FIRM AND UNIFORM MATERIAL THROUGHOUT.
HORIZONTAL CONSTRUCTION KEYS ARE NOT REQUIRED WHEN FOOTING AND WALL ARE POURED MONOLITHICALLY.
ALL COSTRUCTION KEYS SHOWN BETWEEN FOOTINGS AND WALLS ARE 3" X 3".

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

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

STRUCTURE NO. ____

| REVISIONS | | | |
|---|---|---|---|
| (R-1) | 7-17-67 | General Note | M.R.H. |

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

WINGWALLS FOR
CONCRETE BOX CULVERTS
4:1 SIDE SLOPES

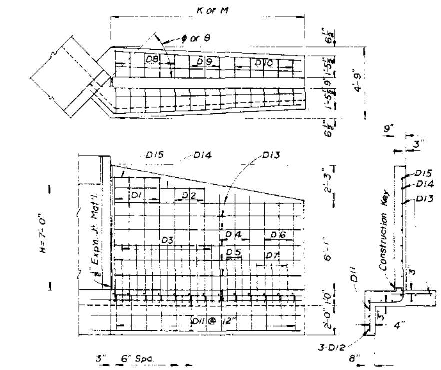
Across ____ Sta. ____
Near ____ Sec. ____ T. ____ R. ____

| | |
|---|---|
| Designed by L.D.P. | Approved by [signature] |
| Made by JWM & RLS | Bridge Engineer |
| Checked by AIT & OSM | Date: July 1, 1965 |

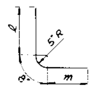
# STANDARD M-601-C

(SHEET 2)
(JULY 1, 1965)

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




WING DETAIL WHEN H = 7'-0"



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

TYPE I

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

TYPE II

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

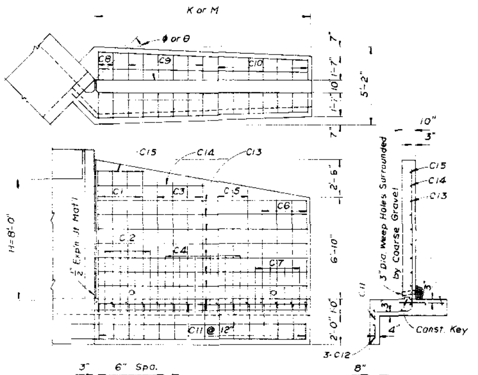
BAR LIST & QUANTITIES FOR ONE WING WHEN H = 7'-0"

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

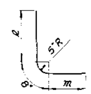
| β | α | φ | θ | H=7'-0" | | H=8'-0" | | H=9'-0" | | H=10'-0" | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | K | M | K | M | K | M | K | M |
| 45° | 45° | 67°30' | 22°30' | 10'-0" | 23'-9" | 11'-0" | 26'-9" | 12'-3" | 29'-6" | 13'-6" | 32'-3" |
| 60° | 30° | 60° | 30° | 10'-6" | 18'-3"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

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

EXAMPLE FOR USING THE ABOVE TABLE. Suppose a stream makes an angle of β=65° with ℄ of roadway, then, from the table, select the nearest angle β=60°, then α, φ, & θ equal 30°, 60°, & 30° respectively. If the desired height "H" of culvert is 8'-0", then "K" & "M" will be 11'-9" & 20'-6". Locate the WING DETAIL WHEN H=8'-0" on this sheet.




WING DETAIL WHEN H = 8'-0"



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

TYPE I

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

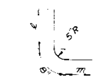
TYPE II

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

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

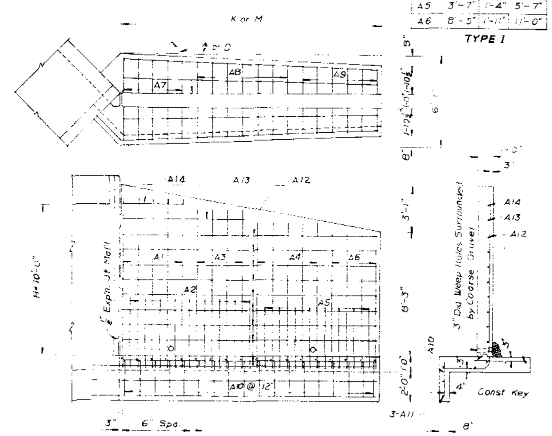
A7 = 3'-5"
A8 = 3'-2"
A9 = 2'-9"
A10 = 2'-6"

TYPE II



| | ℓ | m | length |
|---|---|---|---|
| A1 | 10'-8" | 2'-5" | 13'-9" |
| A2 | 4'-1" | 1'-6" | 6'-3" |
| A3 | 9'-11" | 2'-3" | 12-10" |
| A4 | 9'-2" | 2'-1" | 11'-11" |
| A5 | 3'-7" | 1'-4" | 5'-7" |
| A6 | 8'-5" | 1'-11" | 11'-0" |

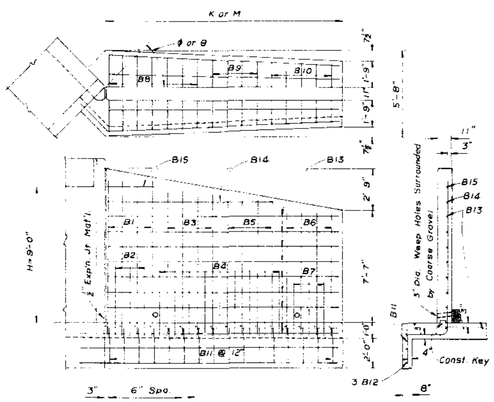
TYPE I



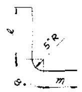

WING DETAIL WHEN H = 10'-0"

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

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




WING DETAIL WHEN H = 9'-0"



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

TYPE I

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

TYPE II

| When φ or θ equals | Number of bars required | | | | | | | | | | | Length of bars | | | | Quantities for One Wing | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B1 5/8" φ Type I | B2 3/4" φ Type I | B3 5/8" φ Type I | B4 5/8" φ Type I | B5 1/2" φ Type I | B6 1/2" φ Type I | B7 1/2" φ Type I | B8 5/8" φ Type II | B9 1/2" φ Type II | B10 1/2" φ Type II | B11 1/2" φ Type II | 3-B12 1/2" φ Type II | 12-B13 1/2" φ Type II | 1-B14 1/2" φ Type II | 1-B15 1/2" φ Type II | Concrete Cu. Yd. | Steel Lb. |
| 22°30' | 7 | 6 | 8 | 16 | 8 | 7 | 7 | 13 | 8 | 9 | 30 | 33'-9" | 29'-2" | 22'-2" | 6'-2" | 15.93 | 930 |
| 30° | 5 | 5 | 7 | 13 | 6 | 6 | 5 | 10 | 7 | 7 | 24 | 27'-0" | 23'-5" | 17'-2" | 4'-2" | 12.82 | 742 |
| 37°30' | 4 | 4 | 5 | 10 | 5 | 5 | 4 | 8 | 5 | 6 | 19 | 21'-1" | 18'-2" | 13'-2" | 3'-2" | 9.98 | 580 |
| 45° | 4 | 3 | 4 | 9 | 4 | 4 | 3 | 7 | 4 | 5 | 16 | 18'-2" | 15'-8" | 11'-2" | 3'-2" | 8.63 | 495 |
| 52°30' | 3 | 3 | 4 | 8 | 4 | 4 | 3 | 6 | 4 | 5 | 15 | 17'-0" | 13'-11" | 10'-2" | 2'-2" | 7.69 | 453 |
| 60° | 3 | 3 | 4 | 7 | 3 | 3 | 2 | 6 | 3 | 4 | 13 | 15'-1" | 12'-8" | 9'-2" | 2'-2" | 7.01 | 406 |
| 67°30' | 3 | 2 | 3 | 7 | 4 | 3 | 3 | 5 | 3 | 5 | 13 | 13'-9" | 11'-11" | 9'-2" | 2'-2" | 6.61 | 385 |

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

REVISIONS

| | | |
|---|---|---|
| | | |

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

WINGWALLS FOR
CONCRETE BOX CULVERTS
4:1 SIDE SLOPES

Across
Sta.
Near Sec. T. R.

Designed by L.D.P. | Approved by [signature]
Made by JWM & RLS | Bridge Engineer
Checked by AIT & GSM | Date: July 1, 1965

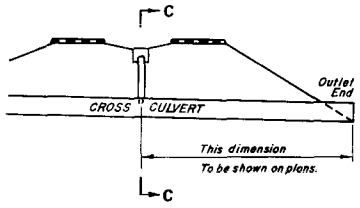
STRUCTURE NO.

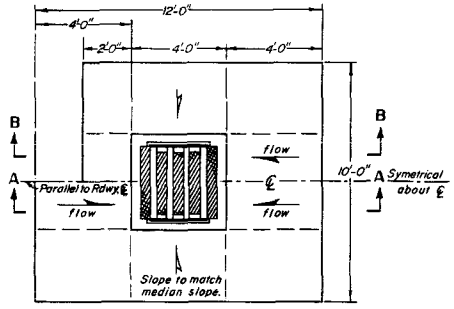
# STANDARD M-604-BA

(JUNE 1, 1967)

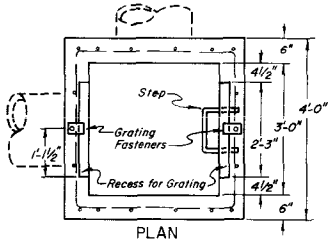
| FEDERAL ROAD REGION NO. | DISTRICT | PROJ. NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 9 | COLORADO | | | |

| REVISIONS | | | |
|---|---|---|---|
| R-1 | 9-13-67 | Grate Detail & Quants. | M.R.H. |
| R-2 | 12-18-67 | Connect to skewed culvert, General Note | M.R.H. |

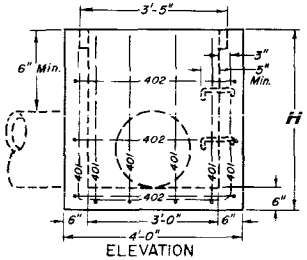



LAYOUT OF INLET IN MEDIAN DITCH

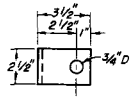


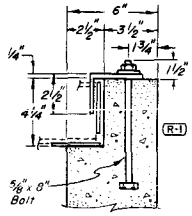

PLAN




ELEVATION

CONCRETE INLET




SECTION D-D R-1

DETAIL OF RECESS AND GRATING FASTENER

(2 REQUIRED)

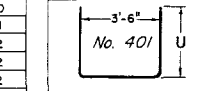
## QUANTITIES FOR ONE INLET

| H | CLASS "A" CONCRETE *(CU. YDS.) | REINF. STEEL (LBS.) | NO. STEPS REQ'D. |
|---|---|---|---|
| 3'-0" | 1.0 | 83 | 0 |
| 3'-6" | 1.1 | 89 | 0 |
| 4'-0" | 1.2 | 105 | 0 |
| 4'-6" | 1.4 | 111 | 1 |
| 5'-0" | 1.5 | 127 | 2 |
| 5'-6" | 1.6 | 134 | 2 |
| 6'-0" | 1.7 | 150 | 2 |
| 6'-6" | 1.9 | 157 | 3 |
| 7'-0" | 2.0 | 172 | 3 |
| 7'-6" | 2.1 | 178 | 3 |
| 8'-0" | 2.3 | 194 | 4 |
| 8'-6" | 2.4 | 201 | 4 |
| 9'-0" | 2.5 | 217 | 4 |
| 9'-6" | 2.7 | 223 | 5 |
| 10'-0" | 2.8 | 239 | 5 |
| 11'-0" | 3.0 | 261 | 6 |
| 12'-0" | 3.3 | 283 | 6 |

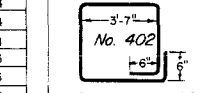
* Note: Volume occupied by pipes to be deducted.

## BAR LIST FOR H=3' AND BENDING DIAGRAM

| MARK | NO. REQ'D | HGT. "U" | LENGTH |
|---|---|---|---|
| 401 | 9 | 2'-7" | 8'-8" |
| 402 | 3 | | 15'-4" |

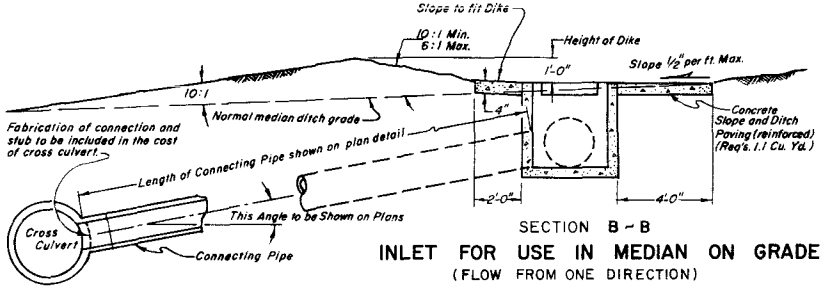



Increase dimension "U" 6" for each 6" increase of H above 3'-0".




Add one bar for each foot increase of H above 3'-0".

All bars to be ½" Dia.—Cut or bend around pipes as required.




SECTION B-B

INLET FOR USE IN MEDIAN ON GRADE

(FLOW FROM ONE DIRECTION)

SECTION C-C

DETAIL SHOWING MEDIAN INLET CONNECTED TO A CROSS CULVERT

## GENERAL NOTES

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

All concrete shall be Class "A" or Class "D".

For detail of Inlet Step, see M-Standard "Steps for Manholes and Inlets".

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

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

Concrete slope and ditch paving shall conform to Section 507. Reinforcement for concrete slope paving shall be 4 x 4, 10/10.

Grating shall conform to Section 604.

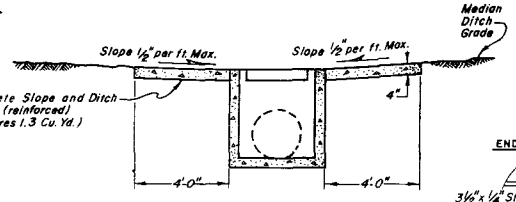
Inlet grating shall be galvanized as described for Frames, Grates, Covers and Steps in Section 712.

R-2 Steps or ladder will be required when Inlet depth exceeds 3'-6"

## MATERIAL LIST FOR GRATING, FASTENERS

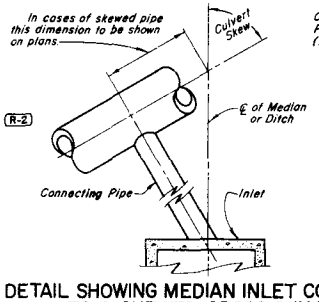
| PART | NO. REQ'D. | SIZE | LBS. PER UNIT | WEIGHT ~ LBS. |
|---|---|---|---|---|
| Strap Iron | 2 | 3½"x1/4"x2'-2⅝" | 2.96/ft. | 13.2 |
| Strap Iron | 2 | 3"x1/4"x2'-2⅝" | 2.6/ft. | 11.5 |
| Beam | 4 | 4I 7.7 x 3'-4" | 7.7/ft. | 102.7 |
| Fastener | 2 | 6"x1/4"x2 1/2" | 1.0 ea. | 2.0 |
| Bolt | 2 | 5/8" x 8" | 0.8 ea. | 1.5 |
| Washer | 2 | | 0.1 ea. | 0.2 |
| | | TOTAL WEIGHT | | 131.2 |

R-1

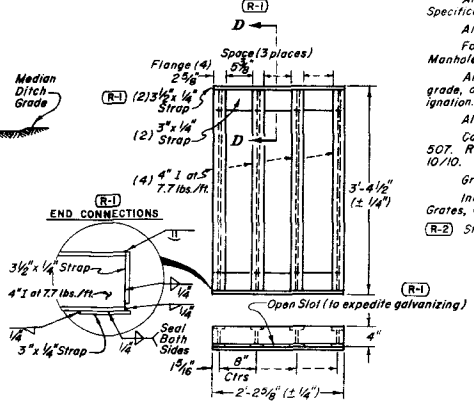



SECTION A-A

INLET FOR USE IN MEDIAN AT BOTTOM OF VERTICAL CURVE




DETAIL SHOWING MEDIAN INLET CONNECTED TO A SKEWED CROSS CULVERT




DETAIL OF GRATING

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

INLET, TYPE C

| | |
|---|---|
| Designed by D. B. R. | Approved by J. E. Olson |
| Made by J. R. B. | Staff Design Engineer |
| Checked by R. S. M. | Date: JUNE 1, 1967 |

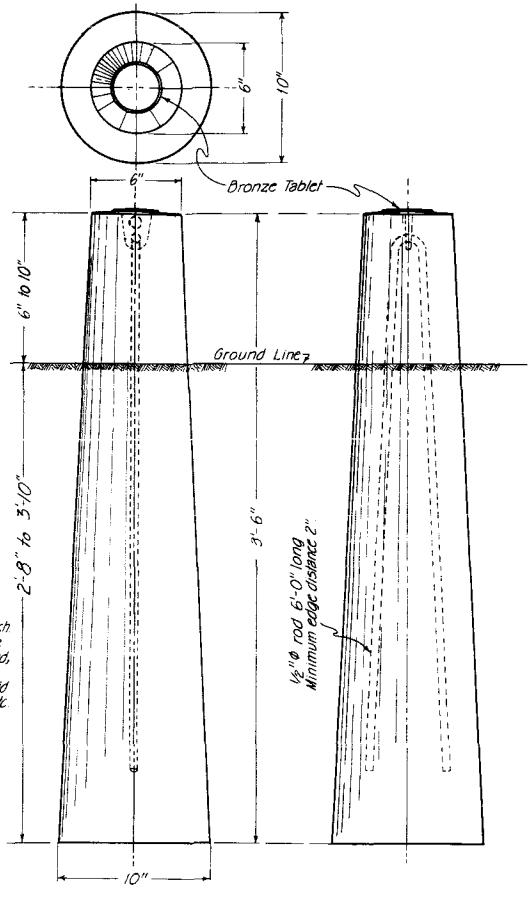
# RIGHT OF WAY MARKER POST

# STANDARD M-612-A

(JULY 1, 1965)

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

| REVISIONS | | | |
|---|---|---|---|
| R-1 | 5-2-66 | R.O.W. Marker Note | M.R.H. |



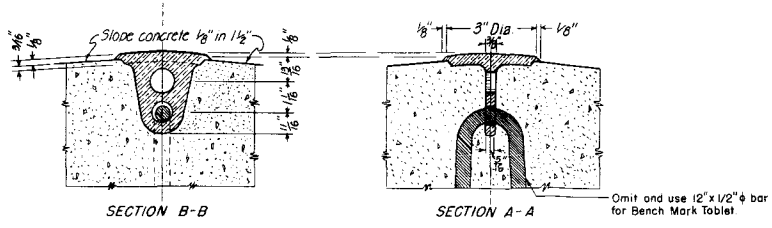

## NOTES FOR R.O.W. MARKER POSTS

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

Posts shall be made of class 'A' Concrete. The upper 12 inches of marker posts shall be rubbed free of form marks, and the top surface of the post must be constructed to drain thoroughly.

(R-1) Light weight aggregate conforming to ASTM Designation C-330 will be allowed.

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




SECTION B-B

SECTION A-A

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

## BENCH MARK

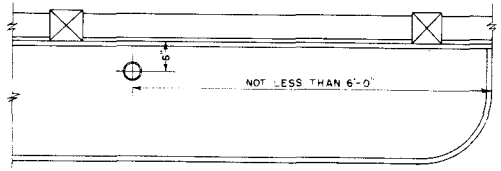
All work shall be done in accordance with Standard Specifications applicable to the project.

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

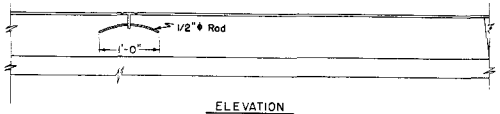
Bronze Bench Mark Tablets will be furnished by the Department at no expense to the Contractor.

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

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




PLAN




ELEVATION

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

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

MARKER POSTS AND BENCH MARKS

| | |
|---|---|
| Designed by R.E.L. | Approved by L.E. Olson |
| Made by E.E.D. | Staff Design Engr. |
| Checked by R.E.L. | Date: July 1, 1965 |

# STANDARD M-614-TB

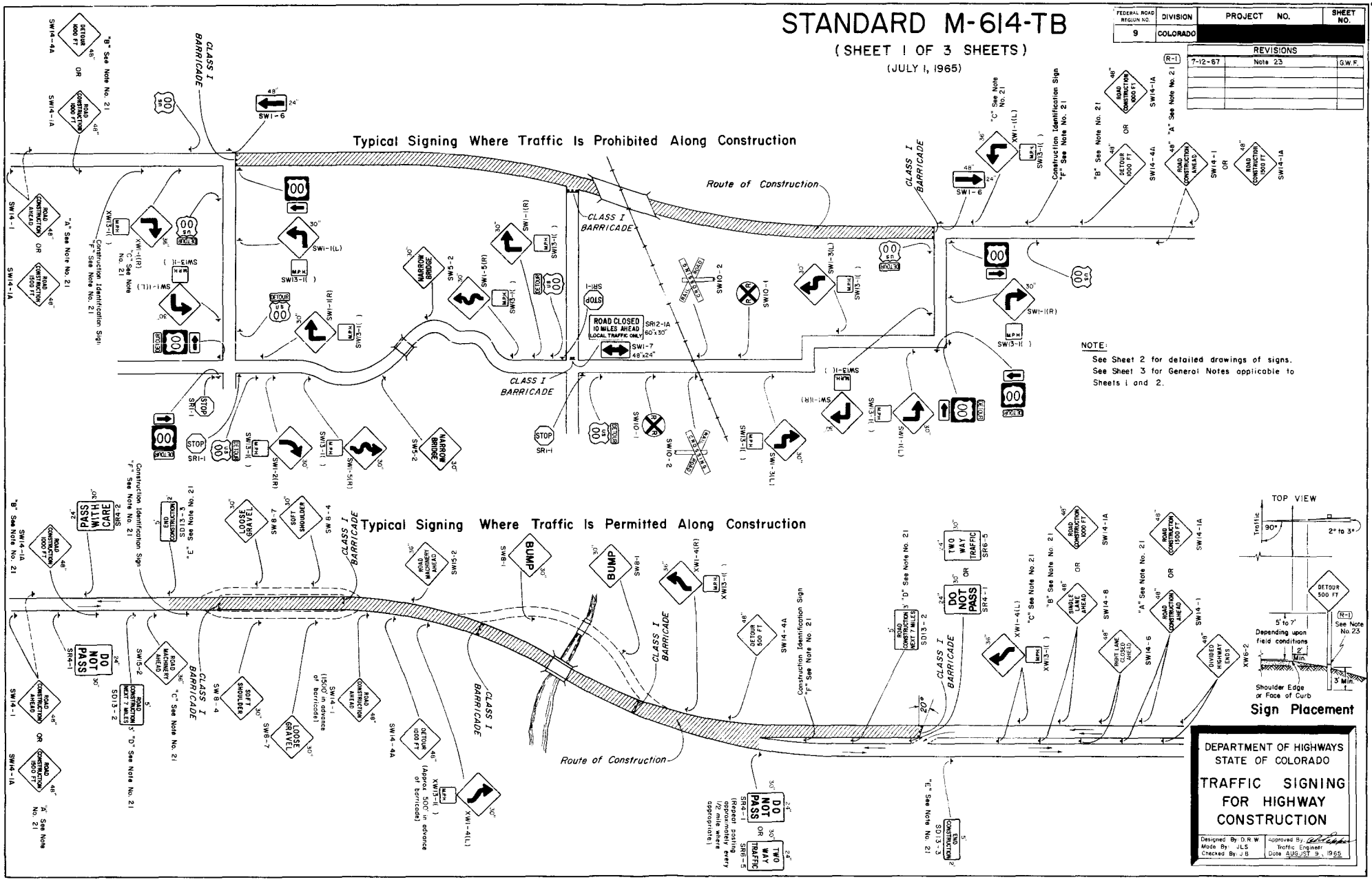
(SHEET 1 OF 3 SHEETS)

(JULY 1, 1965)

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

REVISIONS

| | | |
|---|---|---|
| 7-12-67 | Note 23 | G.W.F. |



# STANDARD M-614-TB

(SHEET 2 OF 3 SHEETS)

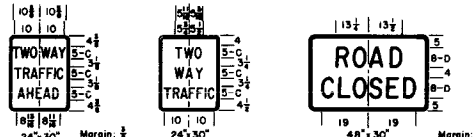
(JULY 1, 1965)

| FEDERAL ROAD REGION NO. | DIVISION | PROJECT NO. | SHEET NO. |
|---|---|---|---|
| 8 | COLORADO | | |

| REVISIONS | | | M.R.H. |
|---|---|---|---|
| R-1 | 7-12-67 | | |
| | | | |
| | | | |
| | | | |

## REGULATORY SIGNS

See Note No. 9




24"x30" SR6-3 — Margin: 3/8, Border: 3/8, Corner Radius: 1 1/2

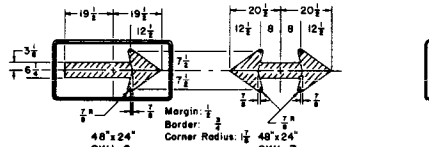
24"x30" SR6-5

48"x30" SR12-1 — Margin: 1/2, Border: 3/4, Corner Radius: 1 7/8

60"x30" SR12-1A

## WARNING SIGNS

See Note No. 10




48"x24" SW1-6 — Margin: 1/2, Border: 3/4, Corner Radius: 7/8

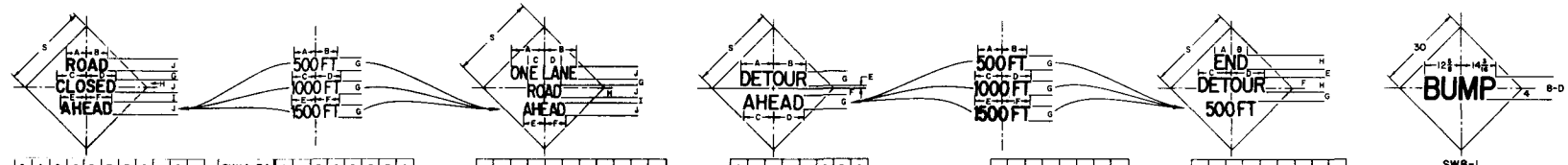
48"x24" SW1-7

| | Panel | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SW13-1 | 18"x18" | 3/8 | 5 1/2 | 5 11/16 | 2 1/4 | 8-C | 2 | 3-E | 2 3/4 | 3/4 | 5 3/16 |
| XW13-1 | 24"x24" | 5/8 | 6 5/8 | 6 13/16 | 3 1/2 | 10-C | 2 3/4 | 4-E | 4 | 15/16 | 6 7/8 |

Margin: 3/8, Border: A, Corner Radius: 1 1/2

## WARNING SIGNS

See Note No. 10




| | S | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SW14-3 | 48 | 11 1/2 | 22 1/2 | 6 3/4 | 16 1/2 | 14 1/2 | 4 1/2 | 4 1/2 | 5 1/2 | 7-D | |
| CW14-3 | 36 | 8 1/2 | 8 1/2 | 11 1/2 | 11 1/2 | 10 1/2 | 10 1/2 | 3 1/2 | 3 1/2 | 5 1/2 | 6-D |

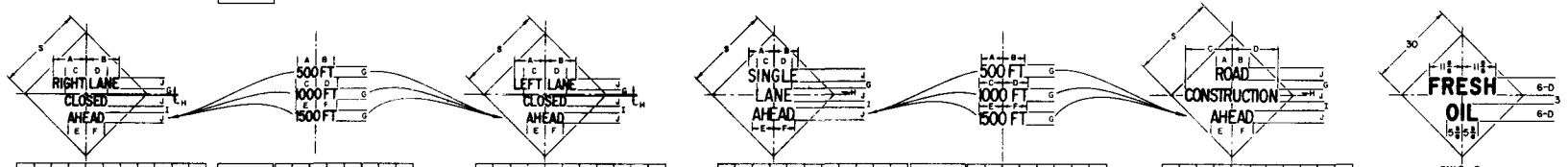
| | S | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| SW14-3A, SW14-5A | 48 | 12 | 12 1/2 | 13 1/2 | 14 1/2 | 13 1/2 | 13 1/2 | 7-C |
| CW14-3A, CW14-5A | 36 | 8 1/2 | 8 1/2 | 9 1/2 | 10 1/2 | 9 1/2 | 9 1/2 | 5-C |

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

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

| | S | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| SW14-4A, SW14-4B | 48 | 13 1/2 | 13 1/2 | 15 | 16 1/2 | 15 1/2 | 15 1/2 | 8-C |
| CW14-4A, CW14-4B | 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 |
|---|---|---|---|---|---|---|---|---|---|
| SW14-4B | 48 | 9 1/2 | 9 | 18 3/16 | 18 3/16 | 4 1/2 | 6 | 5 | 8-D |
| CW14-4B | 36 | 6 1/2 | 6 1/2 | 13 1/2 | 13 1/2 | 3 1/2 | 4 1/2 | 3 1/2 | 6-D |




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

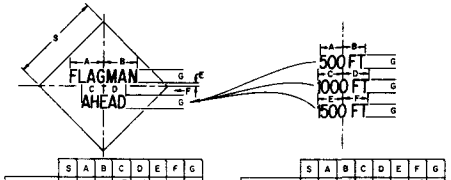
| | S | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| SW14-6A | 48 | 10 1/2 | 10 1/2 | 11 1/2 | 12 1/2 | 11 1/2 | 11 1/2 | 6-C |
| SW14-7A | 48 | 10 1/2 | 10 1/2 | 11 1/2 | 12 1/2 | 11 1/2 | 11 1/2 | 6-C |
| CW14-6A | 36 | 8 1/2 | 8 1/2 | 9 1/2 | 10 1/2 | 9 1/2 | 9 1/2 | 5-C |
| CW14-7A | | | | | | | | |

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

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

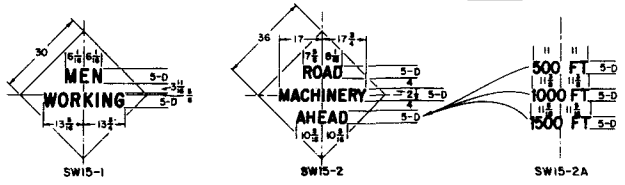
| | S | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| SW14-1A | 48 | 12 | 12 1/2 | 13 1/2 | 14 1/2 | 13 1/2 | 13 1/2 | 7-C |
| CW14-1A | 36 | 9 1/2 | 9 1/2 | 10 1/2 | 9 1/2 | 9 1/2 | 9 1/2 | 5-C |
| CW14-8A | | | | | | | | |

| | 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 1/16 | 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 |
|---|---|---|---|---|---|---|---|---|
| SW14-9 | 48 | 18 | 18 | 11 1/2 | 11 1/2 | 4 1/2 | 4 1/2 | 7-C |
| CW14-9 | 36 | 15 1/2 | 15 1/2 | 10 1/2 | 10 1/2 | 3 1/2 | 4 1/2 | 6-C |

| | S | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| SW14-9A | 48 | 12 | 12 1/2 | 13 1/2 | 14 1/2 | 13 1/2 | 13 1/2 | 7-C |
| CW14-9A | 36 | 10 1/2 | 10 1/2 | 11 1/2 | 12 1/2 | 11 1/2 | 11 1/2 | 6-C |

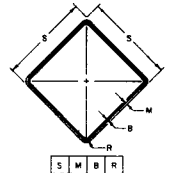



SW15-1

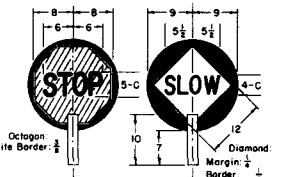
SW15-2

SW15-2A

## PLATE DETAILS



| S | M | B | R |
|---|---|---|---|
| 30 | 1/4 | 3/4 | 7/16 |
| 36 | 3/8 | 7/8 | 2 1/4 |
| 48 | 3/4 | 1 1/2 | 3 |




Octagon: White Border: 3/8

Diamond: Margin: 1/4, Border: 1/4, Corner Radius: 3/4

FLAGMAN SIGN

See Notes No. 20 and 22

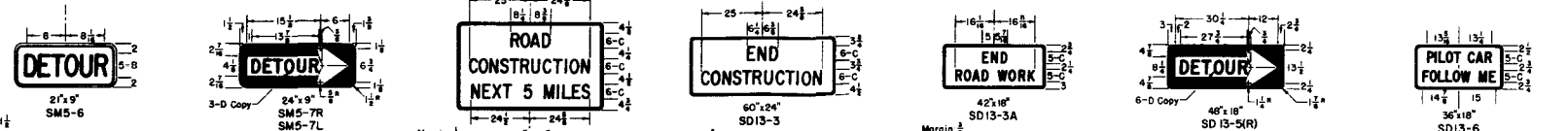
## NOTES:

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




21"x9" SM5-6 — Margin: 3/8, Border: 3/8, Corner Radius: 1 1/2

24"x9" SM5-7R, SM5-7L — 3-D Copy

60"x36" SD13-2 — Margin: 1/2, Border: 3/4, Corner Radius: 1 7/8

60"x24" SD13-3 — Margin: 3/8, Border: 3/8, Corner Radius: 1 1/2

42"x18" SD13-3A — Margin: 3/8, Border: 3/8, Corner Radius: 1 1/2

48"x18" SD13-5(R), SD13-5(L) — 6-D Copy

36"x18" SD13-6 — Margin: 3/8, Border: 3/8, Corner Radius: 1 1/2

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

TRAFFIC SIGNING FOR HIGHWAY CONSTRUCTION

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

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

| FEDERAL ROAD REGION NO. | DIVISION |
|---|---|
| 9 | COLORADO |

| | REVISIONS | | |
|---|---|---|---|
| R-1 | 7-12-67 | Added Note 23 | G.W.F. |
| | | | |
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| | | | |
| | | | |

# STANDARD M-614-TB

## (SHEET 3 OF 3 SHEETS)

(JULY 1, 1965)

## GENERAL NOTES

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

2. Where traffic is maintained through or over any part of the Project the Contractor will be required to mark all hazards within the limits of the Project (including connecting roads) with well-maintained Barricades, Warning, and Guide Signs. All Barricades and Signs shall be moved, added to, changed or removed as required during the progress of construction and removed entirely when the Project is completed.

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

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

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

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

7. Examples for marking Projects, as shown on Sheet 1, are typical of signs required and are subject to alteration to fit actual conditions encountered in the field. Locations for control devices are to be staked by the Engineer. In all cases Warning signs are to be placed well in advance of the hazard, the distance depending on topography and existing approach speeds. Additional markings and any special signs required for the guidance and protection of traffic will be placed as required on the Project at the Contractor's expense.

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

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

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

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

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

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

14. *Posts for regulatory, warning, and guide signs will normally be 4"x 4" or 6"x 6"* and shall conform to the Standard Specifications for Untreated Timber-S4S. Timber shall conform to Construction grade Paragraph 123B or 125B of Standard No. 15 Grading & Dressing Rules for West Coast Douglas Fir (1956) or Dense Structural 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. Torches and Lanterns shall be either of the fuel-burning or battery-powered type approved by the Department. Particular care shall be taken to protect all signs and barricades from smoke and smudge.

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

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

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

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

(R-1) 23. Each timber post shall be provided with a single hole drilled through the neutral axis normal to the roadway 3" above the ground level. The holes shall be 1¼" Ø for 6"x 6" and 1" Ø for 4"x 4" timber posts. The underground portion plus 6" shall be treated with creosote.

SPECIAL NOTE: Requirements of this Standard are optional to those of Standard M-614-TA through 12-31-65. Following that date Standard M-614-TA will be obsolete.

DEPARTMENT OF HIGHWAYS
STATE OF COLORADO

TRAFFIC SIGNING FOR HIGHWAY CONSTRUCTION

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