ARIZONA HIGHWAY DEPARTMENT

ROADWAY CONSTRUCTION

STANDARDS
"C"

1971

HIGHWAY PLANS SERVICES

Thomas H. Scheek
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GENERAL NOTES

The desirable maximum embankment slope rate shall be 4:1 within interchange and grade separation areas.

See Plans for details of roadway width, cut ditch, type and thickness of roadway surfacing, and superelevation. Standard cut and embankment slopes as shown on this sheet may be superseded by special slopes where shown on plans.

For cuts up to 6' use 5' semitangents for slope rounding. For each additional foot of cut add 1' to semitangent to 11' maximum.

Should median slopes intersect see design supplement sheet.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

SLOPES
INTERSTATE AND
CLASS A-A ROADWAYS

Drawing No. C-2.01
MINIMUM SLOPES

NOTE: Std. slope rounding not shown-see General Notes.

INTERMEDIATE SLOPES

PAVED GUTTER IN CUTS

GENERAL NOTES
See Plans for details of roadway width, cut ditch, type and thickness of roadway surfacing, superelevation, and curve widening.

Standard cut and embankment slopes as shown on this sheet may be superseded by special slopes where shown on Plans.

For cuts up to 6' use 5' semitangents for slope rounding. For each additional foot of cut add 1' to semitangent to 11' maximum.

MINIMUM DITCH CONDITION

TYPICAL SECTIONS
MINIMUM SLOPES

Slope measured with respect to subgrade slope.

DETAIL ILLUSTRATING SUBGRADE & EMBANKMENT SLOPE CONTROL

GENERAL NOTES
See Plans for details of roadway width, cut ditch, type and thickness of roadway surfacing, shoulder elevation, and curve widening.

Standard cut and embankment slopes as shown on this sheet may be superseded by special slopes where shown on Plans.

For cuts up to 6' use 5' semitangent for slope rounding. For each additional foot of cut add 1' to semitangent to 11' maximum.

ARIZONA HIGHWAY DEPARTMENT CONSTRUCTION SECTION

SLOPES
CLASS C & D ROADWAYS

Approved Asst. State Eng. Const. C-2.03
### CUMULATIVE PERCENT OF CROWN "C" FOR EACH FOOT RIGHT OR LEFT OF X

<table>
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<tr>
<th>X</th>
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<th>6'</th>
<th>8'</th>
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<td>0.86</td>
<td>0.89</td>
<td>0.91</td>
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</tr>
</tbody>
</table>

### FORMULA

\[
W = \frac{Y}{\text{CUMULATIVE PERCENT OF CROWN "C"}}
\]

### USE OF TABLE
- **Example:** Assume \( W = 40 \) ft. and \( C = 0.45 \) ft.
- Find \( Y \) for \( X = 8 \) ft.

Table shows \( Y = 16\% \) of \( C \), or \( 0.16 \times 0.45 = 0.072 \) ft.

### PARABOLIC CROWN FORMULA AND TABLE

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ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

Rev. 27-58
CROWN DYKE

CROWN DITCH

TYPE A DYKE

TYPE B MEDIAN DYKE

GENERAL NOTES

Bituminous or soil cement protection shall be applied to dyke surfaces as called for on Plans. Dimensions of ditches and dykes, as shown on Plans, are width, depth or height and length. Ditches shall be constructed with a minimum grade to prevent excessive erosion. Ditch outlets shall be provided per Plans. Ditch sections shown may be varied by the Engineer.

CHANNEL

GRADER DITCH

TYPICAL DYKE INSTALLATION AT STRUCTURE

Place dykes at structures to create a water cushion.

DITCHES AND DYKES

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

Rev
5/72

Drawn
G.H.

Traced
J.A.B.

Plan and
Check
R.S.

Approved Asst.
State Eng. Co.

C-3.01
GENERAL NOTES
Concrete for the spillway inlet, spillway and outlet shall be Class A. Concrete for the embankment curb shall be as specified in the Specifications.

SECTION A-A
6 x 6-10/10 wire mesh

SINGLE INLET
Flow A C. Pavement
Subgrade shoulder
Fill slope
Sym. about k for Double Inlet

SPILLWAY SECTION
1/2" expansion joint,
Preformed joint filler.

EMBANKMENT CURB
Indicates inlet
Indicates spillway
Preferred guard rail post location.

NOTE: Depress curb ends with 10:1 slope
Roadway Width

OUTLET DETAIL
Finish grade
6 x 6-10/10 wire mesh cont. bottom & sides.

SECTION ON SPILLWAY & DOUBLE INLET
A.C.
Spillway
Outlet
6 x 6-10/10 wire mesh in apron

Note: When the outlet is used, the wire mesh shall extend through the joint into the outlet in lieu of bending into the key.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION
CONCRETE SPILLWAY INLET & OUTLET
EMBANKMENT CURB

Drawing No. C-4.01

Approved Asst. State Engr. C. L. S. A.
GENERAL NOTES

Use 12", 16 ga. corrugated metal pipe.

24" X 4'-0" C.M.P. tank, 6" X 1'-0" C.M.P. stub and angle supports shall be shop fabricated welded and galvanized in accordance with AASHTO M 36.

Round all exposed concrete corners.

Coupling bands for pipe 21" dia. and smaller may be 18 ga.

All C.M.P. and fittings shall be annular.

---

**ARIZONA HIGHWAY DEPARTMENT**

**PLANS DIVISION**

**SPILLWAY INLET**

**C.M.P. DOWNDRAIN OUTLET**

---

**SECTION A-A**

- Elbow
- 1'-0" C.M.P. outlet on rock
- 6 X 6-10/10 wire mesh in apron
- 1'-3"

**OUTLET-HEADWALL AND CONCRETE APRON**

- Varies with fill slope and pipe cover.

**OUTLET DETAIL**

---

**DETAIL-ANGLE SUPPORTS FOR TRASH RACK**

- #3 bars
- 5/16" x 3" 1/2" J-bolts 2 required with nuts

**DETAIL ANCHOR**

- #9 galv. wire ties double wrapped
- Anchor stakes
- #6 bar 6' long 10" c to c
- 3/16" I.D.

---

**PLAN-INLET**

- 1/2" expansion joint. Preformed joint filler
- Warp inlet cor to meet elevation of top of tank
- 1/4" X 3 1/2"
- 2-way flow
- 3/8" hole

---

**DETAIL-TRASH RACK TO BE GALVANIZED**

- 3/8"
- 1'

---

**OUTLET DETAIL**

- 1" water level section
- 6' - 0"
- 5'-6"
- 4'-0"
- 3'-0"
- 2'-0"
- 1'-0"
- 3'-0" I.D.
- 3/8"

---

**OUTLET DETAIL**

- A.C. Pavement
- Flow
- 2'-0"
- 1'-0"
- 3'-0" I.D.
- 3/8"
- 5" x 3" x 1 3/8"
- Tack weld
- 5/16" galv. 4 required
- #4 bars, 1'-0" c to c horiz. and vert. Place 1 1/2" clear to inside of wall. Bend end and wall vertical bars 1'-0" into floor.
- 3/8" hole
- 2-way flow
- symm. about #
GENERAL NOTES

For C-2.01 slopes with emb. height over 24', L = 1 for 24' emb. height from table + 2.24(emb. height - 24).
For C-2.02 slopes with emb. height over 32', L = 4 for 32' emb. height from table + 1.8(emb. height - 32).
For C-2.03 slopes with emb. height over 13', L = 1 for 13’ emb. height from table + 1.8(emb. height - 13).
• Indicates thickness of pavement structure
• Indicates Length of Spillway.
NOTE: Radii shown for single curbs are typical throughout as shown on plans.

SINGLE CURB  
roadway width  
1'-0"  
1/4" R  
1/4" batter  
6'-0"  
1/4" R  
1" batter  
7'-0"  
1/2" batter

COMBINED CURB & GUTTER  
roadway width  
2 1/2"  
6"  
2'-0"  
6"  
1 1/4" R  
1/2" batter  
6'-11"  
1 1/4" R  
1/2" batter

CURB TERMINAL SECTION  
width as shown on plans  
Slope .01' per ft.  
Sidewalk shall be single course Class A concrete, sweat finished and jointed with a 1/8" deep jointing tool at centers approximately equal to the width of the sidewalk. Sidewalk shall be scored to a depth of 1" at intervals matching the joints in the adjacent curb. Sidewalk shall be edged with a 1/8" radius edging tool.

CONCRETE SIDEWALK

TYPE 'A'
For 6" curb height or over

TYPE 'E'

TYPE 'G'

VALLEY GUTTER

4 1/2"  
1/2" R  
1/4" R  
1'-4"  
1'-0"  
1 1/4" R  
1/2" batter  
7'-0"  
1 1/4" R  
1/2" batter

SECTION A-A  
joint is required between driveway slab and adjacent sidewalk.

计划

ARIZONA HIGHWAY DEPARTMENT  
PLANS DIVISION  
CURB, GUTTER,  
SIDEWALK & DRIVEWAY  
DETAILS

DRAVEN  
O.K.  3-1935
TRACED  
R.A.F.  6-8-67
CHECKED  
J.P.O.  2/8-68
APPROVED  
Engr. Plans  3/8-68

C-5.01
Typical Valley Gutter Construction at Street Intersection or Alley.

Curb & Gutter Measurement on Curves.

Formulas for Quarter Points:

\[ S = \text{Sum of intersecting pavement widths, (Distance between gutter grade lines)} \]
\[ D = \text{Drop from center of intersection to center of return} \]
\[ \text{where } S = \begin{cases} 0' & 90', & F = 0.17 \\ 91' & 100', & F = 0.18 \\ 101' & 110', & F = 0.19 \\ 111' & 136', & F = 0.20 \end{cases} \]
\[ PD = \text{Drop from center of intersection to quarter point.} \]

Street Intersection Grades.
GENERAL NOTES

Paved Turnouts: Width 10' Minimum & 40' Maximum.
Plans notation will be W x L, Surface Material, Type & Standard.
Example: 16' x 30' A.C.T.O. Type "A" Standard C-6.01.

Base material shall be the same as that shown for main roadway, unless otherwise noted.

Excavation or Embankment for turnouts shall be included in quantities for main roadway.

Dimensions indicated as minimum shall be avoided wherever possible in favor of those indicated as desirable.

Curbed driveways and depressed curbs shall be located as noted on Plans or as directed by the Engineer.

All radii shown are to back of curb.

RURAL DEVELOPMENTS:

Res. - 20' Max.
Con. - 30' Max.

10' Min. - 20' Desirable
15' Min. - 40' Desirable

10' Min. - 20' Max.

RURAL DEVELOPMENTS - TYPICAL SECTION AT RURAL DRIVEWAY ENTRANCE

See Std. C-5.01 for Depressed Curb Details

ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION

TURNOUT & DRIVEWAY LAYOUT

Drawn: L. O. Mar 7-66
Traced R.A.F. 11-18-66
Checked J.P.B. 12-2-66
Approved Engr. Plans

C-6.01
DETOUR "A" ENTRANCE (Left turn)

534.35'

Entrance taper

Full width

Existing roadway

DETOUR "B"

Curve No. I

D = 60'

T = 100.08'

Tangent section

Control Line

DETOUR "A"

NOTE: Dimensions - angular and distance - used on drawing above are exemplary. 70 m.p.h. design speed was used. Refer to table for basic design information.

DETOUR "B" ENTRANCE (Right turn)

16' Min.

Tangent section

Control Line

Entrance taper

30'

267.18'

GENERAL NOTES

Detour "A" entrance shall be used where approaching vehicle must turn left. Detour "B" shall be used where approaching vehicle must turn right.

Detour from a horizontal curve: On the inside of the curve the detour take off shall be a curve, see table. On the outside a tangent take off shall be used. A vertical curve may be required to effect a smooth grade change.

The design speed shall be comparable between vertical and horizontal alignment.

The entrance design speed of a detour shall not be less than the normal posted speed of the existing roadway. The design speed for the remainder of the detour may be 20 M.P.H. less than the normal posted speed.

Any intermediate detour entrance may be designed on the basis of normal posted speed less 20 M.P.H. where visible construction activity has slowed traffic for the preceding 1/4 mile.

The minimum width of the detour shall be 28' for existing roadways 34' or wider and a minimum of 24' for existing roadways less than 34' in width.

The entrance taper for Detour "A" shall be extended until full detour width is attained. For Detour "B" the entrance taper shall be extended until a minimum of 14' is attained beyond the edge of existing roadway.

Any deviation from this standard must be approved by the Peace Engineer and Traffic Engineer and the Engineer shall submit the alignment and profile of the proposed change for their review.

Native material used in constructing the detour embankment will be considered suitable for backfill around pipe; however, it shall be reasonably free of rocks and debris.

SPECIAL DETOUR SECTION

Tangent Roadway

Curved Roadway

Entrance

Design Speed

Entr.Taper

Def'l. Angle

Exist. Horiz.

Detour

"A" Take

"B" Take

off Curve

off Curve

Entry

Curvature

Max. Horizontal Curvature

Entrance Design Speed

Curves No. I

D Superelev. D Superelev.

70 3° 0.07'ft.

80 4° 0.07'ft.

90 5° 0.07'ft.

100 6° 0.07'ft.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

DETOUR ENTRANCE
DESIGN TABLE

Drawn

J.P.O.

J.P.O.

Traced

R.A.F.

Rev 12/68

Checked

J.P.O.

C-6.02

Approved Amt.

State Eng Comm.
S indicates sawed contraction joint
C indicates contraction control joint
CN indicates construction joint
LL indicates longitudinal joint.
See Std. C=7.02

Bituminous pavement
2'-min.

2-2" X 8"
nominal timbers
P.C.C.
pavement
1/4" + hot poured
bituminous material
and sand filler
Bridge approach slab

2-16" spikes top and bottom;
spaced per plan.

1/4" Base course
Timber filler.
Depth as required.
Bridge abutment

SECTION

6' min. piece length

Stagger joints
as shown

6" 2' Max.

16" spikes

PLAN

1/4" max.
Plastic tube or
upholstery cord.

Hot poured
Std. joint seal

3/16" max. X 2" saw
cut filled as shown

GENERAL NOTES
All transverse joints shall be in line
with joints in adjacent slabs.

At intersection of side roads or streets,
joins shall be placed to give the
intersection a symmetrical appearance while
conforming to the cross section of the intersecting road
or street.
Timbers used in transverse expansion joint
shall be rough redwood and conform to commercial
grade.

CONSTRUCTION JOINT
To be used at end of pour

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

PORTLAND CEMENT
CONCRETE PAVEMENT
TRANSVERSE JOINTS

Drawn
L.O.M.

Traced R.A.F. 12-66

Checked J.P.O. 5/68

Approved
Engr. Plans 12-68

Rev
C-7.01

#8 bars, 1'-6" c to c
Indicates P.C.C. thickness

INSERT TYPE
CONTROL JOINT

SAWED TYPE
CONTROL JOINT
GENERAL NOTES

All bars used in joints shall be deformed. They shall be held securely in place, parallel to the subgrade and perpendicular to roadway centerline.

All formed longitudinal joints shall be finished with an edging tool not less than 1'-0" wide and 1'-6" long.

In slip form type pavement construction, Longitudinal Joint Type "E" shall be used. In fixed form type construction either Longitudinal Joint Type "E" or "H" may be used.
GENERAL NOTES
All concrete shall be Class A.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

PAVEMENT CUT REPLACEMENT

Drawn O.K.
Traced R.A.R.
Approved Asst. State Eng Consta.

C-7.03
GENERAL NOTES

Anchor slab shall contain no transverse joints.
Anchor slab longitudinal joint shall be according to Std. C-7.02 using anchor slab transverse steel continuous through the joint.

Minimum distance between jointed concrete pavement transverse joints and the required or optional anchorage system construction joints shall be 2'.
Steel shall be structural or intermediate grade.
Splices shall be a minimum of 20 x bar diameter.

Steel shall be 3" clear to anchor slab ends and edges. Lug trenches shall be excavated to 6" minimum clearance on both sides and bottom. Bottom of trench shall be backfilled and compacted smooth and level to 1" of required lug depth. Lug sides shall be formed. Backfill shall be free of rock and extraneous material and compacted to 95% Proctor minimum.

All concrete shall be of the same composition as that used for the jointed concrete pavement.
Expansion joint faces and sleeper slab bearing surface shall be smooth troweled.

DETAIL 1-SLEEPER SLAB

DETAIL 2-FRONT LUG

DETAIL 3-REAR LUG

DETAIL 4-OPTIONAL LUG CONSTR. JOINT

DETAIL 5 EXPANSION JOINT

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

JOINTED CONCRETE PAVEMENT ANCHORAGE

Drawn D.G. 3-71
Traced D.G. 3-71
Checked E.J. 1-71
Approved: Construction

Rev

Drawing No.
C-7.04
GENERAL NOTES

Method "A" shall be used for original ground and/or embankment and backfill material having a min. std Proctor density of 1250/ce and good to excellent shear resistance. Method "B" shall be used if Method "A" soil properties cannot be attained.

Anchor slab shall contain no transverse joints.

Anchor slab longitudinal joint shall be according to Std. C-7.02 using anchor slab steel continuous through joint.

Min. distance between pavement transverse joints and required or optional anchorage system construction joints shall be 2'.

Steel shall be structural or intermediate grade. Splices shall be 10 times bar diameter min.

Lug trenches shall be excavated to 6' min. clearance all around. Bottom of trench shall be backfilled and compacted smooth and level to 1" of required lug depth. Lug sides shall be formed. Backfill shall be free of rock and extraneous material and compacted to 95% Proctor.

All concrete shall be of the same composition as that used for the pavement.

Expansion joint faces and sleeper slab bearing surface shall be smooth troweled.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

ANCHORAGE OF
JOINTED CONCRETE PVMT.
AT STRUCTURES

Drawn: D.G. 3-71
Traced: D.G. 3-71
Checked: J.W. 3-71
Approved: E.T. 3-71

Revision: C-7.05

2-Layers 30# Roofing Felt with Graphite Lightly Sprinkled between Layers.

2-1" x T-2 Premolded Asphalt Boards

Anchor Slab Steel

Anchor Slab

4@10" c to c 4'R Bends (Typ.)

Detail 3-Rear Lug
Front & Center Lugs Same Except as Shown

Detail 5-Expansion Jt.

3" 6@6" 6" 3"

Detail 4-Lug Constr. Jt.

Detail 6-Sleeper Slab

1"-6" 1"-6" 1"-6"

Anchor Slab Steel

Optional Constr. Jts.

2" 2" Expn. Jt.

See Det. 3

Hot Poured Joint Seal

Sleeper Slab

2.5"

2.1" X T-2 Premolded Asphalt Boards

Anchor Slab

Hot Poured Joint Seal

Sleeper Slab

2.5"

2.1" X T-2 Premolded Asphalt Boards

Anchor Slab

Hot Poured Joint Seal

Sleeper Slab

2.5"
CASE I - DIRECT ANGULAR EXIT

Case II to be used only under special conditions which necessitate ramp curvature ahead of nose.

CASE II - PARALLEL DECELERATION

22' min. (Diamond)
24' min. (Loop)
Finishing Course
8' min.
2'-12'
Alignment and profile grade control.

BASE COURSE AND PAVING SHALL BE AS SHOWN ON THE PLANS.

SECTION A-A

GENERAL NOTES
Ramp take off from main curved roadway should provide equivalent minimum deceleration control distances. Shaded areas indicate differential shoulder delineation. See Pavement Marking Standards for stripe details.

ARIZONA HIGHWAY DEPARTMENT CONSTRUCTION SECTION

TYPICAL EXIT RAMP TERMINALS

Drawing No. C-8.01

Rev 5/72
Type "p" Single Curb
see Std. C-5.01

*Radius shown is to back of curb.

1" deep lateral scores shall coincide with curb joints.

Type "F" Single Curb
see Std. C-5.01

1" deep longitudinal score in sections averaging over 15' width.

Class A concrete

SECTION B-B

NOTE: All joints and scores shall be edged with a 1/4" radius tool.
Extend nose paving to a 20' min. width or 30' in length measured from the nose, but in no case shall the paving extend beyond curb end.

SECTION C-C

DETAIL #1 - NOSE PAVING

GENERAL NOTES
The 50:1 taper and corresponding offsets shall also apply when the main roadway has curvature or combined tangent and curvature.
Shaded areas indicate differential shoulder delineation.
See Pavement Marking Standards for stripe details.

SECTION A-A
Base course and paving shall be as shown on the plans.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

TYPICAL ENTRANCE RAMP TERMINAL

Rev 5/72

Drawing No. C-8.02

Signed

[Signature]

[Signature]

[Signature]
The M6-1 and M6-2 snow markers are used to mark the ends of guardrail in snow regions. The M6-1 is used at the beginning of guardrail. The M6-1 is at the end of guardrail. The color for M6 snow markers shall be silver-white or crystal.

The M7-1 and M7-2 snow markers are used to mark the ends of curb in snow regions. The M7-1 is used to mark the beginning of curb. The M7-2 is used to mark the end of curb. The color for M7 snow markers shall be green.

The M8-1 and M8-2 delineators are used as guide markers to indicate roadway alignment, and are placed as follows:

1. For Interstate roadways and other roadways that meet freeway standards, M8-1 delineators are placed continuously on the right side, except where fixed source lighting is in operation. M8-1 delineators may be used on the left side when such placement is necessary to clearly show the alignment.

2. For roadways that do not meet freeway standards, M8-1 delineators are placed continuously on the right side except where fixed source lighting is in operation and (b) along areas used for pull-offs or parking. On sharp right-hand curves M8-1 delineators are placed on the left side. Delineators are bidirectional when applied on the left side of sharp right-hand curves on two-way roadways.

3. M8-1 delineators are placed on through roadways at interchange regardless of fixed source lighting. The crossover through an interchange is normally delineated on the right side and within the limits of the right-of-way at rural interchanges and grade separations.

4. When an M8-1 delineator falls within a crossroad, driveway, parking area, etc., it is moved in either direction a distance not to exceed one-quarter of the normal spacing. If proper placement still cannot be obtained, the delineator is eliminated. M8-1 delineators are not located closer than one-quarter of the normal spacing before or beyond a hazard marker or milepost marker.

5. M8-2 delineators are placed on the right side of left-curving ramps and on acceleration and deceleration lanes. M8-2 delineators are placed on the left side of tangents and right-curving ramps where indicated on C-5.6.

6. On curves, the delineator spacing may be adjusted slightly so that a delineator falls on the P.C. and P.T. of the curve.

The M9-1 marker is used to mark the ends of obstructions such as narrow bridges. The markers are placed on each side of both ends of bridges on two-way roadways, and on each side of the approach end of bridges located on one-way roadways.

The M9-30(H) or M9-31(H) hazard marker is used to mark obstructions that are located within the roadway, such as exit terminal, boxes and channelization islands. Either device is applicable.

The M9-30(V) or M9-31(V) hazard marker is mounted on or immediately in front of obstructions that are located within 2 feet of the pavement edge. These markers are not placed behind guardrail or embankment curb. Either device is applicable.

The F10-3 and D10-3 milepost markers are placed on the right side of the roadway facing approaching traffic. If they cannot be placed within 0.01 mile accuracy, they are omitted. The F10-3 marker is used on freeways. The D10-3 is used on roadways other than freeways.

The M9-6(1) striping maintenance marker is used to mark the end of no-passing zones.

The M9-6(2) striping maintenance marker is used to mark the beginning of pavement striping at no-passing zones in effect for one direction of travel only.

The M9-6(3) striping maintenance marker is used to mark the beginning of pavement striping at no-passing zones in effect for both directions of travel.

The M9-9 hazard marker is used to mark the end of roadways for which there is no alternate vehicular path such as dead end frontage roads.

The M9-10 hazard marker is used to mark extreme hazards located within the roadway, such as transitions from one-way roadways to divided roadways or at T intersections.

The M9-11 guardrail marker is used to delineate guardrail posts. It is placed at 37.5 feet intervals along the line of the guardrail and only for the approach direction.

ARIZONA HIGHWAY DEPARTMENT
Traffic Design Division

DELINEATOR USAGE

NO SCALE

Arizona Highway Department
Traffic Design Division

Drawing No. C-901

Rev. T-1-72

Approved Traffic Engr. (Signature)
NOTES:
1. Metal plates shall be fabricated from either 16-gauge steel or 0.060" aluminum alloy (except M1-6 and M1-8 plates). Metal plates shall be drilled and countersunk to accept #10-16 screw holes. Metal plates shall be painted with a high-visibility paint in accordance with Federal Specifications TT-P-462A, Method 209.1, as applicable. M1-6 and M1-8 plates shall be fabricated from sign grade steel.

2. Where backplates are furnished with the reflective sheathing, the backplate mounting holes shall be provided.

3. Steel plates shall be prime coated on both sides with one coat of Paint Number 1-9 or 1-9, as applicable. Paint shall be in accordance with Federal Specifications TT-P-462A, Method 209.1, as applicable.

4. Single-side metal numerals shall be mounted at the uppermost position on the milepost backplate. Dual and triple-numeral metal numerals shall be positioned vertically on the milepost backplate with the first numeral plate placed at the uppermost position, the second at the center position, and the third at the lowest position. Minor plates shall be secured to the milepost backplate by means of 0.060" x 0.060" x 0.010" x 0.001" long blind rivets.

5. Reflective sheathing shall be either plastic prismatic reflector or reflective sheathing, as provided by the manufacturer. Prismatic reflectors and reflective sheathing shall conform to the requirements of the Standard Specifications. Silver-white reflective sheathing shall be standard reflectivity. Prismatic reflectors shall be yellow, red, or green as required.

Notes continued on C-9.02.2
6. Stripes for the M9-6(1), M9-6(2), and M9-6(3) markers shall be painted with industrial synthetic white enamel paint conforming to Federal Specification TT-T-668NC.  Class B or equal, except as otherwise indicated.

7. The Standard M9-8 is an 18" x 18" red reflectorized marker. The M9-8(1) has an 18" x 18" black opaque background with a 9 - 3/4" diameter red plastic prismatic marker. The M9-8(2) has an 18" x 18" black opaque background with 9 - 4" x 4" red high reflectivity reflective sheeting reflectors.

8. The Standard M9-9 is an 18" x 18" all yellow reflectorized marker. The M9-9(1) has an 18" x 18" black opaque background with a 9 - 3/4" diameter yellow plastic prismatic reflectors. The M9-9(2) has an 18" x 18" black opaque background with 9 - 4" x 4" yellow high reflectivity black reflective sheeting reflectors.

9. The Standard M6 and M7 snow markers may be 4" x 4" metal plates surfaced with high reflectivity reflective sheeting or they may be 3 1/4" diameter plastic prismatic reflectors mounted without back plates.

10. The M9-30(8) and M9-30(V) hazard markers have 3 yellow high reflectivity reflective sheeting reflectors. The M9-31(X) and M9-31(Y) hazard markers have 3 yellow prismatic reflectors.
**NOTES:**

1. The inside edge of M9-30(V) and M9-31(V), M9-1(L) and M9-1(R) hazard markers is placed in line with the inside edge of the obstruction.

2. The M9-11 guardrail tab is installed at 37 1/2" increments along the line of guardrail. The first tab for each installation shall be placed on the first post. The M9-11 tab is placed only on the approach side of the guardrail post.

3. Where the M9-30(H) or M9-31(H) hazard marker is required for an obstruction less than 3'-0" wide, the M9-30(H) or M9-31(H) back plate may be provided in a size smaller than standard, however, reflector sizes shall remain standard.
NOTE:
Steel posts shall conform to ASTM-A-4 and shall not weigh less than 1.9 lbs. per foot and shall be galvanized to conform to ASTM-A-123.
NOTES:

1. MB-1 Delineators are placed on the left side at sharp right-hand curve as deemed necessary by the Traffic Engineer. Delineators are bi-directional, visible from opposite directions, only on two-way undivided roadways.

2. The MB-1 and M9-30(H) or M9-31(H) markers at median openings with left-turn lanes may be mounted together on a single post when the median width is 4' - 0" or less.

Legend

- MB-1

- M9-30(H) or M9-31(H)

ARIZONA HIGHWAY DEPARTMENT
Traffic Design Division

MAINLINE DELINEATOR SPACING

Drawing No.

C-9.05
**SPACING TABLE**

<table>
<thead>
<tr>
<th>Degree of Curve</th>
<th>Spacing on Curve in Feet ($)</th>
<th>Space in Advance and Beyond Curve in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°-0' to 0°-30'</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>0°-35'</td>
<td>450</td>
<td>500</td>
</tr>
<tr>
<td>10°-0'</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>10°-15'</td>
<td>350</td>
<td>500</td>
</tr>
<tr>
<td>10°-30'</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>10°-45'</td>
<td>250</td>
<td>500</td>
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<tr>
<td>20°-0'</td>
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<td>160</td>
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<td>20°-60'</td>
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<td>20°-90'</td>
<td>100</td>
<td>110</td>
</tr>
<tr>
<td>30°-0'</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>30°-60'</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Greater</td>
<td>25</td>
<td>45</td>
</tr>
</tbody>
</table>

**Important:** Maximum spacing for ramp delineation is 200 feet (broken line). Maximum through-lane spacing is 528 feet. Necessary field adjustments in spacing shall be made by the Engineer.

**SPACING PROCEDURE FOR HORIZONTAL AND (CREST) VERTICAL CURVES (VERTICAL CURVE SHOWN)**

**NOTE:**

There shall be a minimum of 3 delineators continuously visible on horizontal curves and the crest of vertical curves. When 3 delineators are not visible, install additional delineators at the midpoints between the normally spaced delineators. If 3 delineators are still not visible, install additional delineators at the quarter points or smaller even increments between the normally spaced delineators until 3 delineators become continuously visible.

**NOTE:**

The M6-1 marker is used only at the beginning of guardrail. The M6-2 is used only at the end of guardrail.

The M7-1 marker is used only at the beginning of curb. The M7-2 is used only at the end of curb.
GENERAL NOTES
Posts and blocks shall be nominal 8" x 8" rough, pressure treated and unpainted. Holes shall be bored before treatment.
All guard rail plate, fittings, hardware, etc. shall be galvanized.
Type A) Installation on normal shoulder line.
Type B) Installation on 2' widened roadway shoulder line.
Type "R" installation shown. Type "A" installation same except that inside face of guard rail coincides with normal shoulder line.

PLAN

FACE ELEVATION
- Std. flared terminal section
- See Detail No. 1
- Provide std. hole in all plates
- Finished shoulder grade

SIDE ELEVATION
- See Detail No. 2
- 6' - 3"
- 2' Widening
- 6' - 3"

DETIAL NO. 1
- Min. 12 ga. plate
- 1 3/4" x 3" x 3/16" washer with 1" x 11/16" washer
- 5/8" x 1 1/4" button head splice bolt with recessed nuts
- 60° Spikes 2/block
- 5/8" X 18" button head bolt 5 recessed nuts

DETIAL NO. 2
- Installation of Guard Rail in embankment curb sections.
- Subgrade
- 2' widened roadway shoulder line

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION
GUARD RAIL - STEEL
SINGLE FACE DETAILS

DRAWN: R.G.
TRACED:
CHECKED: E.W.
APPROVED: Eng. Cone

DRAWING No. C-10.01

Revised 5/72, 7/73, 1/73
**GENERAL NOTES**

When the value of X and/or F is different than values shown in the tables, use the formula to compute applicable Y values.

Where necessary, dimension F may be increased to provide better alignment and grade.

Type A: Installation on normal shoulder line.

Type B: Installation on 2' widened roadway shoulder line.

Type "U" installation shown. Type "A" installation same except that inside face of 6' guard rail coincides with normal shoulder line.

\[
Y = \left( \frac{U}{f^2} \right) \times \left( \frac{F}{F} \right)
\]

- Offset from Tangent line to guard rail.
- Distance between Tangent line and desired location of end of guard rail.
- Length of flared guard rail.
- Distance from beginning of parabolic flare.

- Indicates the preferred distance

**TABLE I**

<table>
<thead>
<tr>
<th>X</th>
<th>Y (Feet)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>12' 6&quot;</td>
<td>0.08</td>
</tr>
<tr>
<td>25' 0&quot;</td>
<td>0.18</td>
</tr>
<tr>
<td>50' 0&quot;</td>
<td>0.37</td>
</tr>
<tr>
<td>62' 6&quot;</td>
<td>0.80</td>
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<tr>
<td>75' 0&quot;</td>
<td>2.10</td>
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**TABLE II**

<table>
<thead>
<tr>
<th>X</th>
<th>Y (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>12' 6&quot;</td>
<td>0.08</td>
</tr>
<tr>
<td>25' 0&quot;</td>
<td>0.11</td>
</tr>
<tr>
<td>37' 5&quot;</td>
<td>0.20</td>
</tr>
<tr>
<td>50' 0&quot;</td>
<td>0.30</td>
</tr>
<tr>
<td>62' 6&quot;</td>
<td>0.50</td>
</tr>
<tr>
<td>75' 0&quot;</td>
<td>0.80</td>
</tr>
</tbody>
</table>

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

GUARD RAIL-STEEL
APPROACH END TREATMENT

Designed by: John H. Hennessey

Approved by: John H. Hennessey

State Eng. Comr.
GENERAL NOTES

Where necessary, dimension F may be increased to provide better alignment and grade.

Connect end shoe to dam with 6 - 7/8" high strength bolts with washers set in internally threaded tubular expansion anchors having an externally slit expansion element and a single core expander. Tensile proof test load in 2500 p.s.i. concrete shall be 5500 lbs.

The guard rail end shoe shall be galvanized in accordance with A.S.T.M. specification A 123.

For construction details of guard rail attachment to bridge, see Plans.

Type A) Installation on normal shoulder line.

Type B) Installation on 2' widened roadway shoulder line.

Type "B" installation shown. Type "A" installation same except that inside face of guard rail coincides with normal shoulder line.

![Diagram of guard rail installation details]

DETAIL C

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

GUARD RAIL-STEEL

BRIDGE APPROACH DETAILS

<table>
<thead>
<tr>
<th>Drawing</th>
<th>B.O.</th>
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<td>5/72</td>
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<td>S.E.E.B.O. 12-69</td>
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<tr>
<td>Checked</td>
<td>J.J.P.O.</td>
</tr>
<tr>
<td>Approved Asst.</td>
<td>State Eng Const.</td>
</tr>
</tbody>
</table>

C-10.04
GENERAL NOTES

Where necessary, dimension F may be increased to provide better alignment and grade.

Connect end shoe to dado with 8 - 7/8" high strength bolts with washers set in internally threaded tubular expansion anchors having an externally slit expansion element and a single core expander. Tensile proof test load in 2500 p.s.i. concrete shall be 6500 lbs.

The guardrail end shoe shall be galvanized in accordance with A.S.T.M. specification A 123.

For construction details of guardrail attachment to bridge, see Plans,
Type A) Installation on normal shoulder line.
Type B) Installation on 2' widened roadway shoulder line.

Type "B" installation shown. Type "A" installation same except that inside face of guardrail coincides with normal shoulder line.

3"/29/32" X 3" slots

3/4" x 211/2" cost slot (optional)

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

GUARD RAIL-STEEL
BRIDGE APPROACH DETAILS

DETAIL C

DETAIL B

Guard rail end shoe and connection bolts. See Detail C and General Notes.

Standard flared terminal section

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

GUARD RAIL-STEEL
BRIDGE APPROACH DETAILS

DETAIL C

DETAIL B

Guard rail end shoe and connection bolts. See Detail C and General Notes.

Standard flared terminal section
### General Notes

When the value of W and/or F is different than values shown in the table, use the formulas to compute the applicable Y values.

For construction details of guard rail attachment to bridge, see Std. C-10.04 and Plans.

Where necessary, dimension F may be increased to provide better alignment and grade.

Type A) Installation on normal shoulder line.

Type B) Installation on 2' widened roadway shoulder line.

Type "B" installation shown. Type "A" installation same except that inside face of guard rail coincides with normal shoulder line.

---

### Table

<table>
<thead>
<tr>
<th>X</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Y (Feet)</td>
</tr>
<tr>
<td>12'-6&quot;</td>
<td>.065</td>
</tr>
<tr>
<td>25'-0&quot;</td>
<td>.260</td>
</tr>
<tr>
<td>37'-6&quot;</td>
<td>.585</td>
</tr>
<tr>
<td>50'-0&quot;</td>
<td>1.200</td>
</tr>
<tr>
<td>62'-6&quot;</td>
<td>2.250</td>
</tr>
<tr>
<td>75'-0&quot;</td>
<td>3.200</td>
</tr>
<tr>
<td>87'-6&quot;</td>
<td>4.125</td>
</tr>
<tr>
<td>100'-0&quot;</td>
<td>5.125</td>
</tr>
</tbody>
</table>

Y = (W)X^2/F^2 = Offset from Tangent line to guard rail.

W = Distance between Tangent line and median center line.

F = Length of flared portion of guard rail.

X = Distance from beginning of parabolic flare to any 12'-6" multiple of parabolic flare.

---

### Diagram

- **Case No. 1**: Bridge
  - Traffic
  - Bridge without safety curb
  - For guard post spacing and details see Std. C-10.04
  - 50' Min.
  - Normal shoulder line
  - 2' widening
  - 6'-3" taper
  - 2' widened roadway shoulder line

- **Case No. 2**: Box Culvert
  - Traffic
  - Box Culvert
  - 50' Min.
  - Normal shoulder line
  - 2' widening
  - 6'-3" taper
  - 2' widened shoulder line
  - Median Q

---

### Arizona Highway Department

**Construction Section**

**Guard Rail - Steel Flare to Median**

- **Drawing No.**: C-10.05
- **Drawn**: D.G.
- **Traced**: S.I.T., D.G. 12-69
- **Checked**: T.P.O.
- **Approved Asst. State Eng. Cons.**: H. H. Hedin
GENERAL NOTES

All concrete shall be Class A.
Transverse joints shall extend through the foundation slab. For continuous or sectional construction, use a 1/4" open joint. Edge joints with a 1/4" radius tool.

Construction joint and #6 bars may be eliminated when barrier and foundation slab are poured monolithic.

For details of transition at terminals and structures, see Std. C-10.09.
GENERAL NOTES
All concrete shall be Class A. Faces of median barrier shall provide a smooth transition.
For median barrier construction details, see Std. C-10.08.
EXPANDED METAL GLARE SCREEN

End or strain post. 2" I.D. nominal size pipe.

3/8" Tension rod and turnbuckle

10" dia. for end or strain posts.

6'3" (Typ.)

Note: Place intermediate strain posts at 500' (max.) intervals with brace and tension rod each side. If chain link fence type is used, place stretcher bar on each side.

EXPANDED METAL POST CONNECTION DETAIL

1" min. @ 60° F

16 post spaces max.

STRAIN WIRE DETAIL

1/2" X 16" eye bolt with 6" X 6" X 1/8" steel anchor plate, nut and locknut.

Varies

1' X 1' X 6" X 1' conc. anchor block.

GENERAL NOTES

For guard rail details, see appropriate Guard rail standard.

There shall be no connection made between the glare screen and the guard rail.

All components shall be galvanized in accordance with A, H, D. Standard Specifications.

All pipe posts shall be capped. Concrete may be job mix concrete of not less than 5 sacks per cu. yd.

Expanded metal shall be 0.250" strand width with 1.53" X 4.0" bridge dimensions on tangents and 0.188" strand width with 0.93" X 2.0" bridge dimensions on curves.

Overlaps shall be one full diamond and shall occur at posts only.

EXPANDED METAL POST CONNECTION DETAIL

SECTION A-A

Strap See Detail.

11 ga. Hog ring fasteners or
9 ga. wire ties @ 1"-6" e to c

22 ga. galv. steel expanded metal.

Guard rail post Q

7 ga. strain wire. See Detail.

Line post 1 1/2" I.D. nominal size pipe or 1 7/8" X 1 3/8" "H" sect.

See Std. 10.02 for detail

10" dia. for line posts

Post cap.

Strapping and seal.

Connection to be made at top, mid-point and bottom of screen.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

MEDIAN GLARE SCREEN

Drawn S.A.F. 4-67
Traced S. L.T. 7-67
Checked M.E.O. 9/80 5-48
Approved Asst. State Eng. Cons. C-10.10

Rev
5-77
5-72
2-73

5-77
GENERAL NOTES
All concrete shall be Class A.
All material and fittings shall be galvanized in accordance with
ASTM A 123.
3/8" tension cables shall be preformed, 6 X 19, hemp core, galvanized,
right regular lay and of improved plow steel.
Fittings not specifically detailed shall be of approved, heavy duty design.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

CHAIN LINK
CABLE BARRIER FENCE

<table>
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<th>Drawing No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.A.F</td>
<td>2-68</td>
<td>C-10.11</td>
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<td>Checked</td>
<td>J.P.</td>
<td>3-68</td>
</tr>
<tr>
<td>Approved Asst.</td>
<td>State Engr. Const.</td>
<td></td>
</tr>
</tbody>
</table>
PLAN - 23" & 26" CATTLE GUARD PLATE

END FRAME TIMBER SIZES

END FRAME POST NOTCH DETAIL

DETAIL - 2" X 3" TIMBER BETWEEN ADJACENT PLATES

Fasten down with 3 - 3/8" X 7' lag screws each piece

GENERAL NOTES

The 2" X 6" & 3" X 6" timbers that are fastened to the ties and the 6" X 6" posts shall be pressure treated, rough and un-painted. The remaining timber shall be given one coat of No. 7 and one coat of No. 8 paint.

The metal plates shall be furnished with the manufacturer's shop coat of paint or shall be given one coat of No. 1 paint.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

CATTLE GUARD
RAILROAD

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
</table>
| Single Track     | 18'-0" | 13'-6"
| 13' Track Centers | 31'-0" | 26'-6"
| 14' Track Centers | 32'-0" | 27'-6"

Drawn: D.G. 3-67
Traced: S.L.T. 4-67
Checked: J.P.O. 5-67
Approved: Engr. Plans 5-67

Rev C-11.03
For all other cattle guard details, see Std. C-11.01.

This standard shall be used in embankment or where highly erodible soil is found.

All concrete shall be Class A.
WING FENCE DETAIL

This detail shall be used where wing fences are called for on plans.

WOOD POST FENCE-TYPE 1 or 2 GATE-6 or 5 WIRE

Existing Gate to be Removed

Existing Gate Removed

GAME FENCE

4-wire game fence shall be constructed using standard 4-wire line fence post spacing and substituting 12 1/2 ga. twisted, barbless wire for the bottom strand.

GENERAL NOTES

For any details not shown on this sheet, refer to Std. C-12.01.
Concrete for posts may be job mix concrete of not less than 5 sacks per cu. yd.

DETAIL FOR REMOVING EXISTING LINE GATES

Procedure: Remove gate and hardware and wire between posts A and C. Install new second brace at post C (Std. C-12.01 fence only). Stretch new wire between posts A and C. Remove post B and brace.
(Approved salvaged wire may be used.)
Staples for wood posts shall be 1 1/2" galvanized and fabricated from 9 gauge wire.

STOCK FENCE

Rectangular mesh galv. stock fence.

9 ga. double wrapped galv. wire ties, 4 each post or 11 ga. clamps.

Existing Gate to be Removed

Existing Gate Removed

ARIZONA HIGHWAY DEPARTMENT CONSTRUCTION SECTION

SUPPLEMENTAL FENCE DETAILS

Rev 12/69
5/72

K.S. C-12.02

Drawing No.

Traced

Checked

Approved Asst. State Eng. Const
When using a roll formed corner post without arm, the barbed wire strands shall be secured to the integral loops by a 6" minimum turn back and twist.

3-12 1/2 ga. galvanized, galvanized, 14 ga. bars. There may be a maximum of 2 barbed wire splices between strain posts, but not on the same wire and no splice shall be placed within 100' of a strain, corner or gate post.

Footers for line post 10' dia...

Footing for Strain, End, Corner and Gate Posts

Fence Using Pipe Members

<table>
<thead>
<tr>
<th>Member</th>
<th>Size</th>
<th>LH/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corner post</td>
<td>3 1/2&quot; I.D. nominal pipe size</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>Line post</td>
<td>1 1/2&quot; I.D. nominal pipe size</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>Strain or gate post</td>
<td>3 1/2&quot; I.D. nominal pipe size</td>
<td>10'-6&quot;</td>
</tr>
<tr>
<td>Brace</td>
<td>1 1/2&quot; I.D. nominal pipe size</td>
<td>as req'd</td>
</tr>
<tr>
<td>&quot;Stretcher bar&quot;</td>
<td>1/6&quot; x 3/4&quot; flat</td>
<td>6'-2&quot;</td>
</tr>
</tbody>
</table>

Fence Using Roll Formed Members

<table>
<thead>
<tr>
<th>Member</th>
<th>Size</th>
<th>LH/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corner post</td>
<td>5.1/4&quot; /ft. section with integral fabric loops per Detail A or equal</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>Line post</td>
<td>2.75&quot; /ft. section per Detail B or equal</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>Strain or gate post</td>
<td>3 1/2&quot; I.D. nominal pipe size</td>
<td>10'-6&quot;</td>
</tr>
<tr>
<td>Brace</td>
<td>1.55&quot; /ft. section per Detail C or equal</td>
<td>as req'd</td>
</tr>
<tr>
<td>&quot;Stretcher bar&quot;</td>
<td>1/4&quot; x 3/4&quot; flat</td>
<td>6'-2&quot;</td>
</tr>
</tbody>
</table>

GENERAL NOTES

Concrete for posts may be job mix concrete of not less than 5 bags per cu. yd. Gates shall be of welded or malleable cast or pressed steel fitting construction. Fittings not specifically detailed shall be of approved heavy duty design. Strain posts shall be spaced at 500' maximum intervals and both corner and strain posts shall have strain panels on each side. All pipe posts shall be capped.

Note: For Walk Gate, see Std. C-12.03.

Fencing shall be 9 ga., 2" mesh, fabricated wire.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

FENCE-INDUSTRIAL TYPE, FABRICATED WIRE

Drawing No. C-12.04

Drawn: I.O.M. 3-65
Traced: R.A.F. 1-68
Checked: J.P.A. 5-68
**200'**

**3/8" galv. cable; 7-wire common; 4200# test minimum. Use for both wood or steel post corner.**

Alignment of barrier fence. See elevations for post locations.

Frontage Road

**Type 1 or 2**

Tee of dyke

Type 1 or 2

Elevation

Main Roadway

Extent of wing wall, end section or pipe culvert

**Type 1 or 2**

Tee of dyke

Type 1 or 2

Elevation

For Type 1 or Type 2 - 6:1 slope only

**Maximum distance between strain posts or strain post and end post. Also, maximum distance between cable clip splices. Place turnbuckle approximately midway between cable clip splices.**

**Maximum distance between end post and cable splices. Place turnbuckle approximately midway between end posts.**

**General Notes**

Concrete for posts may be job mix concrete of not less than 5 bags per cu. yd.

Wood posts for barrier fence shall be rough, pressure treated.

Steel posts for barrier fence shall be painted green with white tops.

Barrier posts shall be S4S redwood, untreated.

All cable ends shall be wrapped with galvanized tie wire in accordance with the cable manufacturer's recommendations.

Barrier fence shall be used only to prevent crossings between roadways and shall not be used where guard rail is required or where physical barriers are present.
EMBANKMENT INSTALLATION

CUT INSTALLATION

Width of cut ditch minus 1'-0".

5:1 slope

4'-0" min.

Note: Drop inlet similar

FIGURE A

PERFORATED C.M.P. INSTALLATION

Finished shoulder line

Fine aggregate

Perforated C.M.P.

Place holes down

1'-0"

Varies

6" Pipe O.D.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

PIPE CULVERT
INSTALLATION

Diameter

Minimum space between pipes

12" to 24" 1'-0"

30" to 66" One-half diameter of pipe

72" to 84" 3'-0"

*When headwalls are used, space as per headwall standard.

Span

Minimum space between pipe arched

18" to 36" 1'-0"

45" to 72" One-third span of pipe arch

SPACEING FOR MULTIPLE INSTALLATIONS

Fill slope

Berm

2:1 slope

6:1 slope

End Elevation

W for outlet end = 4' + pipe dia.

Berm shall be constructed as noted on plans.

GENERAL NOTES

Additional excavation shall be required as shown in Figure A, when headwalls are located in a cut ditch.

Headwall shall not extend more than 3' above the embankment slope and in no case above the shoulder elevation.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

PIPE CULVERT
INSTALLATION

Drawn D.G. 3-68
Traced D.G. 3-68
Checked J.P.D. 3-68
Approved Aes. State Eng. Const.

C-13.01
MORTAR JOINTS

TONGUE AND GROOVE

BUTT (Broken ends)

2" X 2" max. size welded wire fabric. 12 ga. max. Overlap and tie with 2 wire locks.

CONCRETE ENCASEMENT

1' long trench at joints

SOLID ROCK OR OTHER UNYIELDING MATERIAL

GENERAL NOTES

Rubber gasketed joints shall be used on irrigation and storm sewer lines unless mortar joints are specified.

Cross drains with tongue and groove joints will not be required external mortar band.

For minimum cover and maximum fill heights on concrete pipes, refer to Std. C-13:03.

Bedding material shall be placed to spring line on both sides of pipe.

6" min. for pipe in trench.
3" min. for pipe on natural ground.
1'-0" min. for 3/4 O.D. max for pipe on solid rock or other unyielding material.

Bedding Material.

TYPE 1 - POSITIVE PROJECTING

TYPE 2 - NEGATIVE PROJECTING

TYPE 3 - IMPERFECT TRENCH
### Horizontal Elliptical Pipe

<table>
<thead>
<tr>
<th>Size</th>
<th>Area of Open'g</th>
<th>HE II</th>
<th>HE III</th>
<th>HE IV</th>
</tr>
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<tbody>
<tr>
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<td>Min.</td>
<td>Type</td>
<td>Min.</td>
<td>Type</td>
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<tr>
<td>14 x 23</td>
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<td>13</td>
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<tr>
<td>18 x 30</td>
<td>3,1</td>
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<td>2</td>
<td>13</td>
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<tr>
<td>22 x 34</td>
<td>4,1</td>
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<td>13</td>
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<tr>
<td>24 x 38</td>
<td>5,1</td>
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<tr>
<td>27 x 42</td>
<td>6,3</td>
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<td>29 x 45</td>
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<tr>
<td>32 x 49</td>
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<td>34 x 53</td>
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<td>38 x 60</td>
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<td>68 x 76</td>
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</table>

**HE III**

- 15 x 30
- 18 x 30
- 22 x 34
- 24 x 38
- 27 x 42
- 29 x 45
- 32 x 49
- 34 x 53
- 38 x 60
- 53 x 68
- 68 x 80

**HE IV**

- 14 x 23
- 18 x 30
- 22 x 34
- 24 x 38
- 27 x 42
- 29 x 45
- 32 x 49
- 34 x 53
- 38 x 60
- 53 x 68
- 68 x 80

### Vertical Elliptical Pipe

<table>
<thead>
<tr>
<th>Size</th>
<th>Area of Open'g</th>
<th>VE II</th>
<th>VE III</th>
<th>VE IV</th>
<th>VE V</th>
<th>VE VI</th>
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<tr>
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<td>68 x 60</td>
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**VE III**

- 45 x 29
- 49 x 32
- 53 x 36
- 56 x 38
- 58 x 43
- 60 x 48
- 63 x 53
- 68 x 60

**VE IV**

- 45 x 29
- 49 x 32
- 53 x 36
- 56 x 38
- 58 x 43
- 60 x 48
- 63 x 53
- 68 x 60

**VE V**

- 45 x 29
- 49 x 32
- 53 x 36
- 56 x 38
- 58 x 43
- 60 x 48
- 63 x 53
- 68 x 60

**VE VI**

- 45 x 29
- 49 x 32
- 53 x 36
- 56 x 38
- 58 x 43
- 60 x 48
- 63 x 53
- 68 x 60

### General Notes

All fill heights are measured in feet from finished grade to top of pipe. Minimum fill heights shall be as noted except no pipe shall extend above subgrade. For cases not covered hereon, special designs may be prepared.

Type refers to type of placement. For other details see Std. C-13.02.

---

**Arizona Highway Department Plan Division**

**Fill Heights for Reinforced Concrete Pipe**

<table>
<thead>
<tr>
<th>Rev</th>
<th>Drawing No.</th>
<th>Engr. Plans</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>C-13.03</td>
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</table>

**Drawn:** J.P.O. 7-65
**Checked:** S.R. 90 5-68
**Approved:** Engr. Plans
Design of end section shall conform to standards for reinforced concrete pipe. End section joint conformation shall match the pipe joints. Embankment slope shall be warped to match slope of end section.
END SECTION DIMENSIONS
Showing Type 1 Riveted or Bolted Connections

PIECE ARCH

<table>
<thead>
<tr>
<th>GA.</th>
<th>A</th>
<th>B</th>
<th>H</th>
<th>L</th>
<th>W</th>
<th>APPROX. SLOPE</th>
<th>CONNECTION</th>
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<tbody>
<tr>
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<td>18</td>
<td>33</td>
<td>12</td>
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</tbody>
</table>

GENERAL NOTES

The end section may be joined to the pipe, pipe arch or other section by bolts, rivets, dimpled bands or threaded rod type fasterners. For allowable connection types, see table.

For the Type 1 connection, maximum allowable spacing shall be 1'-0" with a minimum of 8 bolts or rivets per joint. 3/8" bolts or rivets shall be used for pipe sizes 18" through 42". 48" and 54" sizes shall use 1/2" bolts or rivets and 3/4" bolts shall be used for 60" and over.

Use Type 2 or 3 connections only on annular pipe or helical pipe with an annular and groove.

The foregoing applies to corresponding area arches.

All components of the end section shall be galvanized.

Embankment slope shall be warped to match slope of end section.

When pipe is exposed beyond normal embankment slope, a covering beam shall be added. See Std. C-13.01.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION
END SECTION CORRUGATED METAL PIPE AND PIPE ARCH

PIECE LENGTH AS SHOWN ON PLANS

Right Angle Culvert
Skewed Culvert
### TABLE I
CORRUGATED, CIRCULAR STEEL PIPE. 2-2/3" x 1/2" ANNULAR OR HELICAL CORRUGATIONS. RIVETED, WELDED OR LOCK-SEAM FABRICATION. H-20 LOADING.

<table>
<thead>
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<td>1</td>
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<tr>
<td>Max.</td>
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<td>2</td>
<td>2</td>
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</tr>
</tbody>
</table>

14 Ga., 5/16" dia. rivets. 12, 10 and 8 Ga., 3/8" dia. rivets.

NOTE: Fill heights in parentheses are for 5% vertically elongated pipe.

### TABLE II
CORRUGATED, CIRCULAR STEEL PIPE. 3" x 1" ANNULAR OR HELICAL CORRUGATIONS. RIVETED, WELDED OR LOCK-SEAM FABRICATION. H-20 LOADING.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Min.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Max.</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

### TABLE III
CORRUGATED, CIRCULAR STRUCTURAL PLATE STEEL PIPE. 6" x 2" CORRUGATIONS. BOLTED FABRICATION. H-20 LOADING

<table>
<thead>
<tr>
<th>DIA.</th>
<th>4-bolts/ft.</th>
<th>6-bolts/ft.</th>
<th>8-bolts/ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min.</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Max.</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

### GENERAL NOTES
All fill heights are measured, in feet, from finished grade to top of pipe. Minimum fill heights shall be as noted except no pipe shall extend above subgrade. Fill heights above 100' shall be used only after a thorough investigation of the foundation and backfill material. All corrugated steel pipe and appurtenant parts shall be galvanized. For installation details, see Std. C-13.01. For fill height design data, see Std. C-13.07.

### ARIZONA HIGHWAY DEPARTMENT CONSTRUCTION SECTION
CORRUGATED METAL PIPE DESIGN FILL HEIGHTS

Bolts used for 3/8" Ga. shall be 7/8" dia.; all others 3/4" dia., Bolts shall be torqued to manufacturer's specifications but not less than 100 ft. lbs. or more than 300 ft. lbs.
### Criterion 1. DEFLECTION OF PIPE

**Formula 1(a) I (for circular pipe) = \( \frac{2.31}{68} \times 57.3 \times \frac{1}{2800000} \)**

**Formula 1(b) I (for 3% vertically elongated pipe) = \( \frac{2.31}{68} \times 57.3 \times \frac{1}{2800000} \)**

Given: \( h = 27 \); \( D = 15 \); \( R = 90 \)

**Find:** Gauge and corrugation required.

**Solution:**

**Deflection of pipe**

**Formula 1(a) I = \( \frac{(2.31)(2729000)(27) - (57.3)(2729000)}{2680000} = 0.138 \)**

**Formula 1(b) I = \( \frac{(1.155)(2729000)(27) - (57.3)(2729000)}{2680000} = 0.071 \)**

The result being negative indicates a gauge requirement lighter than 12 gauge when pipe is elongated 3% vertically.

#### Longitudinal Seam Strength

**Formula 2(a) Cq = \( \frac{6}{2800000} \)**

Solve for \( Cq \) and determine gauge and corrugation from table of \( C_q \) values.

**Criterion 2. BUCKLING OF PIPE WALL**

**Formula 3(a) fu = 45000 - 1.4567 \( \frac{(0.66)(0.88)}{r} \)**

Use \( r \) for the corrugation corresponding to the heaviest gauge determined by formulae la, lb, and 2a. Solve for \( fu \) to determine the maximum allowable buckling stress.

**Formula 3(b) Au = \( \frac{1.405}{fu} \)**

Solve for \( Au \), using \( fu \) value determined in 3a, and select gauge and corrugation from table.

---

\* When deflection or buckling is the control, an increase in the maximum \( h \) may be realized by backfilling to 95% Proctor density. This revises the applicable formulae to:

**Formula 1(a) I = \( \frac{2.08}{2800000} \times 57.3 \times \frac{1}{2800000} \)**

**Formula 3(a) fu = 45000 - 1.4567 \( \frac{(0.66)(0.88)}{r} \)**

---

Criteria 1, 2 and 3 embody the factors to be investigated in the design of corrugated metal pipe culverts.

Appurtenant formulas are developed from data supplied by the S.P.R. 1966 publication titled "Corrugated Metal Pipe Culverts - Structural Design Criteria and Recommended Installation Practices." This formula provides safety factors as follows: Criteria 1 = 3.33; Criteria 2 = 3.33 and Criteria 3 = 2.00.

### Constants used are:

- Embankment weight/ft. = 130 lbs.
- Embankment density = 90% Proctor.
- Modulus of passive earth resistance = 1000 p.s.i.
- Soil stiffness coefficient = 0.32.
- Deflection lag factor = 1.39.
- Modulus of elasticity = 29,000,000 p.s.i.

### Explanation of symbols used:

- \( A_p \) = Area/lin. inch of pipe in sq. inches.
- \( C_q \) = Actual ring compression in lb./ft.
- \( D \) = Pipe diameter in ft.
- \( e \) = Actual buckle stress in p.s.i.
- \( h \) = Fill height: ft. grade to top of pipe in ft.
- \( I \) = Moment of inertia of pipe wall in inches\(^2\) inch.
- \( R \) = Radius of pipe in inches.
- \( r \) = Radius of pipe wall in inches.

---

**CRAZIR HIGHWAY DEPARTMENT PLANS DIVISION**

**COURRUGATED METAL PIPE FILL HEIGHT DESIGN DATA**

**Drawn:** D.G. 9-67  
**Traced:** S.L.T. 10-67  
**Checked:** J.P.O. 3-68  
**Approved:** Engr. Plans C-13.07
### Table 1-A

<table>
<thead>
<tr>
<th>Size - In.</th>
<th>Opening Area Sq. Ft.</th>
<th>Corner Radius In.</th>
<th>Maximum Corner Pressure = 4000 Lb./Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>14 Ga. -.079&quot;</td>
</tr>
<tr>
<td>18 X 14</td>
<td>1.1</td>
<td>3.3</td>
<td>1 1/2</td>
</tr>
<tr>
<td>22 X 14</td>
<td>1.6</td>
<td>4.0</td>
<td>1 1/2</td>
</tr>
<tr>
<td>25 X 16</td>
<td>2.2</td>
<td>4.0</td>
<td>2</td>
</tr>
<tr>
<td>29 X 18</td>
<td>2.8</td>
<td>4.5</td>
<td>2</td>
</tr>
<tr>
<td>36 X 22</td>
<td>4.4</td>
<td>5.0</td>
<td>2</td>
</tr>
<tr>
<td>45 X 27</td>
<td>6.4</td>
<td>5.5</td>
<td>2</td>
</tr>
<tr>
<td>50 X 31</td>
<td>8.7</td>
<td>6.0</td>
<td>3</td>
</tr>
<tr>
<td>58 X 35</td>
<td>11.4</td>
<td>7.0</td>
<td>3</td>
</tr>
<tr>
<td>65 X 40</td>
<td>14.3</td>
<td>8.0</td>
<td>3</td>
</tr>
<tr>
<td>72 X 44</td>
<td>17.6</td>
<td>9.0</td>
<td>3</td>
</tr>
</tbody>
</table>

**General Notes:**

- All fill heights are measured from finished grade to top of pipe arch.
- Minimum fill heights shall be as noted except no pipe arch shall extend above the subgrade.
- To determine fill heights for sizes other than those shown in the tables, use Std. C-13.09 Pipe Arch Design Data.

### Table 2-A

<table>
<thead>
<tr>
<th>Size</th>
<th>Opening Area Sq. Ft.</th>
<th>Corner Radius In.</th>
<th>Maximum Corner Pressure = 4000 Lb./Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>12 Ga.</td>
</tr>
<tr>
<td>6' - 1' X 4'-7&quot;</td>
<td>22</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>7' - 0&quot; X 5'-1&quot;</td>
<td>28</td>
<td>18</td>
<td>1 1/2</td>
</tr>
<tr>
<td>7'-11&quot; X 5'-7&quot;</td>
<td>35</td>
<td>18</td>
<td>1 1/2</td>
</tr>
<tr>
<td>8'-10&quot; X 6'-1&quot;</td>
<td>40</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>9' - 9&quot; X 6'-7&quot;</td>
<td>52</td>
<td>18</td>
<td>1 1/2</td>
</tr>
<tr>
<td>10'-11&quot; X 7'-1&quot;</td>
<td>61</td>
<td>18</td>
<td>1 1/2</td>
</tr>
<tr>
<td>11'-10&quot; X 7'-7&quot;</td>
<td>71</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>12'-0&quot; X 8'-1&quot;</td>
<td>81</td>
<td>18</td>
<td>3</td>
</tr>
</tbody>
</table>

* Bolts shall be torqued to manufacturers specifications but not less than 100 ft. lbs. nor greater than 300 ft. lbs.
TABLE I

<table>
<thead>
<tr>
<th>Gage</th>
<th>$A_g$</th>
<th>$I$</th>
<th>$r$</th>
<th>$I$</th>
<th>$r$</th>
<th>$C_{u1}$</th>
<th>$C_{u2}$</th>
<th>$C_{u3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>0.0646</td>
<td>0.001382</td>
<td>1.726</td>
<td>1.6750</td>
<td>21500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.0808</td>
<td>0.001392</td>
<td>1.726</td>
<td>1.8200</td>
<td>29800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.1330</td>
<td>0.002452</td>
<td>1.726</td>
<td>2.3460</td>
<td>68800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.1656</td>
<td>0.004333</td>
<td>1.726</td>
<td>2.6500</td>
<td>69000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.1777</td>
<td>0.005725</td>
<td>1.726</td>
<td>2.5600</td>
<td>31300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.2263</td>
<td>0.01078</td>
<td>1.678</td>
<td>6.88</td>
<td>9000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.2665</td>
<td>0.126916</td>
<td>1.618</td>
<td>11200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.3064</td>
<td>0.161166</td>
<td>1.688</td>
<td>12200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.3342</td>
<td>0.165833</td>
<td>1.688</td>
<td>144000</td>
<td>186000</td>
<td>220000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Criterions 1, 2, 3 and 4 embody the factors to be investigated in the design of corrugated metal pipe arch culverts.

Appertinent formulae are condensed from data supplied by the 1967 edition of American Iron and Steel Institute’s publication titled “Handbook of Steel Pipe and Fittings Construction” and the B. P. R. 1966 publication titled “Corrugated Metal Pipe Culverts - Structural Design Criteria and Recommended Installation Practices.” These formulae provide safety factors of 1.3, 3.3, 2.3 and 3.3 respectively for Criteria 1, 2, 3 and 4.

Constants used are the same as for Std. C-13.07, “Corrugated Metal Pipe Fill Height Design Data.”

Explanation of variable symbols used:

$A_g$ = Area per lin. inch of pipe arch in sq. in.

$C_{u1}$ = Actual ring compression in lbs./ft.

$C_{u2}$ = Allowable ring compression in lbs./ft.

$C_{u3}$ = Allowable buckling stress on p.s.i.

$h$ = Max. fill height; fin. grade to top of pipe arch.

$S$ = Min. fill height; fin. grade to top of pipe arch.

$I$ = Moment of inertia of pipe arch wall in inches$^2$/inch

$R$ = Span in ft.

$E$ = Rise in ft.

Criterion 1: CORNER PRESSURE

Formula 1 (a) $P = 65(L_2 + L_p)$

Using $b$, take $(L_2 + L_p)$ from Table II and solve for $P$. Note: If $P > 1000$, consideration shall be given toward possible special backfill design.

Formula 1 (b) $(L_2 + L_p) = (S/8) R$ Solving for $L_2 + L_p$: Use Table II to determine $L_2$

Criterion 2: LONGITUDINAL SEAM STRENGTH.

Formula 2 $C_{u1} = 1.675 (L_2 + L_p)$ Using $b$, take $(L_2 + L_p)$ from Table II and solve for $C_{u1}$ Determine gauge and corr. by comparing $C_{u1}$ with $C_{u2}$ values in Table I.

Criterion 3: BUCKLING OF PIPE ARCH WALL

Formula 3 (a) $f_u = 22500 - 0.72735 (1.846/r)^2$

Formula 3 (b) $f_u = 5(L_2 + L_p) / 24 A_g$

Use $r$ for corrugation indicated by Formula 2

Equation $f_u$ from 3(a): Solve for $A_g$ Determine gauge and corrugation from Table I.

Criterion 4: DEFLECTION

Formula 4 (a) $A_g = 0.6 H$

Formula 4 (b) $A_g = 1.507 H r^3$

Use value of $H$ gauge and corrugation required by Criteria 2 and 3. If $L_2 > L_g$, deflection is satisfactory.

EXAMPE:

Given: 72" X 44" Pipe Arch, $h = 15$, $R = 9$.

Find: Gauge, corrugation, $h'$

Formula 1(a) $P = 6 X 6 X 1950 / 9 = 7800$

Since $P > 1000$, investigation of special backfill and/or corner support design is mandatory.

Formula 2 (b) $(L_2 + L_p) = 667 X 9 / 6 = 1000$

From Table II, $h' = 3$

Formula 3 (a) $f_u = 22500 - 0.72735 X (3.84 X 6/1.726)^2 = 920$

Formula 3 (b) $920 = 6 X 1950 / 24 A_g$

$A_g = 0.0507$

Referring to Table I, value of $A_g$ indicates a higher gauge than that called for in Formula 2 so 12 ga., 1-rivet, 2/3" X 1/2" is safe for buckling.

Formula 4 (a) $A_g = 0.6 X 3.67$

$= 2.022$

Formula 4 (b) $A_g = 1.507 X 15 X 6 X (3 X 6/3 X 3.76)^3$

$= 2.08$

$A_g > A_g$ so deflection is satisfactory.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

CORR. METAL PIPE ARCH
FILL HEIGHT
DESIGN DATA

Drawn: B.G. 10-67
Traced: R.A.P. 11-67
Checked: J.P.O. D.5 66
Approved: Engr. Plans:
FULL CIRCULAR PIPE,  
C. M. P. OR STRUCTURAL PLATE PIPE

PIPE ARCH OR  
STRUCTURAL PLATE ARCH

END ELEVATIONS

GENERAL NOTES
The wire mesh shall be fastened or welded in an approved manner to the corrugation crests.
All laps shall be 6" minimum.
Invert paving shall not be placed until fill over pipe is completed.
Concrete shall be Class A or pneumatic mortar.

ARIZONA HIGHWAY DEPARTMENT  
PLANS DIVISION

CORRUGATED METAL PIPE CONCRETE INVERT PAVE 
MENT

Drawn D.G.  
Traced R.A.F. 5-17-67  
Checked J.F.O. 822 5-68  
Approved Engr. Plans 5-31-68

Drawing No. C-13.10
GENERAL NOTES

Payment limits shown include structural excavation for headwalls, cutoff walls, wingwalls, end sections, etc.

Payment limits shown for multiple pipe installations shall be applied to the full width of the excavated trench allowable for structural excavation.

W Width
L length
H Height of barrel or headwall w/o cutoff wall.

See Std. C-13.01, C-13.02
C-13.04, C-13.05

6" min. in rock & trench
1'-5" MAK all others

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

STRUCTURAL EXCAVATION
PAYMENT LIMITS

Drawn: I.A.W.
Traced: R.W.
Checked: R.W.
Approved: A.A.
State: Hwy Constr.

Rev
12/68
3/71
5/72

Drawing No.
C-13.11
LONGITUDINAL SECTIONS THRU BRIDGE

SECTION THRU WALL TYPE ABUTMENT

SECTION THRU TYPICAL SPREAD FOOTING

PIER FOOTING PLAN

STRUCTURAL EXCAVATION
PAYMENT LIMITS
AND SPECIAL BACKFILL PLACEMENT
BRIDGES & RETAINING WALLS

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

Drawing No. C-13.12

Drawing:
Traced:
Checked:
Approved:
Engr. Plans:

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GENERAL NOTES

Bedding material placed for C.M.P. or pipe culvert on natural ground installation shall be a minimum of 3" below invert. When placed in trench bedding material shall be a minimum of 6" below invert.

Bedding material shall be placed to spring line on both sides of pipe.

Placement of special backfill around headwalls and wingwalls shall be the same as around structures.

- See Std. C-13.01, C-13.02, C-13.04, C-13.05
- D/2 + 2"-0"
- 6" min. in rock & trench, 1'-6" min. all others
- C-13 Bedding Material.
MEASUREMENT ONLY (SEE STD. C-13.13 FOR PLACEMENT)

NOTE: Computation of Special Backfill quantity for box culvert is based on the area of a typical installation time (the total length of the structure plus H). No measurement is necessary for wing areas. Use H/2 for box extensions on each end extended.

GENERAL NOTES

Measurement limits for multiple pipe installations will be taken from outside to outside limits of allowable structural excavation.

Pipe Installation backfill shall be computed based on total as installed length of pipe. When headwall or end sections are installed an allowance of H/2 will be added to the total length of pipe for each end section or headwall installed.

Diameters are O.D. & maximum outside width of circular and arch type structures respectively.

- Height of barrel or headwall w/o cutoff wall:
  - H/2 + 2" - 6"
  - 6" min. in rock & trench
  - 1"-6" all others

See Std. C-13.01 C.M.P. & C-13.02 R.C.P., if structure includes flared end section see Std. C-13.05 C.M.P. & C-13.04 R.C.P.
GENERAL NOTES

All concrete shall be Class A. All reinforcing bars shall be #4 except 2 #6 bars over pipe. Bar spacing shall be 1'-0" c to c.

Plan shown is for a 42" pipe. High point of headwall shall not project more than 3" above slope.

Skewed pipe installations shall be constructed parallel to center line of roadway. When end of metal pipe is cut to fit skew, disturbed area of pipe shall be treated in accordance with section 604-3.04 of 1969 Standard Specifications.

The bevel detail will be required only on the inlet end of structures. When reinforced concrete pipe is placed with the bell or groove end up, stream flush with the headwall face, the bevel detail will not be required.
SECTION Z-Z

SECTION Y-Y

ELEVATION

PLAN

3/4" chamfer

GENERAL NOTES
Reference Std. C-13.01.
High point of headwall shall not project more than 3" above slope.
All concrete shall be Class A.
All reinforcing shall be #4 bars
1'-0" c to c

<table>
<thead>
<tr>
<th>PIPE</th>
<th>DIMENSIONS</th>
<th>QUANTITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.D.</td>
<td>W</td>
<td>L</td>
</tr>
<tr>
<td>18&quot;</td>
<td>2'-6&quot;</td>
<td>5'-2&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-0&quot;</td>
<td>6'-8&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-6&quot;</td>
<td>7'-10&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>4'-2&quot;</td>
<td>9'-2&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>4'-6&quot;</td>
<td>10'-6&quot;</td>
</tr>
</tbody>
</table>

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

DROP INLET HEADWALLS

Drawn K.S. 10-39
Traced S.C.R. 8-67
Checked J.P.O. 9-68

Drawing No. C-14.03

Rev. 3/71
**General Notes**

Pipes can be placed in any wall. Sump floor shall have a wood trowel finish and a minimum slope of 4:1 in all directions toward outlet pipe. Welding shall be in accordance with A.A.B. Welding Specifications. For grates LW-1, LW-2, etc., and frame details and opening areas, see Stds. C-15.06 and C-15.07. Any specified gutter depression shall be warped to opening according to Std. C-15.08. All structural steel shall be ASTM A 36. Grate support and nose angle shall be given one shop coat of No. 1 paint. All concrete shall be Class A. Curb opening areas (Sq.Ft.) for Catch Basin No. 1-Single and Catch Basin No. 1-Double equal 0.26 and 0.55, respectively, for each inch of curb "h" + gutter depression - 2 1/2". Construction Joints shall be placed to meet field conditions.

* 3/4" for longitudinal and 3" for transverse grates.
* 2.5"-0" for LW-1, LB-1, TW-1 and TB-1 grates. 1"-6" for LW-2, LB-2, TW-2 and TB-2 grates. Use 1"-6" dimension when catch basin is used with combined curb and gutter. * 2" B-1/2" for LW-1, LB-1, TW-1 and TB-1 grates. 2"-2 1/2" for LW-2, LB-2, TW-2 and TB-2 grates. * $ h = 6" when H is 8" or less; 8" when H is over 8". (See Section B-B)
Pipes can be placed in any wall. 1/2" chamfer top edges of sump walls. Basin sump floors shall have wood trowel finish and a minimum slope of 4:1 from all directions toward outlet pipe. Welding shall be in accordance with A.I.M.E. Welding Specifications.

Exposed steel shall be given one coat of No. 1 paint.

For grates LW-1, TW-2, etc. and frame details and opening areas, see Stds. C-15.06 and C-15.07.

Gutter depression = 3" max. modified to 1 1/2" max. for shoulder locations and no depression for adjoining medians.

Any specified gutter and apron depression shall be warped to opening according to Standard C-15.08.

All Concrete shall be Class A.

All Structural steel shall be ASTM A 36, Adjustable Curb shall be galvanized according to ASTM A 123.

Construction joints shall be placed to meet field conditions.

* 3/4" for LA or LB grates.

** 2'-0" for LW-1, LB-1, TW-1 or TB-1 grates. 1'-6" for LW-2, LB-2, TW-2 or TB-2 grates. Use 1'-6" dimensions when catch basin is used with combined curb and gutter.

t = 6" when H is 8' or less; 8" when H is over 8'. (See Sec. B-B)

---

TZ-15.08

Construction Section

TYPE 2 CATCH BASIN

ARIZONA HIGHWAY DEPARTMENT

CONSTRUCTION SECTION

DRAWN

D.E. 11-66

TRACED

S.L.T. 6-67

CHECKED

J.F.O. 5-68

APPROVED A.D.E.

State Engr. Constr.

C-15.02
GENERAL NOTES

Pipes can be placed in any wall. Sump floor shall have a wood trowel finish and a minimum slope of 4:1 in all directions toward outlet pipe.

Curb over catch basin shall not be constructed until catch basin concrete has set for a minimum of 24 hours. For grate and frame details and opening areas, see Stds. C-15.06 and C-15.07.

Any specified gutter depression shall be warped to opening according to Std. C-15.08. All structural steel shall be ASTM A 36. Grate support shall be given one shop coat of No. 1 paint.

All concrete shall be Class A. Construction joints shall be placed to meet field conditions.

* 3/4" for LW or LB grates.
  3" for TV or TB grates.

** 2'0" for LW-1, LB-1, TW-1 and TB-1 grates. 1'6" for LW-2, LB-2, TW-2 and TB-2 grates. Use 1'6" dimension when catch basin is used with combined curb and gutter.

\( d = 6" \) when \( H = 8" \) or less
\( 8" \) when \( H \) is greater than \( 8" \). (See Section B-B)

ARIZONA HIGHWAY DEPARTMENT

CONSTRUCTION SECTION

TYPE 4 CATCH BASIN

<table>
<thead>
<tr>
<th>Drawn</th>
<th>B.G.</th>
<th>6-67</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traced</td>
<td>S.L.T.</td>
<td>7-67</td>
</tr>
<tr>
<td>Checked</td>
<td>J.F.O.</td>
<td>20-2-67</td>
</tr>
<tr>
<td>Approved Asst.</td>
<td>State Eng.</td>
<td>6-67</td>
</tr>
</tbody>
</table>

Drawing No. C-15.04
GENERAL NOTES
C.B. 5, sump only.
C.B. 5 Single, (illustrated), sump with wing basin upstream.
C.B. 5 Double, sump with symmetrical wing basins each side.
Pipes can be placed in any wall except wall adjacent to a wing basin.
Sump floor shall have a wood travel finish and a minimum slope of 4:1 in all directions toward outlet pipe.
Welding shall be in accordance with A.H.D. Welding Specifications.
Gutter depression shall be warped to opening according to Std. C-15.08.
All structural steel shall be in accordance with ASTM A 36.
Hose angle shall be painted with one No. 1 shop coat.
All concrete shall be Class A.
All reinforcing bars shall be 1/4", 18" c to c both ways and 1 1/2" clear to inside of walls and outside of wing basin floor except as shown.
Curb opening area (Sq. Ft.) per inch of curb "h" + gutter depression = curb opening length (Pt.) X 0.0834.
For grate and frame details and opening areas, see Stds. C-15.06 and C-15.07.
Construction joints shall be placed to meet field conditions.
Opt - 6" when H = 8" or less; 8" when H is greater than 8". (See Section C-C)
2 1/2" x 2 1/2" x 1/2" L
Curb support anchor. 1" @ bar with 3", 90° band.

SECTION B-B

SECTION A-A

NOTE: Provide Std. C-15.08 Construction Drain.

SECTION C-C
Use this section when t = 8"

DETAIL NO. 2

DETAIL NO. 1

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

TYPE 5 CATCH BASIN

Drawing No. C-15.05

Approved Asst. State Reo Const.
**GENERAL NOTES**

Grating units and frames shall be fabricated from structural steel except as noted. Structural steel shall be in accordance with ASTM A 36.

Welding shall be in accordance with A.H.D. Welding Specifications. The completed assembly shall be given one shop coat of No. 1 paint.

LW indicates longitudinal welded. LB indicates longitudinal bolted.

---

**FRAME**

**GRATE TYPES LW-1 & LW-2**

Restricted to use on longitudinal grades of 3% and less.

---

<table>
<thead>
<tr>
<th>Type</th>
<th>Clear Space (in)</th>
<th>No. of Bars</th>
<th>X (in)</th>
<th>Grate Opening (in)</th>
<th>Sq. Ft.</th>
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</thead>
<tbody>
<tr>
<td>LW or LB-1.0</td>
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<td>16</td>
<td>5/16</td>
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<tr>
<td>LW or LB-1.1</td>
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<td>1 9/16</td>
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<td>LW or LB-2.0</td>
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<td>5/16</td>
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<td>LW or LB-2.1</td>
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<td>9</td>
<td>1 9/16</td>
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<tr>
<td>LW or LB-2.2</td>
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<td>7</td>
<td>1 1/16</td>
<td>4.03</td>
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---

**BAR SPACER DETAIL**

Cast iron, cast steel or steel bar stock.

1/2" rod threaded ends, Spot weld or peen.

---

**SECTION A-A**

**GRATE TYPES LB-1 & LB-2**

For use on longitudinal grades in excess of 3% or as an alternate to Type LW on grades of 3% or less.
Delete anchors on one side for curb opening basin. See Std. C-15.01 & C-15.02.

For bar spacing, number of bars and grate opening, see Table.

SECTION

FRAME

<table>
<thead>
<tr>
<th>Type</th>
<th>Clear Spacing</th>
<th>Bars</th>
<th>X</th>
<th>Grate Opening</th>
<th>Sq. Ft.</th>
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<tbody>
<tr>
<td>TW or TB-1.0</td>
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<td>28</td>
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<td>3.47</td>
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<td>TW or TB-1.1</td>
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<td>11/16&quot;</td>
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<td>11/16&quot;</td>
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<td>TW or TB-2.1</td>
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<td>16</td>
<td>5/8&quot;</td>
<td>3.11</td>
<td></td>
</tr>
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</table>

GENERAL NOTES

Grating units and frames shall be fabricated from structural steel except as noted. Structural steel shall be in accordance with ASTM A 36.

Welding shall be in accordance with A.M. Welding Specifications. The completed assembly shall be given one shop coat of No. 1 paint.

TW indicates transverse welded.
TB indicates transverse bolted.
CATCH BASIN TYPES 1, 2, 4-SINGLE, 4-DOUBLe & 5-SINGLE
(Grate opening only or combination; showing minimum spacing for Catch Basins in series.)

CATCH BASIN TYPE 3
(Curb opening only.)

Gutter depression: 3" max. (See Detail No. 1)
O = Normal crown or gutter flow line elevation.
# = Depressed elevation.
# = Straight grade with downward slope.
W = Normal gutter width per Std. C-3.01

CATCH BASIN TYPE 4
(Off roadway location)

Principal flow

'' A. C. Apron

Catching basin wall

6" x 18 ga. C. M. P.
Lght. as req'd.

Plug with conc. upon pvt. comp.

Catch basin drain may be deleted at option of Engineer

No gutter depression shall be used adjacent to median.

GENERAL NOTES

ARIZONA HIGHWAY DEPARTMENT CONSTRUCTION SECTION

DRAWN

S.L.T.

DRAWING NO.

5/72

C-15.08

TRADED

CHECKED

APPROVED A.ST.

STATE ENG CONST.
PLAN PERSPECTIVE
ILLUSTRATING 1-WAY FLOW WITH DYKE

Dike back sloped at 6:1 to intersect ditch grade. (Slope referenced to ditch grade.)

Catch basin and apron

Dike size per plans

PLAN

FLOW

4" Apron

See Grating Detail

4 - 5/8" holes

6:1 dike slope or median ditch grade. (1-way or 2-way flow respectively)

3/4 bars. See Section B-B

6:1 Median ditch grade

24" Outlet pipe

Cutoff walls same material as apron

4#/bars, 1'-0" c to c horiz. and vert., 1 1/2" clear to inside of wall.
No bottom reinforcing. *6"

SECTION B-B

SECTION A-A

GENERAL NOTES

Apron shall be A.C. or P.C. concrete as specified on Plans.

Concrete shall be Class A.

Grating shall be fabricated of structural steel.

Structural steel shall be in accordance with ASTM A 36.

Welding shall be in accordance with A.N.D. Welding Specifications.

Grating assembly shall be given one shop coat of No. 1 paint.

"H" indicated on project Plans.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

MEDIAN CATCH BASIN

Drawn E.G. 3-68
Traced S.A F. 3-68
Checked J.P.O. 30 5-68
Approved

C-15.09
PIE Dimensions

<table>
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<tr>
<th>I.D.</th>
<th>L</th>
<th>E</th>
<th>F (Approx)</th>
<th>C.Y. Conc.</th>
<th>Rein, Steel</th>
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<tbody>
<tr>
<td>18&quot;</td>
<td>2'-0&quot;</td>
<td>1'-0&quot;</td>
<td>1'-9&quot;</td>
<td>0.97</td>
<td>0.96</td>
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<tr>
<td>24&quot;</td>
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<td>1'-0&quot;</td>
<td>1'-9&quot;</td>
<td>1.11</td>
<td>1.07</td>
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<tr>
<td>30&quot;</td>
<td>3'-6&quot;</td>
<td>1'-6&quot;</td>
<td>2'-7&quot;</td>
<td>1.50</td>
<td>1.44</td>
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<tr>
<td>36&quot;</td>
<td>4'-0&quot;</td>
<td>2'-0&quot;</td>
<td>3'-6&quot;</td>
<td>2.08</td>
<td>2.01</td>
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<td>42&quot;</td>
<td>5'-0&quot;</td>
<td>2'-6&quot;</td>
<td>4'-4&quot;</td>
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<td>2.63</td>
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<td>48&quot;</td>
<td>6'-0&quot;</td>
<td>3'-1&quot;</td>
<td>5'-2&quot;</td>
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<td>6'-1&quot;</td>
<td>4.14</td>
<td>4.02</td>
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<td>60&quot;</td>
<td>8'-0&quot;</td>
<td>4'-0&quot;</td>
<td>6'-11&quot;</td>
<td>4.96</td>
<td>4.80</td>
</tr>
</tbody>
</table>

General Notes
All concrete shall be Class A.
All reinforcing bars shall be #4 except two #6 bars over pipe. Bar spacing approximately 1'-0" c to c unless otherwise noted.

Arizona Highway Department
Plans Division

Irrigation Headwalls
18" to 60" Diameter Pipes

Drawn R.J.J. 3-10-58
Traced S.L.T. 7-4-67
Checked P.E. 9-2-68
Approved Egr. Plans

Rev: C-16.01
6x6-10/10 wire mesh, 9 wire ties. See perspective.

- 6x6-10/10 wire mesh entirely enclosing rock backfill including ends. Lac e laps with 2 - strands 9 wire.
- 9 wire ties; double wrapped. 2'-0" c to c both ways.
- Double wrapped with 2 - strands 9 wire 1'-0" c to c.
- Single wrapped with 2 - strands 9 wire 1'-0" c to c.

Stream bed

Enbankment slope

Rock backfill

Top of bank protection

Min. 20° railroad rail or equal. 15' c to c. Type 1 = 10' long; Type 2 = 12' long.

Type 1 = 1'-6"
Type 2 = 2'-0"

50° railroad rail, or equal, 7'-6" c to c. Type 1 = 15' long; Type 2 = 17' long.

Type : TYPE 1 & 2 BANK PROTECTION

GENERAL NOTES

Rock for backfill shall be sound and durable and shall not pass a 6" square opening.

---

### Bank Protection

**Type 1, 2, & 3**

<table>
<thead>
<tr>
<th>Type</th>
<th>Embankment slope rate</th>
<th>h&quot;</th>
<th>Top of bank protection above stream bed</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2:1 or 1 1/2:1</td>
<td>0' to 2'</td>
<td>2' to 4'</td>
</tr>
<tr>
<td>1</td>
<td>2:1 or 1 1/2:1</td>
<td>0' to 3'</td>
<td>4' to 7'</td>
</tr>
<tr>
<td>2</td>
<td>2:1 or 1 1/2:1</td>
<td>0' to 6'</td>
<td>6' to 12'</td>
</tr>
</tbody>
</table>

*When other embankment slope ratios are encountered, warp to 2:1 or 1 1/2:1; that is, warp 1:1 slope to 1 1/2:1.*

---

**Arizona Highway Department**

**Construction Section**

**Bank Protection**

Type 1, 2, & 3

**Drawn:** [Signature]

**Traced:** [Signature]

**Checked:** [Signature]  
State Hwy. Com.  
3/71
Loop Cables around railroad rails as shown.

6 X 6-10/10 Galv. wire fabric placed as shown to enclose all but the top surface of the rock backfill and attached to the rails by a single wrapping with 3 strands of #9 wire, 1'-0" c to c.

Wire fabric end piece

Wire fabric end piece

Rock backfill

Rail head face out

Type 4 = 4'
Type 3 = 5'

3/8" Dia. Cable
Rock backfill
Low stream bed

3/4" Dia. cable placed under basket.

500' Railroad rail, 4' c to c
Type 4 = 15' long
Type 5 = 16' long

TYPES 4 & 5 BANK PROTECTION

2" x 4" galv. woven wire fabric; horizontal wires shall be 2 strands, twisted, min. 12 1/2 ga; diagonal wires min. 14 ga. Attach to rails as shown by single wrapping with 2 strands of #9 wire.

2 Strands #9 wire, twisted taut.

Min. 150' Rails or equal 10' long.

Dyke or Emb.

Intermediate Panel

End Panel

GENERAL NOTES
Rock for backfill shall be sound and durable and shall not pass a 6" square opening.

ARIZONA HIGHWAY DEPARTMENT CONSTRUCTION SECTION

BANK PROTECTION RAIL AND WIRE TYPES 4, 5, 6 & 7

DRAWN
H.A.K.

CHECKED

APPROVED
State Eng. Cptst.
TYPE 1 RIPRAP - PLAIN ROCK

TYPE 2 RIPRAP - GROUTED ROCK

ELEVATION A-A

TYPE 4 RIPRAP - SACKED CONCRETE EROSION CHECK

GENERAL NOTES
Grout for riprap may be pneumatically placed mortar.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

RIPRAP

<table>
<thead>
<tr>
<th>Rev</th>
<th>C-17.03</th>
</tr>
</thead>
</table>

Drawn: D.C. 5-68
Traced: D.G. 5-68
Checked: J.P.O. 5-68
Approved: Engt. Plans
GENERAL NOTES

All concrete shall be Class A.

Every fifth course of bricks shall be laid as stretchers.

Manhole frame and cover, Std. C-18.02, is shown. Other types may be substituted if noted on Plans.

For manhole cut replacement in bituminous or concrete pavement, see Std. C-7.03.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

MANHOLE DETAILS

Drawn: R.E.W. - 3-58
Traced: S.L.T. - 5-67
Checked: J.P.O. - 8-68
Approved: Eng. Plans - 10-68
GENERAL NOTES
Type C cover shall be the same as Type A except that the cover shall be vented with at least six one inch holes, equally spaced in a circle 8 1/2" from the center of the cover.
Type A cover shall be used unless otherwise specified.

The bearing faces shall be machined so that the cover will have a uniform bearing in any position in the frame.

SECTION B-B OF COVER
TYPE A COVER
Approx. weight 190 lbs.

SECTION C-C OF FRAME
Approx. weight 260 lbs.

SECTION A-A OF COVER
TYPE B COVER
Approx. weight 280 lbs.
CONCRETE SURFACE FORD CONCRETE WALLS

- Min. distance below stream bed

BITUMINOUS SURFACE FORD CONCRETE WALLS

- Min. distance below stream bed

GENERAL NOTES
Ford walls to be Class "A" Concrete.

ARIZONA HIGHWAY DEPARTMENT CONSTRUCTION SECTION

Drawn: C.B.B. - 7-65
Traced: S.L.T. - 5-67
Checked: J.F.O. - 5-68
TYPE 1
BITUMINOUS SURFACE FORD

Optional Rock Basket downstream from cutoff wall. See Detail A.

Flow

Depth Gauge

Width of seal coat

Roadway Width

Slope 0.015'/ft.

To be used when treated base is called for on Plans.

TYPE 2
BITUMINOUS SURFACE FORD
TIMBER CUTOFF WALLS

2-2" X 12" planks

4" X 4" X 5'-0"
posts 5' c to c

2" std. pipe
See Detail A.

Wall to be built to one foot above high water level.

3" cap

4'-0" min.

3'-0"

2" std. pipes, 7'-0"
spaced 8' c to c

Depth Gauge - 3" I.B. X 5'-0"
pipes. Paint two fluid coats of white enamel. Paint 1"
wide bands one coat of black enamel.

6 X 6 - 10/10 welded wire fabric. Tie with 2-strands
#9 ga. galv. wire 2" c to c
each way. Tie basket to top
2" X 12" with 2-strands #9
galv. wire at top, bottom,
and each end 5' c to c.

3-40d common nails per board

ELEVATION - TYPE 2

Optional Rock Basket full length of structure. See Detail A.

2" std. pipe.
See Detail A.

DETAIL A

GENERAL NOTES
All timber shall be rough, pressure treated and unpainted.
Rock basket, full length of structure shall be included only when called for on Plans.
See Plans for bituminous surface and base material details.
Galvanize pipes in accordance with ASTM A123.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

FORDS

Drawn C.B.B. 7-65
Traced E.L.T. 5-67
Checked J.P.O. 9-68
Approved Engr. Plans

Rev

C-19.02
GENERAL NOTES

All wood shall be redwood or cedar, S4S and untreated.

Crossing and advance warning signs shall be placed at each approach with steel or aluminum message panels placed only on the side facing traffic.

"Number of tracks" panels shall be deleted for single track crossing.

All crossing sign message panel background shall be silver-white, flat top reflective sheeting with black, opaque letters.

Advance warning sign traffic face background shall be white, yellow, flat top reflective sheeting with black, opaque letters, border and symbol.

All wood and metal surfaces not covered by reflective sheeting shall be primed and finished with two coats of No. 11 white enamel.

Reflective sheeting shall be applied in accordance with the manufacturers specifications.

All lettering shall be in accordance with A.H.D. Traffic Control Manual.

Number Panel: 9" x 8 1/2" x 16 ga. steel or .063 aluminum panel mounted on 9" x 8 1/2" x 1 5/8" redwood or cedar. 5 1/2" series D letters.

Track Panel: 2" x 3" x 8" x 16 ga. steel or .063 aluminum panel mounted on 2" x 3" x 8" x 1 5/8" redwood or cedar. 4" series D letters.

ARIZONA HIGHWAY DEPARTMENT
CONSTRUCTION SECTION

RAILROAD CROSSING SIGNS

5 1/2" series D letters

5/8" round head galv. wood screws, 1 1/4" long.

5/8" x 10" bolts. Cut washers

Fin. shoulder line or front face of curb.

LOCATION PLAN

.063" 6061T6 aluminum or 5/8" medium density, grade B-B plywood

8" series E letters

Steel post Std. C-9.04 modified.

3' 0" splice

RAILROAD ADVANCE WARNING SIGN

Concrete may be job mix concrete of not less than 5 sacks per cu. yd.
**Survey Monument, Frame and Cover**

**General Notes**
A Survey Monument, Frame and Cover, complete and in place, shall be considered as a unit. In bituminous pavement, frame and cover shall be set after A.C. is placed.

A Right of Way Marker, consisting of Survey Monument and Reference Marker, complete and in place, shall be considered as a unit. Right of Way Markers shall be placed as shown on Plans or as directed by the Engineer.

All concrete shall be Class A.

*See A.H.D. Traffic Control Manual*
GENERAL NOTES

Standard Marker shall be made of brass or bronze.

Standard Marker shall be furnished by the State.

Bench marks will be established, by the Engineer, on headwalls, bridge curbs or other permanent structures.
PLAN

- #4 bars 1'-0" c to c full length of slab, lap 2' at splices

- #6 bars 6" c to c

SECTION A-A

1 1/2" clear to base of slab

Utility line

CROSS SECTION

ROADWAY

Slab

Utility line

Slab length as shown on Plans

FOR SINGLE INSTALLATION

Quantities per ft. of slab length

Concrete

Reinforcing Steel

0.31 C.Y.

35.22 lbs.

GENERAL NOTES

Concrete shall be Class A.