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GENERAL NOTE: The term Plans, as used herein, shall refer to the Roadway Construction Plans.
GENERAL NOTES
The desirable maximum embankment slope rate shall be 6:1 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Standard cut and embankment slopes as shown on this sheet may be superseded by special slopes where shown on Plans.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.

NOTE: Std. slope rounding not shown.
See General Notes.
MINIMUM SLOPES

NOTE: Std. slope rounding not shown. See General Notes.

INTERMEDIATE SLOPES

PAVED GUTTER IN CUTS

MINIMUM DITCH CONDITION

GENERAL NOTES
See Plans for details of roadway width, cut ditch, type and thickness of roadway surfacing, super-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Standard cut and embankment slopes as shown on this sheet may be superseded by special slopes where shown on Plans.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' semi-tangents for slope rounding. For each additional foot of cut add 1' to semi-tangent to 11' maximum.
**MINIMUM SLOPES**

NOTE: Std. slope rounding not shown. See General Notes.

**INTERMEDIATE SLOPES**

**MAXIMUM SLOPES**

**MINIMUM DITCH CONDITION**

**SLOPE CONTROL**

**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Standard cut and embankment slopes as shown on this sheet may be superseded by special slopes where shown on Plans.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' semi-tangents for slope rounding. For each additional foot of cut add 1' to semi-tangent to 13' maximum.

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**ARIZONA HIGHWAY DEPARTMENT**

**PLANS DIVISION**

**SLOPES CLASS C & D ROADWAYS**

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Rev C-2.03
### Table: Cumulative Percent of Crown "C" for Each Foot Right or Left of X

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### Example

**Assume** W = 60 ft. and C = 0.65 ft.  
**Find Y for X = 8 ft.**

Table shows Y = 16.00% of C,  
or 0.045 × 0.16 = 0.072 ft.
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.

Grader Ditches and crown ditches or dykes shall be constructed with a minimum grade to prevent excessive erosion. Ditch outlets should be provided where possible. Ditch sections shown may be varied by the Engineer.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

DITCHES AND DYKES

TYPICAL DYKE INSTALLATION AT STRUCTURE
Place dykes at structures to create a water cushion.
Indicates inlet
Indicates spillway

DOUBLE INLET

SECTION A-A

6 X 6-10/10 Wire Mesh

Fin. Grade
1'-0" 3'-3"

A.C.

Spillway
Subgrade Shoulder

Note: Depress curb ends with 6:1 slope.

EMBANKMENT CURB

SPILLWAY SECTION

Note: Where rock is encountered, the outlet may be omitted.

6X6-10/10 Wire mesh cont. bottom & sides.

6 x 6-10/10 wire mesh. Lap 2' & tie.

Outlet

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

EMBANKMENT CURB

Spillway

Outlet

Fill Slope

1/2" expansion joint. Preformed joint filler.

DETAIL - ONE WAY FLOW SINGLE INLET

GENERAL NOTES
Spillway inlet, spillway, outlet and embankment curb shall be Class A concrete.

ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION

CONCRETE SPILLWAY, INLET & OUTLET.
EMBANKMENT CURB

Rev

DRAWN

C.O.M. 1-64

Traced:

3-65

CHECKED:

J.F.O. 3-68

APPROVED

Engr. Plans 5-68

C-4.01
GENERAL NOTES
Use 12" x 16 ga. corrugated pipe. 24" x 4'0" C.M.P. tank, with open bottom and 6" x 1'0" C.M.P. stub, and angle supports shall be shop fabricated and galvanized in accordance with AASHTO M-36.
See Detail for rock installation. Round all exposed concrete corners.

QUANTITIES
Spillway Inlet
1-Way 1.55 C.Y. Class A Conc. 33# Reinf. Steel
2-Way 2.08 C.Y. Class A Conc. 37# Reinf. Steel
Headwall 1.00 C.Y. Class A Conc. 25# Reinf. Steel
Apron 0.60 C.Y. Class A Conc. 6# Reinf. Steel

DETAIL ANCHOR
#6 galv. wire tie double wrapped
Anchor stakes #6 bar 4' long 10" c to c

DETAIl-ANGLE SUPPORTS FOR TRASH RACK
5" x 3/8" x 3/16" 1-way flow symm. about 2-way flow
1/2" expansion joint. Preformed joint filler

DETAIl-TRaSH RACK TO BE GALVANIZED
#3 bars
3/8" bar
3/16" 3/4" I.D.

OUTLET-HEADWALL AND CONCRETE APRON
5'6" - 0'
1/2" expansion joint. Preformed joint filler

ARIZONA HIGHWAY DEPARTMENT
SPILLWAY INLET
C.M.P. DOWNDRAIN OUTLET

SECTION A-A
Elbow
C.M.P. outlet on rock

SECTION B-B

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION
SPILLWAY INLET
C.M.P. DOWNDRAIN OUTLET

C-4.02

Drawn L.O.M. & D.O.
Traced S.L.T. & R.A.F.
Checked T.P.O. 5-68
Approved Engr. Plans 5-68
For C-2.01 slopes with emb. height over 24', \( L = L \) for 24' emb. height from table + 2.24(emb. height - 24).

For C-2.02 slopes with emb. height over 32', \( L = L \) for 32' emb. height from table + 1.8(emb. height - 32).

For C-2.03 slopes with emb. height over 13', \( L = L \) for 13' emb. height from table + 1.8(emb. height - 13).
GENERAL NOTES
For C-2.01 slopes with emb. height over 24', L = L for 24' emb. height from table + 2.24(emb. height - 24).
For C-2.02 slopes with emb. height over 32', L = L for 32' emb. height from table + 1.8(emb. height - 32).
For C-2.03 slopes with emb. height over 13', L = L for 13' emb. height from table + 1.8(emb. height - 13).

C.M.P. DOWNDRAIN LENGTH TABLE

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

C-4.04
**SINGLE CURB**

Roadway width

1'-0"

1/4" R

1/2" batter

**COMBINED CURB & GUTTER**

Roadway width

2 1/2"

6" R

1/4" R

1/2" batter

**CURB TERMINAL SECTION**

Width as shown on plans

Slope 0.01' per ft.

Sidewalk shall be single course Class A concrete, sweat finished and jointed with a 1/4" 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 1/4" radius edging tool.

**CONCRETE SIDEWALK**

**DEPRESSED CURB FOR DRIVEWAY ENTRANCE**

**SIDEWALK EXPANSION JOINT**

**GENERAL NOTES**

All curbs and gutters shall be single course, Class A concrete unless otherwise noted on plans.

All curbs shall be trowel finished.

All gutter flow lines shall be troweled to an accurate grade for a width of 9".

Curbs, or curb and gutter, shall have a 1/4" joint extending all the way through the concrete at locations matching the joints in adjacent P.C.C. pavement; at approximately 15° centers when adjacent pavement is bituminous and at tangent points in curb returns and at structures. The joints may be open or with redwood filler left in place.

* When curb and gutter is located with the roadway section sloping away from the curb, the gutter slope shall match the roadway slope.

---

**ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION**

**CURB, GUTTER, SIDEWALK & DRIVEWAY DETAILS**

**Drawn**

O.K. 3-1953

**Traced**

R.A.P. 6-8-67

**Checked**

J.P.D. 6-9-68

**Approved**

Engr. Plans

**Rev**

C-5.01
**TYPICAL VALLEY GUTTER CONSTRUCTION AT STREET INTERSECTION OR ALLEY**

A = Overall curb and gutter width.
d = Drop from point controlled by grade to outside edge of gutter.
F = Total crown from θ elev. to gutter grade.
a = Distance from θ to inside edge of gutter.
b = Distance from outside edge of gutter to point controlled by grade.
e = Drop from θ to inside edge of gutter.

**CURB & GUTTER MEASUREMENT ON CURVES**

Single curb and combined curb and gutter will be measured along the back of the curb.

**FORMULA FOR QUARTER POINTS**

S = Sum of intersecting pavement widths, (Distance between gutter grade lines.)
D = Drop from center of intersection to center of return

where S = 0' to 90', P = 0.17
" S = 91' to 100', P = 0.18
" S = 101' to 110', P = 0.19
" S = 111' to 136', P = 0.20

PD = Drop from center of intersection to quarter point.

**STREET INTERSECTION GRADES**

**CURB & GUTTER MEASUREMENT & STREET INTERSECTION GRADES**

**TYPICAL CONCRETE ALLEY OR DRIVEWAY CONSTRUCTION**

**GENERAL NOTES**

To determine the value of F, see roadway typical section.
For Curb and Gutter details, see Std. C-5.01.
GENERAL NOTES

Paved Turnouts: W=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. 
Coml. - 30' Max. 
10' Min. 
20' Desirable
40' Min.

15' Min. 

10' Min. 
20' Desirable

R/W Line

Industial Set Back Line

TYPICAL SECTION AT RURAL DRIVEWAY ENTRANCE
See Std. C-5.01 for Depressed Curb Details

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

TURNOUT
&
DRIVEWAY LAYOUT

URBAN DEVELOPMENTS

* 30' Max. - One Way, Commercial
40' Max. - Two Way, Commercial

Note: See Std. C-5.01 for Depressed Curb Details
**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 Plans Engineer and Traffic Engineer and the Engineer shall submit the alignment and profile of the proposed change for their review.

**SPECIAL DETOUR SECTION**

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**ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION**

**DETOUR ENTRANCE DESIGN TABLE**

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<td>R.A.F. 12-66</td>
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**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.
S indicates sawed contraction joint
C indicates contraction control joint
CH indicates construction joint
LL indicates longitudinal joint.
See Std. C-7.02

PLAN
See General Notes

# Indicates P.C.C. thickness

CONSTRUCTION JOINT
To be used at end of pour

GENERAL NOTES
All transverse joints shall be in line with joints in adjacent slabs.
At intersection of side roads or streets, joints shall be placed to give the interaction 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.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION
PORTLAND CEMENT CONCRETE PAVEMENT
TRANSVERSE JOINTS

Checked: J.T.O. 70 E-68
Approved: Engr. Plans: C-7.01
**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'-0" long.

In slip form type pavement construction, Longitudinal Joint Type "F" shall be used. In fixed form type construction either Longitudinal Joint Type "E" or "F" may be used.

---

**PLAN**

**SECTION A-A**

**JOINT TYPE "E"**

- 1/4" radii
- 3/16" max. X 2" saw cut filled as shown
- 3/16" Plastic tube or upholstery cord
- 4 X 2'-0" bars
- Approved chair

**JOINT TYPE "F"**

- 1/4" expansion joint.
- Preformed joint filler
- 1/4" radii
- 3/16" hot poured Std. joint seal.
- Filled as shown
- 2'-0" X 4" max.

**JOINT TYPE "G"**

- 1/4" radii
- Pavement
- Curb 
- 4 X 2'-0" bars
- 2'-0" c to c max.

**JOINT TYPE "H"**

- Existing concrete
- 1'-3" max.
- New concrete
- Concrete curb 
- Plastic tube or upholstery cord
- Joining joint

**LONGITUDINAL JOINT DETAILS**

---

**ARIZONA HIGHWAY DEPARTMENT**

**PLANS DIVISION**

**PORTLAND CEMENT CONCRETE PAVEMENT**

**LONGITUDINAL JOINTS**

**Drawn O.K.**

**Traced R.A.F. 12-66**

**Checked J.P.O. 1113-68**

**Approved Engr. Plans**

**C-7.02**
GENERAL NOTES
All concrete shall be Class A.
CASE I - DIRECT ANGULAR EXIT

CASE II - PARALLEL DECELERATION

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

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

TYPICAL EXIT RAMP TERMINALS

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.
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.

SECTION B-B

NOTE: All joints and scores shall be edged with a 1/4" radius tool.

Extend nose paving to a 20' max. 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

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

TYPICAL ENTRANCE RAMP TERMINAL

Drawn C.B. 3-60
Traced S.E.T. 8-67
Checked J.F.O. 8-68
Approved Eng'g. Plans 3-69

Drawing No. C-8.02
The M9-1 delineator is used as a guide marker for through roadway alignment, and is placed as follows:

1. For interstate roadways and other roadways that meet freeway standards, the M9-1 delineators are placed continuously on the right side except where fixed source lighting is in operation and where left-side placement is necessary to clearly show the alignment.

2. For roadways that do not meet freeway standards, the M9-1 delineators are placed continuously on the right side except (a) where fixed source lighting is in operation, (b) along areas used for pull-offs or parking, or (c) on hazardous right-hand curves where the delineators are placed on the left. Delineators are bi-directional when applied on the left side of hazardous right-hand curves on two-way roadways.

3. M9-1 delineators are placed on through roadways at interchanges regardless of fixed source lighting. The crossroad through an interchange is normally delineated within the limits of the right-of-way at rural interchanges and grade separations.

4. When an M9-1 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. M9-1 delineators are not located closer than one quarter of the normal spacing before or beyond a hazard marker or milepost marker.

The M9-2 delineator is used as a guide marker for the alignment of acceleration and deceleration lanes and for entrance and exit ramps. It is used at all interchanges regardless of fixed source lighting and is placed as follows:

1. The M9-2 delineators are placed continuously on the right side of tangent and left-curving ramps and speed-change lanes. On right-hand curves they are placed on the left side.

2. 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 bridge marker is used to mark the ends of narrow bridges. The marker is placed on each side of both ends of bridges located on two-way roadways, and on each side of the approach end of bridges located on one-way roadways.

The M9-2 pipe culvert marker may be used to mark the ends of pipes which require periodic maintenance except that they are not installed in the medians of divided highways.

The M9-3H hazard marker is used to mark obstructions that are located within the roadway, such as exit terminal mashes and channelization islands.

The M9-3W 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 or within a line of M9-2 delineators.

The M9-5 milepost marker is placed on the right side of the roadway. If it cannot be placed within 0.01 mile accuracy, it is omitted.

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

The M9-6(2) striping 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 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 extreme hazards located within the roadway, such as transitions from two-way roadways to divided roadways, or at dead-end locations.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

DELINEATOR USAGE

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Rev

C-9.01

Drawing No.
NOTES:

All delineator plates, hazard-marker plates, milepost plates, striping-marker plates, and pipe-culvert marker plates shall be constructed from either 16 ga. steel or 6061-T6-.063 aluminum sheet. The M9-1R and M9-1L hazard marker plates may be constructed from sign-grade plywood.

The 16 ga. steel plates shall be painted with one coat of LA or LB primer, both sides, and one coat of industrial synthetic black, Interstate green, or highway yellow enamel, both sides, as specified, or shall be a minimum of 16 gauge hot-dipped galvanized, Federal Spec. Q-Q-S-775A and primed with a corrosion inhibiting primer and final coat black, Interstate green, or highway yellow enamel Federal Spec. T-T-489C Class 8 or equal.

The 6061-T6 aluminum sheets shall be etched by approved methods and then primed with 1D primer, both sides. Final coat, both sides, shall be industrial synthetic black, Interstate green, or highway yellow as specified.

Stripes for the striping markers shall be painted with industrial synthetic white enamel paint conforming to Federal Spec. T-T-489C Class 8 or equal.

Amber and crystal reflectors shall be plastic, prismatic, center-mounted devices mounted with 3/16" dia. corrosion resistant fasteners, or high-intensity, weather-resistant reflective sheeting applied directly to the back plate. Reflective sheeting for M9-1 hazard markers shall be silver-white, weather-resistant reflective sheeting. All reflective devices shall conform to the A.H.D. Standard Specifications.

Where back plates are furnished with the reflective sheeting type reflector, the reflector mounting holes shall not be provided.
M9-1 AND M9-2 DELINEATORS

M9-1 HAZARD MARKER

M9-2 PIPE-CULVERT MARKER

M9-3H HAZARD MARKER

NOTES:

Delineator, hazard-marker and mile-post plates are installed perpendicular to the roadway.

Pipe-culvert marker and striping-marker plates are oriented parallel to the roadway.

Striping markers are placed as far as practicable from the roadway edge.

The inside edge of M9-3V, M9-1L, and M9-1R hazard markers is placed in line with the inside edge of the obstruction.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

DELINEATOR PLACEMENT

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Drawn T.E.D. 4-68
Traced T.E.D. 4-68
Checked T.E.D. 4-68
Approved Engr. Plans 4-68
Delineator are oriented perpendicular to approaching traffic

- Deform ends of threads after installation
- 5/16" dia. x 2 1/4" corrosion resistant stove bolt and hex nut. 2 reqd. per post

- 3/16" dia. corrosion resistant stovobolt and hex nut (typ.)

- 1 3/4" x 4" 12 ga. corrosion resistant plate 2 reqd. per post

Steel Post

NOTES:

- Steel posts shall conform to ASTM-A-499 and shall not weigh less than 1.9 lbs. per foot.
- Steel posts and bi-directional delineator bracket shall be galvanized to conform to ASTM-A-123.
1. MB-1 delineators are placed on the left side at hazardous right-turning curves on two-way undivided and non-freeway divided roads. They are bi-directional, visible from opposite directions, only on two-way undivided roadways.

2. The MB-1 and M9-3H markers at median openings with left-turn lanes may be mounted together on a single post when terminal width is 4'-0" or less.

3. Undivided two-way roadways having four or more traffic lanes should be delineated continuously on both sides.

**NOTES:**

**LEGEND**

- **NO SCALE**
- **MB-1**
- **M9-3H**

**ARIZONA HIGHWAY DEPARTMENT**

**PLANS DIVISION**

**DELINEATOR MAINLINE SPACING**

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The following method may be used to estimate the degree of curvature when insufficient data is available.

Middle ordinate (measured in inches) corresponds with degree of curvature. (Example: 25° = 62" curve)

To Determine Spacing By This Method
Find degree of curvature by stretching a 62'-0" line at any convenient point on the centerline of the curve and then measure the middle ordinate (in inches). The middle ordinate corresponds with the degree of curvature.

Important: Maximum spacing for MB-2 delineators is 200 feet (broken line). Maximum mainline spacing for MB-1 delineators is 500 feet. Necessary field adjustments in spacing length shall be made by the Engineer.

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 snow-marker posts may be 7'-6" steel sign posts or 4" x 4" x 8'-0" wood posts and shall be painted black. They may be fastened to the guardrail posts if applicable.

The single 3½" dia. green center-mount reflector is used only at the beginning of curb. The double green reflector is used at the end of curb.

The single 3½" dia. crystal center-mount reflector shall be used only at the beginning of the guardrail. The double crystal reflector shall be used at the end of the guardrail.
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.

FACE ELEVATION

SIDE ELEVATION

Installation of Guard Rail in embankment curb sections.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

GUARD RAIL-STEEL
SINGLE FACE DETAILS

DETAIL NO. 1

DETAIL NO. 2
**DETAIL NO. 1 - GUARD RAIL POST INSTALLATION ON STRUCTURES**

- Post length as required
- Fin. grade
- 2-6" x 8" x 1/2" 3" long

**SECTION A-A**

- 1" sq. or hex.
- head mach. bolt, nut and washers

**ELEVATION**

- 5/8" bolt size self drilling anchors

**DETAIL NO. 2 - MEDIAN BARRIER**

- 3" min. 60 # spikes 2 per block
- 8" x 8" x 1'-2" block
- 1 3/4" x 3" washer, 8 ga. 1 each side.

- 5/8" sq. or hex.
- head mach. bolt or 5/8" # rod threaded both ends. (See General Notes)

- Where guard rail crosses curb return at raised median terminus, vertical
- transition shall be accomplished in 12'-6" horizontally. Rear rail bolt holes as required.

**GENERAL NOTES**

For other applicable guard rail details, see Std. C-10.01. Bolt ends shall not project more than 1 1/2" beyond face of block. If adjustment shortening is required, threads shall be left in functional condition. 5/8" bolt size self drilling anchors shall have a min. 1500# pull out strength in 2500 p.s.i. concrete in accordance with manufacturer's specifications.
### Table I

<table>
<thead>
<tr>
<th>$X$</th>
<th>$Y$ (Feet)</th>
<th>$W$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5' - 0''</td>
<td>0.08</td>
<td>0.11</td>
</tr>
<tr>
<td>9' - 0''</td>
<td>0.14</td>
<td>0.17</td>
</tr>
<tr>
<td>12' - 6''</td>
<td>0.16</td>
<td>0.21</td>
</tr>
<tr>
<td>15' - 0''</td>
<td>0.33</td>
<td>0.67</td>
</tr>
<tr>
<td>37' - 6''</td>
<td>0.75</td>
<td>1.00</td>
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<tr>
<td>50' - 0''</td>
<td>1.25</td>
<td>1.50</td>
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<tr>
<td>62' - 6''</td>
<td>2.08</td>
<td>2.78</td>
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<tr>
<td>75' - 0''</td>
<td>3.00</td>
<td>4.00</td>
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### Table II

<table>
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<th>$X$</th>
<th>$Y$ (Feet)</th>
<th>$W$</th>
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</thead>
<tbody>
<tr>
<td>5' - 0''</td>
<td>0.08</td>
<td>0.11</td>
</tr>
<tr>
<td>9' - 0''</td>
<td>0.14</td>
<td>0.17</td>
</tr>
<tr>
<td>12' - 6''</td>
<td>0.16</td>
<td>0.21</td>
</tr>
<tr>
<td>15' - 0''</td>
<td>0.23</td>
<td>0.37</td>
</tr>
<tr>
<td>37' - 6''</td>
<td>0.70</td>
<td>1.00</td>
</tr>
<tr>
<td>50' - 0''</td>
<td>1.25</td>
<td>1.50</td>
</tr>
<tr>
<td>62' - 6''</td>
<td>1.90</td>
<td>2.25</td>
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<tr>
<td>75' - 0''</td>
<td>2.08</td>
<td>2.50</td>
</tr>
<tr>
<td>87' - 6''</td>
<td>3.81</td>
<td>4.50</td>
</tr>
<tr>
<td>100' - 0''</td>
<td>5.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

$Y = (W)^2 / X^2 = \text{offset from shoulder line to guard rail.}$

$W = \text{Distance between shoulder line and desired location of end of guard rail.}$

$F = \text{Length of flared guard rail.}$

$X = \text{Distance from beginning of parabolic flare.}$

6' - 0'' indicates the preferred value.

**General Notes**

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

Where necessary, dimension $F$ may be increased to provide better alignment and grade.
One way roadway shown. For two way roadway, use symmetrical trailing guard rail flare with 10" x 10" anchor post and block at end.

**CASE NO.1 BRIDGE WIDTH LESS THAN ROADWAY WIDTH**

- Constan. ε

Traffic

As noted on Plans 6'-3" Post Spacing

Guard rail anchor block

Bridge curb line

F = 125' Min.; 150' for high speed facilities (see table below)

Traffic Lane

**CASE NO.2 BRIDGE WIDTH EQUALS ROADWAY WIDTH**

- **SEE GENERAL NOTE 1**

Traffic

Base of Curb

Guard rail anchor block

Paved shoulder

GENERAL NOTES

For shoulder widths less than 5' or when bridge width equals roadway width, use straight guard rail with flared approach end treatment.

When guard rail is continued beyond the required flare, the last four flare panels shall be modified to avoid a sharp change in direction.

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

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

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

### Guard Rail: Steel Detail at Bridge Approaches

<table>
<thead>
<tr>
<th>Shoulder Width</th>
<th>X</th>
<th>12'-6&quot;</th>
<th>25'-0&quot;</th>
<th>37'-6&quot;</th>
<th>50'-0&quot;</th>
<th>62'-6&quot;</th>
<th>74'-0&quot;</th>
<th>86'-6&quot;</th>
<th>100'-0&quot;</th>
<th>112'-6&quot;</th>
<th>125'-0&quot;</th>
<th>137'-6&quot;</th>
<th>150'-0&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5'</strong></td>
<td>W</td>
<td>0.04</td>
<td>0.16</td>
<td>0.36</td>
<td>0.64</td>
<td>1.00</td>
<td>1.44</td>
<td>1.96</td>
<td>2.56</td>
<td>3.24</td>
<td>4.00</td>
<td>125'</td>
<td>125'</td>
</tr>
<tr>
<td><strong>8'</strong></td>
<td>W</td>
<td>0.10</td>
<td>0.28</td>
<td>0.46</td>
<td>0.74</td>
<td>1.11</td>
<td>1.70</td>
<td>2.30</td>
<td>3.00</td>
<td>3.70</td>
<td>4.44</td>
<td>5.63</td>
<td>6.94</td>
</tr>
<tr>
<td><strong>10'</strong></td>
<td>W</td>
<td>0.14</td>
<td>0.36</td>
<td>0.63</td>
<td>1.11</td>
<td>1.70</td>
<td>2.30</td>
<td>3.00</td>
<td>3.70</td>
<td>4.44</td>
<td>5.63</td>
<td>6.94</td>
<td>100'</td>
</tr>
<tr>
<td><strong>12'</strong></td>
<td>W</td>
<td>0.10</td>
<td>0.39</td>
<td>0.87</td>
<td>1.54</td>
<td>2.14</td>
<td>2.92</td>
<td>3.70</td>
<td>4.44</td>
<td>5.63</td>
<td>6.94</td>
<td>11.76</td>
<td>14.00</td>
</tr>
</tbody>
</table>

**Formula:**

\[ Y = 2W(X/F)^{2} \]

- **W** = Distance between curb line extended and shoulder line of approach roadway.
- **X** = Length of flared guard rail.
- **F** = Distance from first post at bridge to any 12'-6" multiple of guard rail flare.
- **Y** = Offset from curb line to face of guard rail.
CASE NO. 1  BRIDGE WIDTH LESS THAN ROADWAY WIDTH

CASE NO. 2  BRIDGE WIDTH EQUALS ROADWAY WIDTH

CASE NO. 3  BOX CULVERT

### GENERAL NOTES

When the value of \( W \) and/or \( F \) is different than values shown in the table, use the formula to compute 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.

---

### Formula

\[
Y = \left( \frac{W}{F} \right)^2 \%
\]

- \( W = \) Distance between curb line extended (Case No. 1), or shoulder line (Case Nos. 2 & 3), 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.
- \( Y = \) Offset from curb line or shoulder line to face of guard rail.

---

### Table

<table>
<thead>
<tr>
<th>X</th>
<th>Y(Feet)</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26'</td>
<td>.065</td>
</tr>
<tr>
<td>12'-6&quot;</td>
<td>.065</td>
<td>.075</td>
</tr>
<tr>
<td>23'-0&quot;</td>
<td>.260</td>
<td>.300</td>
</tr>
<tr>
<td>37'-0&quot;</td>
<td>.385</td>
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<td>100'-0&quot;</td>
<td>4.16</td>
<td>4.800</td>
</tr>
<tr>
<td>112'-6&quot;</td>
<td>5.265</td>
<td>6.075</td>
</tr>
<tr>
<td>125'-0&quot;</td>
<td>6.500</td>
<td>7.500</td>
</tr>
<tr>
<td>137'-6&quot;</td>
<td>7.865</td>
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<td>212'-6&quot;</td>
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<td>225'-0&quot;</td>
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<tr>
<td>250'-0&quot;</td>
<td>26.00</td>
<td>30.000</td>
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</table>

---

### ARIZONA HIGHWAY DEPARTMENT

PLANS DIVISION

GUARD RAIL-STEEL FLARE TO MEDIAN

Drawn: B.G. D.C.
Traced: S.L.T. 9-67
Checked: J.R.O. 7/10/73
Approved: Eng'r. Plans

Rev: C-10.05
**ISOLATED INSTALLATION**

1-Way roadway, flare symmetrical about this line.

**2-WAY ROADWAY OBSTRUCTION**

Traffic

50' 75' 75'

75' 50' Var. 50' 75'

200' desirable min.

**FILL PROTECTION**

Traffic

50' 75'

Note: Tie approach into preceding cut. If no cut precedes fill, begin approach end treatment 125' prior to required area.

**BOX CULVERT WITH DRIVABLE MEDIANS**

Traffic

50' Var. 50' 75'

**BOX CULVERT WITHOUT DRIVABLE MEDIANS**

Traffic

50' Var. 50' 75'

Guard rail required if less than 30'

* Min. Std. approach and treatment

** Median bridge or sign standards**

40' min. mid. width

**BRIDGE STRUCTURE WITH CROSS ROAD**

No guard rail is normally required unless the median is less than 60', traffic lane to traffic lane.

Traffic

50' 75'

Less than 60'

125'

**BARRIER TRANSITION AT OVERPASS**

Taper shall not exceed 50:1

**GENERAL NOTES**

These drawings do NOT establish warrants for guard rail installation, Post spacing shall be 6'-3" throughout.

---

**ARIZONA HIGHWAY DEPARTMENT**

**PLANS DIVISION**

**GUARD RAIL-STEEL**

**TYPICAL INSTALLATIONS**

**Drawing No.** C-10.06
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 1/8" 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.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

MEDIAN BARRIER CONCRETE

<table>
<thead>
<tr>
<th>Rev</th>
<th>Drawing No.</th>
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<tr>
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</table>

DRAWN  D.G.  Traced  R.A.F.  8/67
CHECKED  J.F.O.  6/68
APPROVED  Engr. Plans  M.H.
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

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

END OR STRAIN POST. 2" I.D. nominal size pipe.

3/8" Tension rod and turnbuckle

1/2" I.D. Nom. size pipe.

.051" aluminum or 22 ga. galv. steel expanded metal.

.090" bar stock or 9 ga. wire ties 1"-6" e. to e.

7 ga. strain wire. See Detail.

Line post 1 1/2" I.D. nominal size pipe or 1 7/8" X 1 5/8" "H" sect.

9" dia. for line posts.

EXPANDED METAL POST CONNECTION DETAIL

Stainless steel strapping with aluminum expanded metal. Galvanized steel strapping with steel expanded metal.

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 steel materials, except stainless, shall be galvanized in accordance with ASTM A-123.

All pipe posts shall be capped.

All concrete shall be Class A.

Expanded metal shall be 0.250" strand width with 1.333" X 4.0" bridge dimensions on tangents and 0.188" strand width with 0.933" X 2.0" bridge dimensions on curves.

ALTERNATE END POST TENSION ROD LOCATION

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

9" dia. for line posts.

Line post 1 1/2" I.D. nominal size pipe or 1 7/8" X 1 5/8" "H" sect.

6'-3" (Typ.)

STRAIN WIRE DETAIL

1" min. @ 60° F

Turnbuckle

Wire rope clamp

16 post spaces max.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

MEDIAN GLARE SCREEN

Drawn: R.A.F. 6-67
Traced: S.L.T. 7-67
Checked: J.F.O. 8-68
Approved: Engineer Plans J.H. Lockhart 10-68

C-10.10
**ANCHOR BLOCK PLAN**

- 3" x 7" x 3/8" washer of cold rolled stock and 1" U.S. Std. nuts

- 1/2" N.C. thread

**CABLE CLAMP DETAIL**

- 3/8" carriage bolt and nut

**STRETCHER BAR BAND DETAIL**

- 1/8" x 1" steel stretcher bar band

**ELEVATION**

- 7 ga. strain wire

- 1" drop forged steel turnbuckles

**END VIEW**

- Top of post and wire mesh

- 2" X 2 1/4" H-Section fence post

**GENERAL NOTES**

All concrete shall be Class A.

All material and fittings shall be galvanized in accordance with ASTM A 123.

3/6" tension cables shall be pre-formed, 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.
CATTLE GUARD

PLAN

For grille see enlarged detail

SECTION ON CENTER LINE FOR ANY WIDTH ROADWAY

Rails to be set 1/4" min. to 1/2" max. above top of concrete abutment.

Section A-A showing relationship of top of concrete, and finished grade line.

ELEVATION B-B

1/2"

3/16"

1/2" R

PART SECTION A-A

RAIL TREADS

1 1/2" I.D. nominal size pipe or 2" X 2" X 1/4" X 10'-0" X c to c

1/4" Web belt 6" X 6" cemented with hot asphalt.

General Notes

All concrete shall be Class A. Used rails may be used providing they are clean, free from rust, of uniform cross section and weigh 25 lbs./ft. min.

All rails, structural steel, steel posts and braces shall be given one shop coat of No. 1 paint.

Arizona Highway Department

plans division

Cattle Guard

Material List - Cattle Guard with Gate

<table>
<thead>
<tr>
<th>Item</th>
<th>Pcs.</th>
<th>Size</th>
<th>Length</th>
<th>Steel#</th>
<th>Conc. C.V.</th>
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<tr>
<td>Post, Steel</td>
<td>3</td>
<td>See Std. C-12.01</td>
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<tr>
<td>Braces, Steel</td>
<td>6</td>
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<tr>
<td>Rein. Bars</td>
<td>8</td>
<td>3&quot;-6&quot;</td>
<td></td>
<td>11'-0&quot;</td>
<td>61.50</td>
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<tr>
<td>Rein. Bars</td>
<td>8</td>
<td>3&quot;-6&quot;</td>
<td></td>
<td>3'-6&quot;</td>
<td>18.70</td>
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<td>7 Unit - 40' ROADWAY</td>
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<td></td>
<td></td>
<td>17.60</td>
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<tr>
<td>56 6&quot;X6&quot;X3/4&quot;</td>
<td>2</td>
<td>3'X3/8&quot;</td>
<td>45'-0&quot;</td>
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<tr>
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<td>2</td>
<td>3'X3/8&quot;</td>
<td>36'-0&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Unit - 26' ROADWAY</td>
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<td></td>
<td></td>
<td></td>
<td>13.30</td>
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<tr>
<td>40 6&quot;X6&quot;X3/4&quot;</td>
<td>2</td>
<td>3'X3/8&quot;</td>
<td>24'-0&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 6&quot;X6&quot;X3/4&quot;</td>
<td>2</td>
<td>3'X3/8&quot;</td>
<td>24'-0&quot;</td>
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</table>
Plan - 23" & 26" Cattle Guard Plate

End Frame Timber Sizes

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 unpainted. 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.

Nails not required in holes thus:

Note: See Plan and Section of track.

A

Elevation

One Half of Single Track Cattle Guard

END FRAME POST NOTCH DETAIL

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

CATTLE GUARD
RAILROAD

Dimensions

<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.I.T. 4-67
Checked J.P.O. 4-68
Approved Engr. Plans C-II.03
GENERAL NOTES
For all other cattle guard details, see Std. C-11.01.
This standard shall be used on embankment or where highly erodable soil is found.
All concrete shall be Class A.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

CATTLE GUARD DRAINAGE

Drawn: M.G.T. 6-15-65
Traced: R.A.F. 5-9-67
Checked: I.P.D. 6-10-68
Approved Engr. Plans: 6-15-68

C-11.04
End posts. Both line fence and wing fence wires shall be terminated at and fastened securely to these posts.

Wing fence shall be securely fastened to wing wall by 1/2" eye bolts or other approved method.

ROADWAY

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 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 Stds. C-12.01.

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.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION
SUPPLEMENTAL FENCE DETAILS

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION
SUPPLEMENTAL FENCE DETAILS

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PLANS DIVISION
SUPPLEMENTAL FENCE DETAILS

ARIZONA HIGHWAY DEPARTMENT
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SUPPLEMENTAL FENCE DETAILS
Hog ring fasteners or 9 ga. tie wires top and bottom 1'-6" c to c

7 ga. strain wire top and bottom

Knuckled salvage up

All pipe posts to be capped with dome type cap

Corner or end post

Strain post

Stretcher bar 1/4" x 3/4"

3/8" truss rod

Stretcher bar band

Line post - "H" section or pipe

Strain, End & Corner Posts

2" T.D. Nominal size pipe

Line Posts 1 1/2" T.D. Nominal size pipe

"H" Sec. 1 7/8" X 1 5/8" Nominal size

Braces 1 1/4" T.D. Nominal size pipe

Gate 1 1/2" T.D. Nominal size pipe

Fencing 9 ga., 2" mesh fabricated wire

FENCE

CHAIN LINK

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

GENERAL NOTES
All concrete shall be Class A.
Gates shall be of welded or malleable cast or pressed steel fitting construction.
Fittings not specifically detailed shall be of approved heavy duty design.
"H" Section posts shall be capped with pressed steel tops.

10' max.
10' max.
10' max.
6' 2 1/4" min.
6' 2 1/4" min.
6' 2 1/4" min.
6' 2 1/4" min.
6' 2 1/4" min.
6' 2 1/4" min.

Strain Panel
To be spaced at 500' maximum intervals

Corner or End Panel

3', 3'-6" or 4' wide as called for on plans

Hinges shall permit full swing

Fork latch with provision for padlock

Hog ring fasteners or 9 ga. tie wires top and bottom 1'-6" c to c

Walk Gate

4'-10" dia.
4'-10" dia.
4'-10" dia.

Weight as specified on plans

C-12.03

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

FENCE
CHAIN LINK

Drawn L.O.M. 2-58
Traced R.A.F. 11-67
Checked J.P.O. 9-68
Approved Engr. Plans 6-68
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. galv. barbed wire. 14 ga. barbs. 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.

#7 ga. strain wire top and bottom. Tie with 9 ga. wire or hog ring fasteners 1'-6" c to c.

Footings for Strain, End, Corner and Gate Posts

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

### Fence Using Pipe Members

<table>
<thead>
<tr>
<th>Member</th>
<th>Size</th>
<th>Lgth.</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>
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<tr>
<td>Line post</td>
<td>1 1/2&quot; I.D. nominal pipe size</td>
<td>9'-6&quot;</td>
</tr>
<tr>
<td>Brace or gate post</td>
<td>1 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>Stretcher bar</td>
<td>1/2&quot; x 3/4&quot; flat</td>
<td>6'-2&quot;</td>
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### Fence Using Roll Formed Members

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<thead>
<tr>
<th>Member</th>
<th>Size</th>
<th>Lgth.</th>
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</thead>
<tbody>
<tr>
<td>Corner post</td>
<td>3.144 /ft. section with integral fabric loops per Detail A or equal</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>Line post</td>
<td>2.728 /ft. section per Detail B or equal</td>
<td>9'-6&quot;</td>
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<tr>
<td>Strain or gate post</td>
<td>3 1/2&quot; I.D. nominal pipe size</td>
<td>10'-6&quot;</td>
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<tr>
<td>Brace</td>
<td>1.358 /ft. section per Detail C or equal</td>
<td>as req'd.</td>
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<tr>
<td>Stretcher bar</td>
<td>1/4&quot; x 3/4&quot; flat</td>
<td>6'-2&quot;</td>
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</table>

* Not used with corner post having integral fabric loops. (See Detail A)

### GENERAL NOTES

All concrete shall be Class A.

Gates shall be of welded or millable 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 each side.

All pipe posts shall be capped.

Note: For Walk Gate, see Std. C-12.03.
**TYPE 1 BARRIER FENCE - STEEL POSTS**

- **Cable sag per 20’**
  - 2 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.**
  - 2 1/2” X 2 1/2”
  - X 1/4” ≤ 5’ long

**INTERMEDIATE POST**

- **Approved line post section, 5’ long**
  - Anchor plates on line posts. See C-12.01.

**STRAIN POST**

- **2 1/2” X 2 1/2” X 1/4” ≤ 5’ long**
  - Top of dyke

**END POST**

- **2 1/2” X 2 1/2” X 1/4” ≤ 5’ long**
  - Toe of dyke

---

**SECTION A-A**

- Galv., Crosby type cable clip
  - 6’ filler piece
  - 2” × 8” X 5’-0” wood brace

**SECTION B-B**

- 1/2” × 6” galv. lag bolt
  - 1/2” galv. spring washer (powerline hardware)

**SECTION C-C**

- 60” spikes
  - 2 each support posts
  - 6” X 8” X 5’-0” wood brace

**SECTION D-D**

- 2-3/8” galv., Crosby type cable clips. 2-1/2” c to c min. Use on cable endings either wood or steel post corner.

---

**TYPE 2 BARRIER FENCE - WOOD POSTS**

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

**INTERMEDIATE POST**

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

**END POST**

**GENERAL NOTES**

- All concrete shall be Class A.
- 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 54S 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.

---

**ARIZONA HIGHWAY DEPARTMENT PLAN DIVISION**

**BARRIER FENCE AND BARRIER POST**

**Drawn** D.G. 10-66

**Traced** S.L.T. 10-67

**Checked** J.F.P. 76-60

**Approved** Brt. Plans

**Rev** C-12.05

**Drawing No.** 3-45
EMBANKMENT INSTALLATION

CUT INSTALLATION

Note: Culvert length will be given in 2' units.

Variety

Finished grade

Subgrade

Note: Drop inlet similar

Slope as called for on Plans

Drain. or chan. excav.

Culv. lgth. with end section.
See Std. C-13.03 or C-13.05 whichever is applicable

6:1 slope

4'-0" min.

FIGURE A

End treatment as called for on Plans

Finished shoulder line

-1'-0"

Fine aggregate

6" Pipe O.D.

Perforated C.M.P.
Place holes down

Perforated C.M.P. INSTALLATION

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

PIPE CULVERT INSTALLATION

Drawn D.G. 3-68
Traced D.G. 3-68
Checked J.P.O. 7/15/68
Approved Engr. Plans

Rev 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.

MORTAR JOINTS

CONCRETE ENCASEMENT

1' long trench at joints

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 require external mortar bands.

For minimum cover and maximum fill heights on concrete pipes, refer to Std. C-13.02.

In the type I placement the contractor may elect to place the embankment first and then excavate a trench for the pipe - No Pay Item.

SOLID ROCK OR OTHER UNYIELDING MATERIAL

TYPE 1 - POSITIVE PROJECTING

TYPE 2 - NEGATIVE PROJECTING

TYPE 3 - IMPERFECT TRENCH

ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION

REINFORCED CONCRETE PIPE PLACEMENT

Drawn: B.E.N. 3-58
Traced: S.I.T. 7-67
Checked: J.P.O. 9/19/68
Approved: Egr. Plans 9/19/68

C-13.02
## HORIZONTAL ELLIPTICAL PIPE

<table>
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<tr>
<th>Size</th>
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**NOTE:** NL indicates no limit.

## VERTICAL ELLIPTICAL PIPE

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## ROUND PIPE

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**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 developed.

Type refers to type of placement. For further details see Std. C-13.02.
### GENERAL NOTES

Design of end section shall conform to standards for reinforced concrete pipe.

End section joint conformance shall match the pipe joints.

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

---

### PIPE DIAMETER AND DIMENSIONS - INCHES

<table>
<thead>
<tr>
<th>PIPE DIA</th>
<th>APPROX. WEIGHT</th>
<th>DIMENSIONS - INCHES</th>
<th>APPROX. SLOPE</th>
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---

### SPACING FOR MULTIPLE INSTALLATION

1'-0" min.

---

### CULVERT LENGTH AS SHOWN ON PLANS

ARIZONA HIGHWAY DEPARTMENT

PLAN 114-2500

END SECTION

REINFORCED CONCRETE PIPE

<table>
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<th>Rev.</th>
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**Drawn:** D.C. - 4-67

**Traced:** S.L.T. - 5-67

**Checked:** I.P.O. - 6-68

**Approved:** Engr. Plans - 7-68
GENERAL NOTES

The end section shall be joined to the pipe, arch or connector by welding or 3/8" bolts or rivets. The maximum allowable spacing of the bolts or rivets shall be 1'-0" but in no case shall there be less than 12 bolts or rivets per joint.

When a connector is used, the pipe or arch and the connector shall be joined by a standard coupling band.

End sections comprised of two or more pieces may be field assembled using 3/8" bolts or rivets.

End sections may be welded, bolted, or riveted directly to pipe or arch without use of 24" connectors.

All components of the end section shall be galvanized.

Embankment slope shall be warped to match slope of end section.
### TABLE I

**CORRUGATED, CIRCULAR, STEEL PIPE - 2 2/3 X 1/2 ANNULAR OR HELICAL CORRUGATIONS RIVETED, WELDED OR LOCK SEAM FABRICATION**

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### TABLE III

**STRUCTURAL PLATE PIPE - 6 X 2 CORRUGATIONS**

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### GENERAL NOTES

All fill heights are measured in feet, from finished grade to top of pipe.

Minimum fill heights shall be noted except no pipe shall extend above the subgrade.

Fill heights over 100' shall be used only after a thorough investigation of the foundation material.

All corrugated metal 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 PLANS DIVISION

**CORRUGATED METAL PIPE DESIGN FILL HEIGHTS**

- **Rev:**
- **D.M.:**
- **S.L.T.:**
- **Drawing No.:**
- **Checked:**
- **Approved:**

**NOTE:**
1. Indicates circular pipe.
2. Indicates 36 vertically elongated pipe.
3. When sizes below heavy line are used, design calculations shall be prepared and submitted for checking.

* Bolts shall be torqued to not less than 200 ft. lbs. nor greater than 300 ft. lbs.
**Arizona Highway Department**

**Plans Division**

**Corrugated Metal Pipe Fill Height Design Data**

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Given: $h = 27$; $D = 15$; $R = 90$

Solution: Deflection of pipe

- Formula 1(a) $I = \frac{2.31 R^3 h - 57.3 R^3}{26,800,000}$
- Formula 1(b) $I = \frac{0.0239 r}{26,800,000}$

Example:

- Solve for $A_g$ using $f_u$ value determined in 3a, and select gauge and corrugation from table.

**Criteria 1. Deflection of Pipe**

Formula 1(a) $I$ (for circular pipe) = $\frac{2.31 R^3 h - 57.3 R^3}{26,800,000}$

Formula 1(b) $I$ (for 5% vertically elongated pipe) - Substitute $h/2$ for $h$ in 1a. Solve for $I$ in 1a and determine required gauge and corrugation from table. If 6" X 2" corrugation is indicated, solve for $I$ in 1(a) to determine gauge required for elongated pipe. If $I$ is negative, metal thickness required is less than the minimum tabular value.

**Criteria 2. Longitudinal Seam Strength**

Formula 2(a) $C_a = \frac{D h}{0.0046}$

For solving $C_a$ and determine gauge and corrugation from table. $C_u$ values are provided.

**Criteria 3. Buckling of Pipe Wall**

Formula 3(a) $f_u = 45,000 - 1.4547 \left(0.66 R \frac{h}{R}\right)^2$

Use $R$ for the correlogram corresponding to the highest stress determined by formulae 1a, 1b and 2a. Solve for $f_u$ to determine the maximum allowable buckling stress.

Formula 3(b) $A_g = 1.805 R h$,

Solve for $A_g$, using $f_u$ 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 revision also applies to:

- Formula 1(a) $I = 2.08 R^3 h - 57.3 R^3$
- Formula 3(a) $f_u = 45,000 - 1.4547 \left(0.66 R \frac{h}{R}\right)^2$

Analysis:

Using vertically elongated pipe, the lightest gauge and corr. that will satisfy all requirements is 7 gauge, 6" X 2" corr. Similarly, with circular pipe the lightest gauge is 5. Since cost-wise the two are comparable, 7 ga. 6" X 2" 5% vertically elongated pipe is selected. All other 6" X 2" $C_u$ values are for 3/4" bolts.
### TABLE 1-A
**CORRUGATED, STEEL PIPE ARCH, 2 2/3" X 1 1/2" CORRUGATIONS, RIVETED, WELDED OR LOCK SEAM FABRICATION, H-20 LOADING**

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**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 sites other than those shown in the tables, use Std. C-13.09 Pipe Arch Design Data.

### TABLE 2-A
**STRUCTURAL PLATE PIPE ARCH, 6" X 2" Corrugations, BOLTED FABRICATION, 6-BOLTS/FT. *, H-20 LOADING**

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* Bolts shall be torqued to not less than 200 ft. lbs. nor greater than 300 ft. lbs.
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</table>

Criteria 1 CORNER PRESSURE

**Formula 1 (a)**

\[ P = 60(L_u + L_p) \]

Using \( h \), take \( (L_u + L_p) \) from Table II and solve for \( P \).

Note: If \( P > 4000 \), consideration shall be given toward possible special backfill design.

**Formula 1 (b)**

\[ (L_u + L_p) = \frac{600}{h} \]

Solve for \( L_u + L_p \). Use Table II to determine \( h \).

Criteria 2 LONGITUDINAL SEAM STRENGTH.

**Formula 2**

\[ C_a = 1.675(L_u + L_p) \]

Using \( h \), take \( (L_u + L_p) \) from Table II and solve for \( C_a \).

Determine gauge and corr. by comparing \( C_a \) with \( C_0 \) values in Table I.

Criteria 3 BUCKLING OF PIPE ARCH WALL

**Formula 3 (a)**

\[ f_u = \frac{22500 - 0.72735 (3.84/\pi)^2}{2A_a} \]

Use \( r \) for corrugation indicated by Formula 2.

Equate \( f_u \) from 3(a) in 3(b) and solve for \( A_a \).

Determine gauge and corrugation from Table I.

Criteria 4 DEFLECTION

**Formula 4 (a)**

\[ \Delta_u = 0.6H \]

**Formula 4 (b)**

\[ \Delta_u = \frac{1.20708}{29,000,000} \]

Use value of heaviest gauge and corrugation required by Criteria 2 and 3. If \( L_u > C_a \), deflection is satisfactory.

**TABLE II**

<table>
<thead>
<tr>
<th>bₙ</th>
<th>Lₑ</th>
<th>Lₖ</th>
<th>Lₐ+Lₚ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'</td>
<td>1800</td>
<td>130</td>
<td>1930</td>
</tr>
<tr>
<td>2'</td>
<td>800</td>
<td>260</td>
<td>1060</td>
</tr>
<tr>
<td>3'</td>
<td>400</td>
<td>390</td>
<td>790</td>
</tr>
<tr>
<td>4'</td>
<td>200</td>
<td>500</td>
<td>700</td>
</tr>
<tr>
<td>5'</td>
<td>150</td>
<td>650</td>
<td>800</td>
</tr>
<tr>
<td>7'</td>
<td>175</td>
<td>910</td>
<td>1085</td>
</tr>
<tr>
<td>8'</td>
<td>100</td>
<td>1040</td>
<td>1140</td>
</tr>
</tbody>
</table>

For \( bₙ > 9 \) and over, \( Lₙ \) is eliminated so total load then becomes \( b \times 130 \).

**Example:**

**Given:** 72" X 64" Pipe Arch, \( h = 15 \), \( R_c = 9 \).

**Find:**

Gauge, corrugation, \( h' \)

**Formula 1(a)**

\[ f_u = 6 \times 6 \times 1950 \]

\[ 6 \times 6 \times 1950 = 19550 \]

From Table II, \( h' = 3 \)

**Formula 2**

\[ C_a = 1.67 \times 6 \times 1950 \]

\[ C_a = 31950 \]

**Formula 3 (a)**

\[ f_u = \frac{22500 - 0.72735 (3.84/6)^2}{2C_a} \]

\[ f_u = 9620 \]

**Formula 3 (b)**

\[ 9620 = 6 \times 1950 \]

**ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION**

**CORR. METAL PIPE ARCH FILL HEIGHT DESIGN DATA**

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

Appurtenant formulas are condensed from data supplied by the 1967 edition of American Iron and Steel Institute's publication titled "Handbook of Steel Drainage and Highway Construction Products" and the R. P. R. 1966 publication titled "Corrugated Metal Pipe Culverts - Structural Design Criteria and Recommended Installation Practices." These formulas provide safety factors of 1, 3.33, 2 and 3.33 respectively for Criteria 1, 2, 3 and 4.

Constants used are the same as for Std. C-13.07, "Corrugated Pipe Arch Fill Height Design Data."

Explanation of variable symbols used:

- \( A_a \): Area per lin. inch of pipe arch in sq. in.
- \( C_a \): Actual ring compression in lbs./ft.
- \( C_0 \): Allowable ring compression in lbs./ft.
- \( f_u \): Allowable buckling stress in p.s.i.
- \( h \): Max. fill height: fin. grade to top of pipe arch.
- \( h' \): Min. fill height: fin. grade to top of pipe arch.
- \( l \): Moment of inertia of pipe arch wall in inches^4/inch
- \( r \): Radius of gyration of pipe wall in inches.
- \( \Delta_a \): Allowable deflection in inches.
- \( \Delta_u \): Actual deflection in inches.
- \( S \): Span in ft.
- \( H \): Rise in ft.
- \( R_c \): Corner radius in inches
- \( P \): Corner pressure in lbs./sq. ft.
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.
All concrete shall be Class A.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION
CORRUGATED METAL PIPE
CONCRETE INVERT PAVEMENT

DRAWN
R.G.
TRACED
E.A.F. 5-17-67
CHECKED
J.R.M. 5-68
APPROVED
Engr. Plans
CONCRETE BOX CULVERTS

H = Height of barrel or headwall excluding cutoff wall.  
D = 1'-6" max.

Concrete or corrugated pipe
Pipe with normal wingwall, flared end sect. or U headwall
Pipe with skewed wingwall
Pipe with L headwall

GENERAL NOTES

Payment limits shown include structural excavation for headwalls, cutoff walls, wingwalls, and sections etc.
Placement of special backfill around headwalls and wingwalls shall be the same as that for structures.
Payment limits shown shall be applied to multiple installations by discounting the overlap in width limits.
D indicates the O.D. and maximum outside width of circular and arch type structures respectively.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

STRUCTURAL EXCAVATION
PAYMENT LIMITS
AND SPECIAL BACKFILL PLACEMENT

Sections Showing Structural Excavation Width Limits and Special Backfill Placement
PIECE LINES AND PIPE CULVERTS
All reinforcing shall be 8% bars 1'-0" c to c

3/4" chamfer

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

DROP INLET HEADWALLS

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>18&quot;</td>
<td>24&quot;</td>
<td>24&quot;-6&quot;</td>
<td>24&quot;-8&quot;</td>
<td>4&quot;</td>
<td>1&quot;-3 3/8&quot;</td>
<td>1&quot;-4&quot;</td>
<td>9&quot;</td>
<td>1&quot;-4&quot;</td>
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<td>24&quot;-6&quot;</td>
<td>24&quot;-8&quot;</td>
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<td>1&quot;-3 3/8&quot;</td>
<td>1&quot;-4&quot;</td>
<td>9&quot;</td>
<td>1&quot;-4&quot;</td>
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<td>0.04</td>
<td>1.55</td>
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<td>1&quot;-4&quot;</td>
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<td>1&quot;-4&quot;</td>
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<td>0.06</td>
<td>2.29</td>
<td>0.13</td>
<td>112</td>
<td>166</td>
<td></td>
</tr>
</tbody>
</table>

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.
**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.H.D. Welding Manual.

For grates LW-1, TW-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 0.35, respectively, for each inch of curb "h" + gutter depression - 2.1".

* 3/4" for longitudinal and 3" for transverse 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 faced with combined curb and gutter.
*** 2'-8 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. 2" t = 6" when H is 8" or less; 8" when H is over 8". (See Section B-B)

**ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION**

**TYPE 1 CATCH BASIN**

<table>
<thead>
<tr>
<th>Drawn</th>
<th>D.O.</th>
<th>7-67</th>
</tr>
</thead>
<tbody>
<tr>
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<td>R.A.F.</td>
<td>7-67</td>
</tr>
<tr>
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<td>J.P.O.</td>
<td>7-67</td>
</tr>
<tr>
<td>Approved</td>
<td>Engr. Plans</td>
<td>7-67</td>
</tr>
</tbody>
</table>

| Drawing No. | C-15.01 |

---

**PLAN-CATCH BASIN NO. 1 - SINGLE**

- #3 bars, 6" c to c 1 1/2" clear to top of nose section and inside of wall. See Detail No. 3.
- Nose angle & anchor. See Detail No. 1.
- Varies.
- "h" of curb adjoining.
- Gutter depression if specified.
- Construction joint.
- Type A or G concrete, curb.
- No bottom reinforcing.

**SECTION A-A**

**DETAIL NO. 1**

- #3 bar 6" c to c.
- 1 1/2" clear to top of nose section and inside of wall. See Detail No. 3.
- Nose angle & anchor. See Detail No. 1.
- Varies.
- "h" of curb adjoining.
- Gutter depression if specified.
- Construction joint.
- Type A or G concrete, curb.
- No bottom reinforcing.

**DETAIL NO. 2**

- 1/2" stove bolts, 2 per frame. Avoid conflict with grate.
- 5 W 18.5

**SECTION B-B**

Use this section when t = 8"
2-1/2" X 1 1/2" button head retaining bolts with lock washers & nuts.

Support angle. See Detail #1 & Table #1.

7-1/2" bolt size self drilling type concrete anchors.

Gutter control grade = 2%. Grate and frame as specified.

Note: Provide Std. C-15.08 Construction Drain.

PLAN

TABLE #1

<table>
<thead>
<tr>
<th>Angle size</th>
<th>Support Angle size</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 1/16&quot; to 8 3/16&quot;</td>
<td>4&quot; x 4&quot; x 3/8&quot;</td>
</tr>
<tr>
<td>8 1/16&quot; to 9 3/16&quot;</td>
<td>5&quot; x 5&quot; x 3/8&quot;</td>
</tr>
<tr>
<td>9 1/16&quot; to 10 1/16&quot;</td>
<td>6&quot; x 6&quot; x 3/8&quot;</td>
</tr>
</tbody>
</table>

SECTION A-A

Note: Fabricate entire assembly from 3/8" steel. All square butt joints welded both sides using 3/8" fillets & 3/4" beads.

Center support bracket

Cold form top plate.

SECTION B-B

3" (Applicable to all support angle sizes.)

GENERAL NOTES

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.N.D. Welding Manual. 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. 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.

* 3/4" for LW or LB grates.
3" for TW or TB 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" dimension when catch basin is used with combined curb and gutter.

C = 6" when H is 8' or less; 8" when H is over 8'. (See Sect. B-B)

ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION

TYPE 2 CATCH BASIN

Drawn D.G. 11-66
Traced S.L.T. 6-67
Checked J.F.O. 4-68
Approved Engr. Plans C-15.02

Rev
PLAN, CATCH BASIN NO. 4-SINGLE

Gutter control grade

PLAN, CATCH BASIN NO. 4-DOUBLE

Grate frame and frame anchors

Dimensions are common to C.B. No. 4-single except as shown.

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 A36.
Grate support shall be given one shop coat of No. 1 paint.
All concrete shall be Class A.

* 3/4" for LW or LB grates.
3" for TW 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.

\[ t = 6" \text{ when } H = 8' \text{ or less} \]
\[ t = 8" \text{ when } H > 8' \text{ and } H \leq 12' \text{ or less} \] (See Section B-B)

SECTION B-B

Use this section when \( t = 8" \)

SECTION A-A

No bottom reinforcing

DETAIL NO. 1

1/2" stove bolts, 2 per frame. Avoid conflict with grate.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

TYPE 4 CATCH BASIN

Drawn  E.G.  5-67
Traced  S.B.S.  7-67
Checked  J.P.O.  9-68
Approved  Engr. Plans  9-68

Drawing No. C-15.04
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 trowel finish and a minimum slope of 4:1 in all directions toward outlet pipe.
Welding shall be in accordance with A.H.D. Welding Manual.

Gutter depression shall be warped to opening according to Std. C-15.08.
All structural steel shall be in accordance with ASTM A 36.
Nose angle shall be painted with one No. 1 shop coat.
All concrete shall be Class A.
All reinforcing bars shall be \( \frac{3}{4} \) 18" c to c both ways and 1 1/4" clear to inside of walls and outside of wing basin floor except as shown.

Curb opening area (Sq. Ft.) per inch of curb "b" = gutter depression = curb opening length (Ft.) x \( \frac{0.003}{b} \).

For grate and frame details and opening areas, see Stds. C-15.06 and C-15.07.

\( \phi = 6" \) when \( H = 8" \) or less; 8" when \( H \) is greater than 8". (See Section C-C)

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

\[ H = 3'3" \text{ min. when } L = 3' \]
\[ 3'5" \text{ min. when } L = 6' \]
\[ 3'7" \text{ min. when } L = 10' \]
\[ 4'0" \text{ min. when } L = 17' \]
GRATE TYPES LW-1 & LW-2
Restricted to use on longitudinal grades of 3% and less.

<table>
<thead>
<tr>
<th>Type</th>
<th>Clear Spacing</th>
<th>No. Bars</th>
<th>X</th>
<th>Grate Opening Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW or LB-1.0</td>
<td>9/16&quot;</td>
<td>16</td>
<td>5/16&quot;</td>
<td>4.38</td>
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<tr>
<td>LW or LB-1.1</td>
<td>3/8&quot;</td>
<td>12</td>
<td>1/16&quot;</td>
<td>6.99</td>
</tr>
<tr>
<td>LW or LB-1.2</td>
<td>2&quot;</td>
<td>9</td>
<td>9/16&quot;</td>
<td>5.41</td>
</tr>
<tr>
<td>LW or LB-2.0</td>
<td>1&quot;</td>
<td>12</td>
<td>5/16&quot;</td>
<td>3.47</td>
</tr>
<tr>
<td>LW or LB-2.1</td>
<td>3/8&quot;</td>
<td>9</td>
<td>1/16&quot;</td>
<td>3.75</td>
</tr>
<tr>
<td>LW or LB-2.2</td>
<td>2&quot;</td>
<td>7</td>
<td>1/16&quot;</td>
<td>6.03</td>
</tr>
</tbody>
</table>

BAR SPACER DETAIL
Cast iron, cast steel or steel bar stock.

1/2" rod threaded end
Spacer
Nut & cut washers
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.
### 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.B.D. Welding Manual.

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

**TW** indicates transverse welded.

**TB** indicates transverse bolted.

### Grate Types TW-1 & TW-2

<table>
<thead>
<tr>
<th>Type</th>
<th>Clear Spacing</th>
<th>No. Bars</th>
<th>X</th>
<th>Grate Opening</th>
<th>Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TW or TB-1.0</td>
<td>1&quot;</td>
<td>28</td>
<td>7/8&quot;</td>
<td></td>
<td>3.67</td>
</tr>
<tr>
<td>TW or TB-1.1</td>
<td>3/8&quot;</td>
<td>22</td>
<td>11/16&quot;</td>
<td></td>
<td>3.93</td>
</tr>
<tr>
<td>TW or TB-1.2</td>
<td>2&quot;</td>
<td>16</td>
<td>1 5/8&quot;</td>
<td></td>
<td>4.31</td>
</tr>
<tr>
<td>TW or TB-2.0</td>
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<td>28</td>
<td>7/8&quot;</td>
<td></td>
<td>2.51</td>
</tr>
<tr>
<td>TW or TB-2.1</td>
<td>3/8&quot;</td>
<td>22</td>
<td>11/16&quot;</td>
<td></td>
<td>2.89</td>
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<tr>
<td>TW or TB-2.2</td>
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<td>16</td>
<td>1 5/8&quot;</td>
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<td>3.11</td>
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### Frames

<table>
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<th>Type</th>
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<th>X</th>
<th>Grate Opening</th>
<th>Sq. Ft.</th>
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</thead>
<tbody>
<tr>
<td>TW or TB-3.0</td>
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<td>56</td>
<td>1 1/8&quot;</td>
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<td>14.59</td>
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</table>

### Section A-A

- **Bar Spacing Detail**: Cast iron, cast steel or steel bar stock.
- **Nut & cut washers**: Spot weld or peen.
- **Spacer**: 1/2" rod threaded ends.
- **2 1/2" 9/16" holes**

### Technical Specifications

- **ARIZONA HIGHWAY DEPARTMENT**
- **PLAN'S DIVISION**

---

**CATCH BASIN GRATE TB AND TW GRATES**

- **Drawn**: D.C. 6-67
- **Traced**: S.L.T. 7-67
- **Checked**: J.P.O. 10-67
- **Approved**: Engr. Plans 6-68

- **Drawing No.**: C-15.07

---
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.)

CATCH BASIN TYPE 4
(Off roadway location)

CATCH BASIN CONSTRUCTION DRAIN
*Drain may be deleted at option of Engineer

Apache depression
Gutter depression: 3" max. (See Detail No. 1)
O = Normal crown or gutter flow line elevation.
D = Depressed elevation.
# = Straight grade with downward slope.
W = Normal gutter width per Std. 0.5 ft

GENERAL NOTES
No gutter depression shall be used adjacent to median.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

CATCH BASIN
DEPRESSED APRON
& CONSTRUCTION DRAIN

Drawn
S.L.T, 10-67
Traced
S.L.T, 10-67
Checked
J.P.O, 9/8-68
Approved
Engr. Plans

C-15.08
PLAN PERSPECTIVE
ILLUSTRATING 1-WAY FLOW WITH DYKE

PLAN

 Experienced flow

 6:1 rake slope or
  median ditch grade,
 (1-way or 2-way
 flow respectively)

 8" bars. See
 Section B-B

 9/16" bars, 1'-0" c to c
 horiz. and vert., 1 1/2"
 clear to inside of wall.
 No bottom reinforcing.

 3/4" Outlet pipe.

 Median ditch grade

 Cutoff walls
 same material
 as apron

 Match median
cross slope

 26" Outlet pipe.

 SECTION A-A

 SECTION B-B

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.H.D.
Welding Manual.
Grating assembly shall be given one shop
cost of No. 1 paint.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION
MEDIAN CATCH BASIN

Drawn R.G. 3-68
Traced R.A.F. 3-68
Checked J.F.O. 3-68
Approved Engr. Plans

C-15.09
INLET TO BOX CULVERT
(See Bridge sheets for details)

SECTION A-A

GENERAL NOTES
All concrete shall be Class A.
Steel pipe, plate and strip shall be
in accordance with ASTM A 36.
Exposed steel shall be given one
shop coat of No. 1 paint.

*When O.D. + 5" exceeds 1'-11", use
3/8" plate.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

MEDIAN DYKE
CATCH BASIN

DRAWN: D.G. 3-68
TRACED: R.A.F. 4-68
CHECKED: J.F.O. 5-68
APPROVED: Super. Plans 6-68

DRAWING NO. C-15.10
### 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.

### PIPE DIMENSIONS

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### ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

**IRRIGATION HEADWALLS**

18" TO 60" DIAMETER PIPES

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<th>Drawing No.</th>
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**Drawn**
R.J.J. 3-10-58

**Traced**
S.L.T. 5-4-67

**Checked**
J.P.O. 6-18-68

**Approved**
Engr. Plans 6-18-68
Irrigation Valve Number of valve shall correspond to the size of the pipe in inches. No. 6 to No. 20.

PART SECTION
FLUSH IRRIGATION VALVE.

Concrete "T" or "L" to be included with valve.

Concrete plaster

Slope to fit local conditions

Cement plaster

Pipe size 6" thru 18" as called for on plans

16 ga. galv. iron gate

For open ditch installation

TYPE 1

For pipes 6" through 24". Gate and frame shall be galvanized iron. Type shown is for concrete pipe. For C.M.P., external steel adjustable band shall be used in place of internal steel ring.

TYPE 2
6X6-10/10 wire mesh, #9 wire ties. See perspective.

Double wrapped with 2 - strands #9 wire

Single wrapped with 2 - strands #9 wire
1'-0" c to c

TOP OF BANK PROTECTION

Embankment slope

Rock backfill

Stream bed

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

TYPE: TYPE 1 & 2 BANK PROTECTION

GENERAL NOTES
Rock for backfill shall not pass a 6" square opening.

<table>
<thead>
<tr>
<th>Type</th>
<th>Embankment slope rate</th>
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<th>Top of bank protection above stream bed</th>
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<td>3</td>
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<td>4' to 7'</td>
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<td>6'</td>
<td>6' to 12'</td>
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*When other embankment slope rates are encountered, warp to 2:1 or 1 1/2:1; that is, warp 1:1 slope to 1 1/2:1.
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.


50# Railroad rail, 4' c to c
Type 4 = 15' long
Type 5 = 18' long

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.

Min. 15# Rails or equal 10' long.  
2 Strands #9 wire, twisted taut.
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

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

Drawing No. C-17.03
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. - 5-57
Checked J.P.O. 7-58
Approved Engr. Plans

Drawing No. C-18.01
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.
CONCRETE SURFACE FORD CONCRETE WALLS

* Min. distance below stream bed

8" Class D concrete
Finished 4% Grade

Slope 0.015'/ft.

2-1/4 bars top and bottom

3" Weep Holes
1'-0"
1'-0"

ELEVATION LOOKING UPSTREAM

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

Wall may be built to this line

3" weep hole 20' c to c

ELEVATION LOOKING DOWNSTREAM

3" Cap

Finished Grade

6" 6" 6"

FORD CONCRETE WALLS

* Min. distance below stream bed

3" I.D. nominal X 3'-0" Iron pipe.
Paint 2 field coats of white
enamel. Paint 1" wide markers
1 coat of black enamel.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

REV

C-19.01

GENERAL NOTES

Ford walls to be Class D Concrete.
TYPE 1
BITUMINOUS SURFACE FORD

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

TYPE 2
BITUMINOUS SURFACE FORD
TIMBER CUTOFF WALLS

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

ELEVATION - TYPE 2

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.R.B. 7-45
Traced B.L.T. 5-67
Checked J.P.O. 9-68
Approved Eng. Plans

C-19.02

Drawing No.
GENERAL NOTES

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

When a single railroad crossing sign is used for a crossing, both sides of cross arms shall carry sheet steel or aluminum message panels. When two railroad crossing signs are used for a crossing, lettered message panels shall be mounted only on the side of cross arms facing traffic.

Railroad 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 highway yellow flat top reflective sheeting with black, opaque letters, border and symbol.

All wood and metal surfaces, except those covered with reflective sheeting shall be primed and finished with two coats of No. 11 white enamel.

Reflective sheeting shall be applied in accordance with the manufacturer’s specifications.
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.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

SURVEY MONUMENT, FRAME AND COVER

RIGHT OF WAY MARKER

DRAWN 11-65

CHECKED J.F.O. 10-68

APPROVED ENGR. PLANS 12-68

REV C-21.01

4 X 4 X 5/16

LOCATION DETAIL

Min. 2'-0"

Std. Marker, Transit point shall be punched by Engineer.

Std. Marker See Std. C-21.02

Camber 3/4"

May be poured to neat lines below grade.

3'-0"

ELEVATION

SURVEY MONUMENT

ELEVATION MARKER

REFERENCES MARKER

TOP VIEW OF LID

SECTION A-A

MIN. WEIGHT OF FRAME = 78 lbs.

MIN. WEIGHT OF COVER = 31 lbs.

3/4" opening for Pry bar

TOP VIEW OF FRAME

SYMM.

2 Costs All White Roman Letters, @5 Jet Black

P.C. 145 + 438

4"

Core 2 3/4"

Square holes

1-Shoe coat of @1 primer

Hwy. B. Of W.

Series E letters

2'-6"

2'-3"

2'-0"

4-1/4"

1'-1 1/2"

11 1/2"

9 3/8"

9 7/8"

3 7/8"

1 1/4"

1 1/4"

1 1/4"

1 1/2"

1 1/2"

8"

6 5/8"

6 7/8"

9 1/4"

9 1/2"

4"

4"

4/4"

11/2"

4/4"

1/2"

3 7/8"

Min.

NEW OR EXISTING

Pavement structure
ELEVATION
STANDARD MARKER
FOR USE AS BENCH, SURVEY MONUMENT AND R/M MARKERS

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.

ARIZONA HIGHWAY DEPARTMENT PLANS DIVISION

STANDARD MARKER

Drawn D.C. 2-68
Traced D.G. 2-68
Checked J.P.O. 6-68
Approved Engr. Plans 9-68
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

CROSS SECTION

FOR SINGLE INSTALLATION

Quantities per ft. of slab length
Concrete | Reinforcing Steel
0.31 | 0.1 | 35.22 lbs.

GENERAL NOTES
Concrete shall be Class A.

ARIZONA HIGHWAY DEPARTMENT
PLANS DIVISION

SLAB OVER
UTILITY LINE

Drawn: L.O.M. 5-65
Traced: B.O. 3-67
Checked: J.R.O. 7-68
Approved: Engr. Plumber

Rev C-22.01
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