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- **Pen Size** 0: Aggregate, Select, Subgrade, Ground Line Profile, Barbed Wire Fence & Gate, Chain Link Fence & Gate, Guard Rail & Breakaway Cable Terminal, Gas Line, Irrigation Ditch, Concrete, Irrigation Ditch, Earth, Irrigation Line (1"x20"), Irrigation Line (1"x100"), Power or Joint Use Line, Sanitary Sewer (1"x20"), Sanitary Sewer (1"x100"), Storm Drain (1"x20"), Storm Drain (1"x100"), Street Light with Mast Arm.
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- **New Symbol**: 1

**Design Approvals**

**Department of Transportation***

**Highways Division - Standard Drawings***

**ARIZONA***

**PLANS SYMBOLS**

**C-01.11**
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**NOTE**
ALL LINES AND SYMBOLS NOT SHOWN WILL CONFORM TO:
- American National Standard Symbols for Section Lining (ANSI Y14.2-1973)
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GENERAL NOTES

1. Roadway width, cut ditch, superelevation, and type and thickness of roadway surfacing will be shown on project plans.

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

3. Wetted perimeter should not extend above subgrade in unpaved ditch.

4. pavement structure slopes are relative to subgrade slope. Slopes beyond the pavement structure, such as embankment and cut slopes, are relative to horizontal.

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

6. When median slopes intersect, see project plans.

TYPICAL SECTIONS
**GENERAL NOTES**

1. Roadway width, cut ditch, superelevation, and type and thickness of roadway surfacing will be shown on project plans.

2. 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.

3. Wetted perimeter should not extend above subgrade in unpaved ditch.

4. Pavement structure slopes are relative to subgrade slopes. Slopes beyond the pavement structure, such as embankment and cut slopes, are relative to horizontal.

*Variable to 6:1 maximum*
GENERAL NOTES

1. Roadway width, cut ditch, super-elevation, and type and thickness of roadway surfacing will be shown on project plans.

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

3. Kettleed perimeter should not extend above subgrade in unpaved ditch.

4. Pavement structure slopes are relative to subgrade slope. Slopes beyond the pavement structure, such as embankment and cut slopes, are relative to horizontal.

*T variable to 4:1 maximum
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**Formula**

\[ y = \frac{V^2}{2g} \times \frac{1}{1 + \frac{V^2}{2g}} \times \left( \frac{1}{1 + \frac{V^2}{2g}} \right) \]

**Use of Table**

- **Example:**
  - Average V = 60 ft. and C = 0.45 ft.
  - Find V for V = 6 ft.

- **Table shows: 16.06% of C, or 0.16 X 0.45 = 0.072 ft.**

---

**Design Approval**

**State of Arizona**

**Department of Transportation**

**Division of Highways**

**Standard Drawings**

**Payment Crown, Parabolic**

**Design:**

1/89
GENERAL NOTES:

1. Dimensions of ditches and dykes, as shown on plans, are top width, height and length.
2. Ditches shall be constructed with a minimum grade to prevent erosion. Ditch outlet treatment shall be as provided on plans.
3. See Std. C-03.10 for parallel channel and dyke treatment with respect to recovery area.

CROWN DYKE

CROWN DITCH

TYPE A DYKE

TYPE B TRANSVERSE MEDIAN DYKE

* Slope relative to grade of median at intersection with toe.

GRADER DITCH

GENERAL CHANNEL SLOPES

TYPICAL DYKE INSTALLATION AT STRUCTURE

Place dykes at structures to create a water cushion.
* If channel lies within recovery area, use continuation of emb. slope for inner channel slope and 4:1 slope rate for outer channel slope.

**CHANNEL**

**DYKE WITHIN RECOVERY AREA**

**DYKE OUTSIDE RECOVERY AREA**

**GENERAL NOTES**
See also Std. C-03.10
GENERAL NOTES
1. Concrete for the spillway inlet, spillway and outlet shall be Class B.
2. Where rock is encountered, the outlet may be omitted.
3. When outlet is used, the wire mesh shall extend through the joint into the outlet in lieu of bending into the key.
4. Spillway invert slope shall be uniformly downward from A to B.

OUTLET DETAIL
GENERAL NOTES

1. Round all exposed concrete corners.
2. Tank, stub, trash rack and angle supports shall be shop fabricated, welded and galvanized in accordance with ASTM A-36.
3. Stub shall have annular corrosion. Downstream piping beyond stub may be either annular or helical.
4. Permissible couplings shall be mechanical, heat-shrinkable polyolefin sheet; one piece lap type neoprene sheet or slip seam; all 12" min. width and 18 ga. min.
5. Inlet invert slope shall be uniformly downward from one foot inside of embankment curb base.
6. Inlet and outlet concrete shall be Class B. Embankment curb concrete shall be in accordance with Standard Specifications.

OUTLET DETAIL

OUTLET-HEADWALL AND CONCRETE APRON

#6 bars 1'0" c to c horiz. and vert. Place 1 1/2" clear to inside of walls. Bend and wall vertical bar 1'0" into floor.

DETAIL ANCHOR

Anchor stakes #6 bar 1' long 10" c to c

DETAIL-ANGLE SUPPORTS FOR TRASH RACK

3/8" hole 2-way flow sym. about ™

PLAN-INLET

2 - 1/4"x3 1/2" galv. 3 bolts 

3/8" hole 2-way flow sym. about ™

DETAIL-TRASH RACK STEEL TO BE GALVANIZED AFTER FABRICATION

Finished grade A.C. 3" min.

6 X 6 - W1.4 wire mesh

24" X 45° annual C.M.P. tank.

Steel: 16 Ga.

OUTLET-HEADWALL AND CONCRETE APRON

#6 bars 1'0" c to c horiz. and vert. Place 1 1/2" clear to inside of walls. Bend and wall vertical bar 1'0" into floor.

OUTLET DETAIL

OUTLET-HEADWALL AND CONCRETE APRON

#6 bars 1'0" c to c horiz. and vert. Place 1 1/2" clear to inside of walls. Bend and wall vertical bar 1'0" into floor.

#6 bars 1'0" c to c horiz. and vert. Place 1 1/2" clear to inside of walls. Bend and wall vertical bar 1'0" into floor.

DETAIL ANCHOR

Anchor stakes #6 bar 1' long 10" c to c

DETAIL-ANGLE SUPPORTS FOR TRASH RACK

3/8" hole 2-way flow sym. about ™

PLAN-INLET

2 - 1/4"x3 1/2" galv. 3 bolts 

3/8" hole 2-way flow sym. about ™

DETAIL-TRASH RACK STEEL TO BE GALVANIZED AFTER FABRICATION

Finished grade A.C. 3" min.

6 X 6 - W1.4 wire mesh

24" X 45° annual C.M.P. tank.

Steel: 16 Ga.

OUTLET-HEADWALL AND CONCRETE APRON

#6 bars 1'0" c to c horiz. and vert. Place 1 1/2" clear to inside of walls. Bend and wall vertical bar 1'0" into floor.

OUTLET DETAIL

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Finished grade A.C. 3" min.

6 X 6 - W1.4 wire mesh

24" X 45° annual C.M.P. tank.

Steel: 16 Ga.
GENERAL NOTES

1. For C-02.10 slopes with embankment height over 24', L = L for embankment height from table + 2.24(emb. height - 24).
2. For C-02.20 slopes with embankment height over 32', L = L for embankment height from table + 1.8(emb. height - 32).
3. For C-02.30 slopes with embankment height over 36', L = L for embankment height from table + 1.8(emb. height - 36).

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DIVISION OF HIGHWAYS
STANDARD DRAWINGS

REV

SPILLWAY, EMBANKMENT
LENGTH TABLE

C-04.30
GENERAL NOTES
1. For C-02.10 slopes with embankment height over 24', L = L for embankment height from table + 2.6*(emb. height - 24).
2. For C-02.20 slopes with embankment height over 32', L = L for 32' embankment height from table + 1.8*(emb. height - 32).
3. For C-02.30 slopes with embankment height over 13', L = L for 13' embankment height from table + 1.8*(emb. height - 13).
GENERAL NOTES:
1. Single curb, and curb and gutter may be constructed by the use of forms or the concrete may be extruded.
2. When the roadway section slopes away from the gutter, the slope of the gutter shall match the roadway cross slope.
3. Two inch deep contraction joints shall be placed in the curb and the gutter at locations which match the joints in adjacent Portland cement concrete pavement and at approximate 15 foot centers when adjacent to asphaltic concrete pavement. Joints shall be either hand tooled or sawed.
4. One half inch thick expansion joints shall be located at tangent points in curb returns, at structures and at maximum 60 foot intervals. The ½ inch joint filler shall extend the full depth of the concrete.
5. Concrete shall be finished with a steel trowel followed by brushing with a fine brush along the length of the curb and gutter.
6. All exposed edges and hand tooled joints shall be finished with a tool having a ½ inch radius unless a larger radius is indicated.

EMBANKMENT CURBS:
1. No additional finishing will be required after extrusion or removal of the forms when curb receives a neat appearance and the surface is uniform in texture and color.
2. The curb shall conform to the cross section as shown except that the horizontal dimensions shall not vary more than ½ inch.
GENERAL NOTES:

1. Unless otherwise specified, sidewalks shall be 4 inches in depth and driveways shall be 6 inches in depth.

2. One inch deep transverse contraction joints shall be placed in sidewalks at intervals of approximately 5 feet. If the sidewalk is over 7 feet in width, a 1 inch deep longitudinal contraction joint shall be placed in the center of the sidewalk. The maximum area of sidewalk without contraction joints shall be approximately 36 square feet. Contraction joints in driveways shall be 1 inch in depth. Joints shall be either formed or scored. Formed joints shall be finished with a tool having a 1 inch radius.

3. One half inch expansion joints shall be located between sidewalks or driveways and all abutting structures. Maximum length of sidewalk without expansion joint shall be 60 feet. The 1 inch joint filler shall extend the full depth of the concrete.

4. Concrete shall be finished by means of a float, then steel trowelled, and then broomed with a fine brush in a transverse direction.

Driveway

Width As Shown On Project Plans

Slope 0.01' Per Ft.

CONCRETE SIDEWALK

[Diagram of driveway and sidewalk with notes and dimensions]
GENERAL NOTES

Paved Turnouts: Plan notation will be WNL, surface material, type and standard. Example: 20' X 30' A.C.T.O., Type A, Standard Q-06.10
Show R graphically.
Base material shall be the same as what shown for main roadway, unless otherwise noted.
Excavation or embankment for turnouts shall be included in quantities for main roadways. Dimensions indicated as minimum shall be avoided whenever possible in favor of those indicated as desirable.
Driveways and depressed curbs shall be located as noted on plans or as directed by the Engineer.
The Type 'A' turnout is the preferable turnout design. Type 'B' and 'C' shall only be used when absolutely necessary.

Driveway Types:
Residential - one providing access to a single family residence, to a duplex, or to an apartment building containing five or fewer dwelling units.
Commercial - one providing access to an office, retail or institutional building or to an apartment building having more than five dwelling units.
Industrial - one directly serving a substantial number of truck movements to and from loading docks of an industrial facility, warehouse or truck terminal.
Driveways for high volume traffic generators shall be approved individually by Traffic Engineering Section.
Driveways with curb returns in urban areas shall be installed only with the approval of Traffic Engineering Section.

Joint Use Driveways - it may become desirable for landowners of adjacent properties to require a joint driveway to service both properties. If this is the case, only one of the two adjacent landowners need apply for the access permit, but a notarized written mutual agreement, signed by all parties involved, must accompany the application form.

Construction of curb, gutter and sidewalk in urban areas by the permittee, along that portion of the highway frontage under permit application, may be a stipulation of the permit approval if there appears to be reasonable need.

Drainage structures shall be provided under driveways where necessary.

RURAL DEVELOPMENTS

(1) 10' min., 20' des.
(2) 15' min.
(3) 25' min., 40' des.
(4) 40' min.
(5) One way couplet for use only on one way roadways.
(6) 40' max. joint use d'way

* Residential: 10' min., 30' max.
Comm. Commercial: One way, 15' min., 30' max.
Two way, 25' min., 40' max.
Indust: 20' min., 40' max.

RURAL CROSS SECTION

COMMERCIAL & INDUSTRIAL: 20' min., 40' desirable. Residential: 10' min.

Max. Grades: Residential: 5% Industrial: 3% Commercial: 6%

RURAL DEVELOPMENTS

(1) 10' min., 20' des.
(2) 15' min.
(3) 25' min., 40' des.
(4) 40' max.
(5) One way couplet for use only on one way roadways.
(6) 40' max. joint use d'way

* Residential: 10' min., 30' max.
Comm. Commercial: One way, 15' min., 30' max.
Two way, 25' min., 40' max.
Indust: 20' min., 40' max.

URBAN DEVELOPMENTS

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DIVISION OF HIGHWAYS
STANDARD DRAWINGS

DESIGN APPROVED

DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

DRAWING NO.
C-06.10

SIGNATURE

TURNOUT & DRIVEWAY LAYOUT

REV
1/83
**Adjusted tangent sections and lengths as required, Ramp L_a distance.**

NOTE: Dimensions - angular and distance - used on drawing above are example. 30 m.p.h. design speed was used. Refer to table for basic design information.

**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 assist a smooth grade change. The design speed shall be compatible 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 1/2 mile.

The minimum width of the detour shall be 26' for existing roadways 36' or wider and a minimum of 24' for existing roadways less than 36' in width.

The entrance taper for Detour "B" shall be extended until full detour width is attained. For Detour "B" the entrance taper shall be extended until a minimum of 15' 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.

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.
S indicates sawed contraction control joint
CN indicates construction joint
LL indicates longitudinal joint
See Std. C-07, 20

PLAN
See General Notes

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 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.
Backer Rod - (Expanded cellular rubber) Shall conform to the requirements of ASTM D 1595 Grade # 588 41.

RCC Pavement, Concrete, Transverse Joints

STATE OF ARIZONA
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STANDARD DRAWINGS

11/83

REV.

DRAWING NO.

C-07.10
LONGITUDINAL JOINT DETAILS

**PLAN**

- **JOINT TYPE "E"**
  - Construction Joint
  - 1/4" radii
  - 6 1/2"
  - 84 X 2'-0" bars

- **JOINT TYPE "G"**
  - Construction Joint
  - 1/4" radii
  - Pavement
  - Curb & Gutter

- **JOINT TYPE "H"**
  - Expansion Joint
  - 1/4" radii
  - 1/4" expansion joint
  - Preformed joint filler

**SECTION A-A**

- Concrete curb & gutter
- Existing concrete
- Longitudinal Joint Type "E" or "F"
- Std. 0-07.10
- Joint Type CH
- 84 X 2'-0" bars
- 2'-6" c to c max.

**GENERAL NOTES**

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.

Backer Rod - (Expanded cellular rubber) Shall conform to the requirements of ASTM D 1056 Grade # SBS A1.
GENERAL NOTES
All concrete shall be Class S, 2000 lbs. psi
GENERAL NOTES
1. For ramp cross section details, see Std. C-6.20.
2. For gore area paving details, see Std. C-6.20.
3. Shaded areas indicate differential shoulder delineation.
4. Parallel deceleration is to be used only under special conditions necessitating ramp curvature ahead of gore.

**Normal to ramp**
**Normal to Main roadway**
Where shown on plans, rumble strips shall be constructed on the highway shoulders by making indentations approximately 1/8" deep in the asphalt concrete surfacing.

The indentations shall be formed by rolling the asphalt concrete while still hot with a roller to which segments of 2 1/2" steel rods have been welded to the drum.

The rod segments shall be 2' long and be fully welded to the roller drum at approximately 8" centers.

Each roller shall be equipped with an acceptable guide that extends in front of the roller and is clearly visible to the operator in order that proper alignment of the completed scored shoulder is obtained.

Use on interstate and primary roadways 40' and wider.
GENERAL NOTES

1. Grooves in curbed shoulders shall terminate at the face of the single curb or at the edge of the gutter.

2. Grooves shall extend through pavement edge of shoulders with no curb.

<table>
<thead>
<tr>
<th>Design Speed Per Plans M.P.H.</th>
<th>Spacing Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>60</td>
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<tr>
<td>70</td>
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<td>60</td>
<td>45</td>
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<td>55</td>
<td>40</td>
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<tr>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
</tr>
</tbody>
</table>

3" x 1" Corrugated Configuration

SECTION A-A

ENTRANCE RAMP

EXIT RAMP

GROOVE SPACING
GENERAL NOTES

All embankment curb shall be protected by guard rail.

Guard rail, exclusive of flares, shall not begin or end within embankment curb.

SECTION A-A

TYPE A GUARD RAIL INSTALLATION

SECTION B-B

REFLECTOR TAB DETAIL
**GENERAL NOTES**

All embankment curb shall be protected by guard rail.

Guard rail, exclusive of flares, shall not begin or end within embankment curb.

**TYPE B GUARD RAIL INSTALLATION**

- Use FLARED BCT ASSEMBLY
- Shown G4(S) System or Use Other Systems
- 25:1 Taper
- Hinge Point
- Normal Roadway Shoulder
- 2' Widening
- 3'

**PLAN**

**SECTION A-A**
- With Embankment Curb
- Emb Slope
- Subgrade
- Normal Slope per Plans

**SECTION B-B**
- Without Embankment Curb

**REFLECTOR TAB DETAIL**
- High Reflectivity Reflective Sheeting
- 3"
- 2½' 90°
GENERAL NOTES:
1. Median Barrier shall be constructed by the slip form or extrusion method.
2. When obstacles are encountered which prevent the use of slip form equipment, the closure shall be accomplished by the use of stationary forms.
3. Unless otherwise specified on project plans, the Type 1 Median Barrier shall be constructed.
4. Concrete shall be Class S, design strength $f' = 3000$ psi.
5. If the footing and barrier are cast monolithically No. 6 "S" shaped rebar and optional construction joint will not be required.
6. Construction joints shall be kept to a minimum. Joints shall be finished with tool having a 1/4 inch radius.
7. Contraction joints shall be sealed with an approved Joint sealant.
GENERAL NOTES:
1. Concrete shall be Class S, design strength $f_c' = 3000$ psi.
2. Unless otherwise specified on project plans, the Type 1 Median Barrier shall be constructed.
3. Median Barrier shall be placed upon either Asphaltic or Portland Cement Concrete Pavement.
4. Pavement thickness adjacent to Median Barrier shall be 3/4 inch minimum.
5. Joints shall be finished with a tool having a 1/4 inch radius.
6. This standard shall not be used when an individual run consists of less than five 20 foot sections.
GENERAL NOTES:

1. Concrete shall be Class S, design
strength f' = 3000 p.s.i.

2. Unless otherwise specified on the
project plans, the Type 1 Median Barrier
shall be constructed.

3. Median Barrier shall be placed upon
either asphaltic or Portland Cement
Concrete Pavement.

4. Pavement thickness adjacent to
Median Barrier shall be 3/4 inch minimum.

5. The Median Barrier shall be placed
upon a bed of grout in order to provide
a uniform bearing.

6. Dowelled joints shall be grouted under
pressure until all of the openings and
the joints are filled.

7. This standard shall not be used when
an individual run consists of less than
five 20 foot sections.
Omit Rectangular Plate Washers And Reflectorized Tabs Under Post Bolt Heads, Posts Two Thru Eight

Use 25' Rail Length Of Single W-Beam In First Section

Shown GD4 (W) System
Or Use GD4 (W) System

PLAN

\\[ A \]

37.6\'

X = 37.21'

30'

ELEVATION

Use Rectangular Plate Washer (Spec) Under Post Bolt Head On Ninth Post
And Start Reflectorized Tabs

SECTION A-A

LAYOUT AND DETAILS OF THE FLARE

<table>
<thead>
<tr>
<th>FLARED GEOMETRICS</th>
<th>Dist Along 37&quot;</th>
<th>Dist Along X Axis</th>
<th>Dist Along Y Axis To Face Of Guard Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dst Along 37&quot;</td>
<td>6' 0&quot;</td>
<td>6.25'</td>
<td>0.14'</td>
</tr>
<tr>
<td>Dst Along X Axis</td>
<td>12' 6&quot;</td>
<td>12.49'</td>
<td>0.45'</td>
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<td>Dst Along Y Axis</td>
<td>18' 9&quot;</td>
<td>18.71'</td>
<td>1.01'</td>
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<tr>
<td></td>
<td>25' 0&quot;</td>
<td>24.92'</td>
<td>1.79'</td>
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<tr>
<td></td>
<td>31' 3&quot;</td>
<td>31.08'</td>
<td>2.79'</td>
</tr>
<tr>
<td></td>
<td>37' 6&quot;</td>
<td>37.21'</td>
<td>4.00'</td>
</tr>
</tbody>
</table>
Showed G4(15) System
Or Use G4(25) System

Use W-Beam Back-Up Plate At
Posts Where W-Beam Splice
Does Not Occur (Typ)

Use 25' Rail Length
Of Single W-Beam
In First Section

Omit Rectangular Plate Washers
And ReflectORIZED Tabs Under
Post Bolt Heads, Posts Two
Thru Nine

PLAN

A

A

37.6'

32'

X=37.21'

30'

ELEVATION

Use Rectangular Plate Washer (Spcl)
Under Post Bolt Head On Tenth Post
And Start ReflectORIZED Tabs

6'3''  6'3''  6'3''  6'3''  4'2''  4'2''  4'2''  6'3''  6'3''

Use Rectangular Plate Washer (Spcl)
Under Post Bolt Head On First Post

Shown Type B
Installation

Varies

Roadway Width

Varies

0.4'

2' Min

1'-3''

3'' Bituminous Surfacing

3' Bituminous Surfacing

Normal Slope Per Plans

SECTION A-A

LAYOUT AND DETAILS OF THE FLARE

FLARED GEOMETRICS

<table>
<thead>
<tr>
<th>Dist Along 37.6' Parabolic Curve</th>
<th>Dist Along X Axis</th>
<th>Dist Along Y Axis To Face Of Guard Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'3''</td>
<td>6.25'</td>
<td>0.11'</td>
</tr>
<tr>
<td>12'6''</td>
<td>12.49'</td>
<td>0.44'</td>
</tr>
<tr>
<td>16'8''</td>
<td>16.64'</td>
<td>0.79'</td>
</tr>
<tr>
<td>20'10''</td>
<td>20.78'</td>
<td>1.23'</td>
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<tr>
<td>25'0''</td>
<td>24.92'</td>
<td>1.78'</td>
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<tr>
<td>31'3''</td>
<td>31.06'</td>
<td>2.76'</td>
</tr>
<tr>
<td>37'6''</td>
<td>37.21'</td>
<td>4.00'</td>
</tr>
</tbody>
</table>
GENERAL NOTES

BCT Cable Assembly shall be tightened to remove slack.

ELEVATION

1-1/4" Button Head Bolt (Spec).
And Recess Nut (Spec) With Rectangular Plate Washer (Spec) Under Head.
And Wide Type A Plain Washer (Under Nut).

W-Beam End Section Flared

1-1/4" Button Head Bolt (Spec).
And Recess Nut (Spec) With Wide Type A Plain Washer (Typ).

1/4" Polystyrene Filler
All Four Sides

Class S Concrete, 4000 PSI

6x6-W2.9xW2.9 Welded Wire Fabric Lap One Square

24" Dia Concrete Footing

PLAN

24"

6"

5/8" 3/4" 1"

21/4" 2" 1/4"

12"

16"

One Way Only Traffic

DETAIL A

BCT Cable Assembly
BCT Terminal Post (Timber)
BCT Sleeve, 2" Dia
1/4" BUNC Hex Thick Nut With Type A Plain Washer

6"

8"

4"

DETAIL B

BCT Cable Assembly
1/4" BUNC Hex Nut With Type A Plain Washer

2-1/4" x 12" Hex Bolt And Hex Nut With Wide Type A Plain Washer

BCT Anchor Plate, PL 4
4 Dia For Lock Pin

Steel W Section, 12 Ga

PHANTOM LINE

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STANDARD DRAWINGS

C-10.21

REV 1/83

GUARD RAIL ANCHOR ASSEMBLY (TIMBER POST)
GENERAL NOTES

1. BCT Cable Assembly shall be tightened to remove slack.

2. 5/16"-18 UNC x 3" Heavy Hex Screw, connecting BCT Terminal Post (Steel) and BCT (Steel) Foundation Plates, shall be torqued to 170 ft. lbs.
GENERAL NOTES

Extend buried W-Beam 6'-3" past last short post.

Drill through top of box culvert with rotary drill.

Bracket may be made of one piece hot bent, or two pieces welded together.

Short posts anchored to box culvert roof shall be 8"x8" only.

INSTALLATION DETAIL

BOLTED ANCHOR BOX CULVERT INSTALLATION

PHOTOSHOP

STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DRAWINGS

DESIGN APPROVED

STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DRAWINGS

APPROVED FOR DISTRIBUTION

BURIED & BOLTED ANCHOR TIMBER POST

DRAWING NO.

C-10.23

REV. 1/93
GENERAL NOTES

Extend buried W-Beam 6'-3" past last short post.

Drill through top of box culvert with rotary drill.

Bracket may be made of one piece hot bent, or two pieces welded together.

PLAN

Finished Grade

Varies

Pipe Culvert

ELEVATION

BOLTED ANCHOR BOX CULVERT INSTALLATION

INSTALLATION DETAIL

BOLTED ANCHOR BOX CULVERT INSTALLATION

SECTION A-A

SHOWN G4(5) SYSTEM
OR USE G4(2S) SYSTEM

12 Ga Steel W-Beam Guard Rail, Bit Coated If Pipe Culvert Bit Coated

2-1/2" UNC X 2" Button Head Bolt (Spc1) And Recess Nut (Spc1) With Rectangular Plate Washer (Spc1) (Under Head) And Wide Type A Plain Washer (Under Nut) (Typ)

2-1/2" UNC X (T+2 1/2") Hex Bolt And Two Hex Nuts With One Wide Type B Plain Washer (Under Nuts) (Typ)

1/8" Hole (Typ)

1/8" Plate

1" Radius (Max.)
**NOTE:** Block 1 is a \( \frac{3}{4} \) x 12" x 14" Plate
Block 2 may be a solid 6" x 14"
Plate tapered in thickness from
\( \frac{3}{4} \) to \( \frac{1}{2} \) welded to \( \frac{3}{4} \) x 12" x 
14" Plate

---

**Concrete Barrier**

1" Dia Sleeve

\( \frac{5}{8} \) UNI Hex Bolt and Hex Nut
With Type B Beveled Washer (Under Head)
And Wide Type A Washer (Under Nut)
(Typ)

1" Drill (Block 2 Only)

\( \frac{5}{8} \) UNI Ferrule
Wing Nut

**SECTION THRU BLOCK AND ANCHORAGE**

**DETAIL F**

\( \frac{5}{8} \) UNI Hex Nut
Tack Welded To Plate
(Block 3, 4, 5, 8)

\( \frac{3}{4} \) x 12" x 14" Plate

\( \frac{1}{4} \) x 14" Plate

\( \frac{1}{4} \) x 12" x 14" Plate

14" Rad

**DETAIL G**

BLOCK DETAILS

1" Drill, 5 Holes

\( \frac{3}{4} \) Drill Blocks
3, 4, 5, 1"

Drill Block 2

---

**DETAIL H**

TERMINAL CONNECTOR BACK PLATE

3" 6" 3" 3" 6" 3" 3" 6" 3" 3" 6" 3" 3" 6" 3" 3" 6" 3" 3"

---
<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>BLOCK</th>
<th>A</th>
<th>B</th>
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<td>1</td>
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<td></td>
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<tr>
<td></td>
<td>5</td>
<td>4 1/2&quot;</td>
<td>3 1/2&quot;</td>
</tr>
</tbody>
</table>

NOTE: Block 1 is a 1/4" x 1/2" x 14" Plate. Block 2 may be a solid 6" x 14" Plate tapered in thickness from 1/2" to 1/16" welded to 1/4" x 12" x 14" Plate.

Concrete Barrier
1" Dia Sleeve

1/2" UNC Hex Bolt And Hex Nut
With Type B Beveled Washer (Under Head) And Wide Type A Washer (Under Nut) (Typ)

1/2" UNC Ferrule Wing Nut

SECTION THRU BLOCK AND ANCHORAGE

DETAIL F

Tack Welded To Plate
(Blocks 3, 4, & 5)

DETAIL G

BLOCK DETAILS

DETAIL H

TERMINAL CONNECTOR BACK PLATE
PLAN

1/2" 9 UNC Ferrule Wing Nut Assembly (Typ), Detail F

Concrete Barrier

Traffic

1/2" Bituminous Joint Filler

Traffic

Block 1

Detail E

Block 2

Detail E

Block 3

Detail E

Block 4

Detail E

Block 5

Detail E

W6 x 8.5 x 14" or W6 x 9 x 14"

Structural Shape Block (Typ)

2 1/2" 10 UNC x 11/2" Hex Bolt (Top), One 2 5/8" 10 UNC x 13" Hex Bolt And Two Hex Nuts With Four Type B Beveled Washers (Under Head And Nut) Per Block (Typ)

1/2" 10 UNC x 11/2" Heavy Hex Structural Bolt (Typ)

1 1/2" 3'-1 1/2"

3'-1 1/2"

3'-1 1/2"

3'-1 1/2"

1'-0"

2'-1 1/2"

3'-1 1/2"

6'-3"

ELEVATION

25' One Piece W Beam Guard Rail

Post No. 3, This Is The Same Post Shown On Median W Beam BCT Attenuator Assembly

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STANDARD DRAWINGS

DESIGN APPROVED:
W Beam Terminal Connector
W Beam End Section (Rounded), Detail T

Steel Block (Typ) Detail L
Strip $\frac{3}{16}'' \times 12''$

Sheet $\frac{3}{8}'' \times 30''$

Special Steel Block Detail K

Steel Post (Typ) Detail J

Terminal Steel Post Detail H

Traffic

W Beam

$3\frac{1}{2}''$

ELEVATION

ONE WAY TRAFFIC - RIGHT SIDE OF ROADWAY
OR TWO WAY TRAFFIC

Base Plate D Detail M

$\frac{9}{16}''$ Hook Bolt (Right Angle Bent) And Hex Nut (4 Each) (Typ), Detail S

Slope To Drain From Posts (Typ) 24'' Diameter Concrete footing (Typ), Detail R

6x6-W2.9xW2.9 Welded Wire Fabric, Lap One Square (Typ)

36''

36''

12''

6''

6''

6''

6''

26''

8.4''

8.4''

22''

6''

6''

6''

6''

37.4''

12.5''

16.2''

6''
Plan

Traffic

One Way Traffic—Left Side of Roadway

Terminal Steel Post Detail H

Steel Post (Typ) Detail J

Special Steel Block Detail K

Sheet 5/8 x 30" Strip 3 1/8 x 12"

Steel Block (Typ) Detail L

Terminal Connector

W Beam End Section (Rounded) Detail T

W Beam

Elevation

Nose Plate Detail Q

9' 12"

6'-3"

Detail D

Detail A

BCT Cable Assembly, Detail P

Slope To Drain From Posts (Typ) 24" Diameter Concrete Footing (Typ) Detail R

6x6-W2.3xW2.9 Welded Wire Fabric, Lap One Square (Typ)

1" Dia. Hole (Typ)

2'-0"

16 5/8"

12 1/2"

37 1/4"

9 UNC x 18" Hook Bolt (Right Angle Bent) And Hex Nut (4 Each) (Typ), Detail S

Base Plate Detail M

W Beam

Elevation

One Way Traffic—Left Side of Roadway

Nose Plate Detail Q

9' 12"

6'-3"

Detail D

Detail A

BCT Cable Assembly, Detail P

Slope To Drain From Posts (Typ) 24" Diameter Concrete Footing (Typ) Detail R

6x6-W2.3xW2.9 Welded Wire Fabric, Lap One Square (Typ)

1" Dia. Hole (Typ)

2'-0"

16 5/8"

12 1/2"

37 1/4"

9 UNC x 18" Hook Bolt (Right Angle Bent) And Hex Nut (4 Each) (Typ), Detail S

Base Plate Detail M

W Beam

Elevation

One Way Traffic—Left Side of Roadway
1. BCT Cable Assembly shall be tightened to remove slack.

2. 5/8"-11 UNC x 3 1/2" Heavy Hex Structural Bolt, connecting Base Plate A to Base Plate B, shall be torqued to 170 ft. lbs.
ONE WAY TRAFFIC—RIGHT SIDE OF ROADWAY
OR TWO WAY TRAFFIC
**GENERAL NOTES**

1. Tension wire: AWG No. 9 (0.148") galv. to conform to ASTM-A-116 Class 2. Wind wire approximately 3 turns around ferrule.


7. 4" x 1" Plate round or square spacer: 9/16" Dia. hole, ASTM-A-36, Galv. ASTM-A-153 Class C.

8. Stainless steel strap & seal shall conform to ASTM-A-176 Type 430. Straps 0.020" x 0.122" (single crimp).


10. Glare screen: 18 Ga. steel, ASTM-A-526, Galv. ASTM-A-526/A235, expanded to the following dimensions: 3.3" shortway of diamond and 4.1" longway of diamond (C to C of bridges) with a strand width of 0.250" angled at approx. 20° to plane of orig. sheet. Top edge to be shop curved, and crimped on 12" centers. After expansion, galv. steel shall be prepared according to Mil. Spec. TT-C-490 and primed with baked on Zinc Chromate Epoxy min. 0.2 Mil. dry film. Finish coat shall be Polyester Enamel min. 1.0 Mil. by the electrostatic spray method. Color shall be indicated on plans.


13. All Intermediate post support brackets shall face in same direction. End panel support brackets shall face as shown.

**POST SUPPORT BRACKET**

*Note: Contractor may drill holes or cast holes to set anchor bolt required to anchor plate of glare screen post assembly to the median barrier. If cast hole is used, seat bolt in sulfur, epoxy or other material approved by the Engineer.
GENERAL NOTES

Posts shall be 12'-0" C to C. Structural steel shall conform to ASTM-A-36, Galv. ASTM-A-123.


Type B washer shall conform to ASTM-F-436, Galv. ASTM-A-153 Class C.

Helical spring lock washer shall conform to ASTM-A-313, Galv. ASTM-A-153 Class C.

For other Glare Screen dimensions and specifications, see Standard G-10.96.
**GENERAL NOTES:**

1. Standard plans for Cattle Guard, Footing Type, consists of Standards O-11.10, O-11.11, and O-11.12.
2. Cattle guard shall be sloped to conform to the roadway cross section, except that where an odd number of grill units is specified in a crowned roadway, the center grill unit shall be installed level.
3. Where the adjacent roadway is paved, an angle 4" X 4" X 3/8" with 5/8" diameter stud with head, 1"-0" alternate center to center is required.
4. Where the adjacent roadway is unpaved, an angle assembly is required. An angle assembly consists of one 4" X 4" X 3/8" angle and one 2" X 2" X 3/8" angle connected with 5/8" diameter studs. The studs shall be bent 90° and placed on 1'-0" centers.
5. Each angle and angle assembly shall be fabricated to form a single piece for the full length of the cattle guard.
6. Quantities shown for concrete and reinforcing bars are to be considered approximations for informational purposes only.
7. When guard rail is to be used at the cattle guard, it may be possible to reduce the number of grill units required.

**UNIT TABLE**

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<th>GRILL UNITS REQUIRED</th>
<th>CONCRETE CUBIC YARDS</th>
<th>REBAR LB.</th>
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**SECTION A-A**

Paved Roadway

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Unpaved Roadway

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**SECTION B-B**

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<table>
<thead>
<tr>
<th>2 X 2 X 3/8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpaved</td>
</tr>
</tbody>
</table>

**Drawn By:**

[Signature]

**Approved For:**

[Signature]

**Drawn:**

[Signature]

**Approved:**

[Signature]

**STATE OF ARIZONA**

**DEPARTMENT OF TRANSPORTATION**

**DIVISION OF HIGHWAYS**

**STANDARD DRAWINGS**

**ROADWAY CATTLE GUARD-FOOTING TYPE**

**REV:**

1/83

**DRAFTING NO:**

O-11.10
GENERAL NOTES:

1. For Cattle Guard details see Std. G-11.10.

2. Material for shoulder transition shall be placed to the finished roadway elevation for the entire length of the transition. When the roadway is paved, Aggregate Subbase or Aggregate Base shall be used. When roadway is unpaved a material equivalent to the existing roadway shall be used.

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STANDARD DRAWINGS
ROADWAY CATTLE GUARD - FOOTING TYPE, MSE: DETAILS
DRAWING NO. G-11.12
DRAFT: 1/83

DESIGN APPROVED

PREPARED BY

CHECKED BY

DATE

10 : 1 Taper Shoulder Transition

Cattle Guard

Roadway Width

10 : 1 Taper Shoulder Transition

POST AND BRACE ASSEMBLY

2" - 10 UNC X 3/4" Hex Bolt And Hex Nut, With 1 Type "A" Wide Plain Washer

SECTION B-E

2" Square (Outside Nominal Dimension) Tubular Post, 5'-9"

Concrete Curb Footing, 4 Places

7/8" - 10 UNC X 11" Hex Bolt And Hex Nut, With 1 Type "A" Plain Washer

END VIEW

SECTION D-D

Concrete Curb Footing

2" - 10 UNC X 3/4" Hex Bolt And Hex Nut, With 1 Type "A" Wide Plain Washer

SHOULDER TRANSITION AT CATTLE GUARDS
GENERAL NOTES
1. For all other cattle guard details, See Stds. C-11.10, 11.11 & 11.12.
2. This standards shall be used in embankment or where highly erodable soil is found.
3. All concrete shall be Class B.

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STANDARD DRAWINGS"

"CATTLE GUARD, DRAINAGE"

"Ditch line"
GENERAL NOTES

1. This design applicable only to wood tie track construction. Wood shims shall be unpainted and cut from material meeting the specifications of the existing ties, 3"x3/8"x10" treads, 2"x2/" bearing bars and 2" nom. dia. pipe wing assemblies shall be primed with one coat on No. 1 paint and finished with two coats of yellow enamel paint.
GENERAL NOTES:
1. Length of posts and braces shall not be less than 7'-0".
2. Woven wire fence fabric shall be attached to the post at the top, bottom, and intermediate wires.
3. The post of an End Post Assembly may be a gate, latch, or end post.
4. Intermediate Post Assemblies shall be located as shown and at intervals not to exceed 650 feet.
5. A twisted wire stay shall be centered between posts.

Woven Wire Fence Types

Design Number and Dimensions for Various Types of Fencing
GENERAL NOTES:

1. For game and antelope fence the bottom wire shall be barbed.

2. There shall be three stay equally spaced between posts.

3. Length of posts and braces shall not be less than 7'-0".

4. The posts of an End Post Assembly may be a gate, latch, or end post.

5. Intermediate Post Assemblies shall be located as shown and at intervals not to exceed 650 feet.
GENERAL NOTES

1. Each Type 1 gate shall have a diagonal truss rod and tightening.
2. Each Type 1 gate frame greater than five feet in width shall have an additional vertical bracing. The maximum spacing between vertical braces shall not exceed five feet.
3. An Intermediate Post Assembly shall be set one panel width from Latch Post and Gate Post.
4. Gate Post & Latch Posts - Uprights - Angles, 2\(\frac{1}{4}\)" X 2" X 2", weighing 4.16 lbs/ft, prior to fabrication.
5. Braces - Angles, 2" X 2" X 2", weighing 3.19 lbs/ft, prior to fabrication.

Or and alternative angle of equivalent weight.
GENERAL NOTES:

1. The alignment of the wing fence shall be as directed by the Engineer to avoid drainage, erosion or other similar conditions.

2. An Intermediate Post Assembly or other post assembly shall be set one panel width from Gate Posts.
GENERAL NOTES:

1. A right-of-way or access control fence across a drainage channel shall be connected to the fence from the wingwall by means of a Connecting Fence Assembly.

2. An Abutting Fence Assembly shall be used where an existing fence intersects a right-of-way or access control fence.

3. An Intermediate Post Assembly may be located so that it can be utilized, along with an additional brace, as a Connecting Fence Assembly at an intersecting fence; however, the spacing of intermediate post assemblies shall not exceed 650 feet.

4. The Fence Connection To Wingwall shown is a suggested arrangement for terminating the fence at the wingwall. Final location of eye bolts and line post will be determined by the Engineer.
**Typical Post Dimensions**

<table>
<thead>
<tr>
<th>Fabric Type</th>
<th>Line Posts</th>
<th>End, Corner, Latch and Pull Posts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Round (l.b.)</td>
<td>H-Section</td>
</tr>
<tr>
<td>72&quot; and Less</td>
<td>1 1/2&quot;</td>
<td>1.875&quot; x 1.665&quot;</td>
</tr>
<tr>
<td>Over 72&quot;</td>
<td>2&quot;</td>
<td>2.250&quot; x 2.000&quot;</td>
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</table>

Note: Options exercised shall be uniform on any one project. Dimensions shown are nominal.

**Interim Gate Assembly**

**Gate Table**

<table>
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<tr>
<th>Gate Swing</th>
<th>Post Length</th>
<th>Post Hole Dia. x Depth</th>
<th>Nominal I.D.</th>
<th>Weight - Linear Per Foot</th>
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</thead>
<tbody>
<tr>
<td>Up to 6&quot;</td>
<td>H x 3 3/4&quot;</td>
<td>10&quot; x 11/16&quot;</td>
<td>1 1/2&quot;</td>
<td>4 1/4&quot;</td>
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<tr>
<td>Over 6&quot; to 10&quot;</td>
<td>H x 5 3/4&quot;</td>
<td>12&quot; x 1 1/4&quot;</td>
<td>2&quot;</td>
<td>5 1/4&quot;</td>
</tr>
<tr>
<td>Over 10&quot; to 15&quot;</td>
<td>H x 7 1/2&quot;</td>
<td>16&quot; x 1 3/4&quot;</td>
<td>2 1/2&quot;</td>
<td>7 1/2&quot;</td>
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</tbody>
</table>

Note: Post sizes and weights are minimums. Larger sizes may be used on approval of the Engineer.

**Dimensions**

- **Corner Post Assembly**
  - Typical:
    - 10'-0" Maximum
    - Typical Both Sides

- **Intermediate Post Assembly**
  - Typical:
    - 10'-0" Maximum
    - Typical Both Sides

- **Gate**
  - 14'-0" Maximum
  - 10'-0" Minimum
  - Typical Both Sides

- **Detail A**
  - 1'-0" Maximum
General Notes

1. Pipes shall be installed either in a trench condition or in a non-trench condition in natural ground or in an embankment.

2. In a trench condition, the vertical and horizontal limits shall be maintained; otherwise, a non-trench condition exists.

3. Bracing shall conform to OSHA requirements.

D - Outside diameter of full circle pipe or outside dimension (span or rise) of arch, arch pipe, elliptical pipe.

T - Minimum wall thickness for NRC/PCP, as per project plans.

Δ - D + 2 feet maximum for diameters up to 4 feet and D + 3 feet maximum for diameters 4 feet and over.

∅ - 6 inches except when on unyielding or unstable material, then as per the standard specifications.

- Non-trench condition
- Trench condition
- Bedding limits

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Design Approved

Approved for Distribution

Pipe Culvert Placement

Plan No. C-13.15
**GENERAL NOTES**

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.

---

**CULVERT LENGTH AS SHOWN ON PLANS**

---

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STANDARD DRAWINGS

PIPE, REINFORCED CONCRETE

END SECTION

DRAWING NO. O-13.20
END SECTION DIMENSIONS
Riveted or Bolted Connections

TYPE 1

MULTIPLE INSTALLATION SPACING

TYPE 2

TYPE 3

TYPE 4

TYPE 5

GENERAL NOTES

The end section may be jointed to the pipe or connector section by bolts, rivets, dimpled bands, slip-seam bands or threaded rod type fasteners. For allowable connector types, see table.

The type 1 connector (far left) is by means of bolts or rivets. Maximum circumferential fastener spacing shall be 12" and with a minimum of 8 fasteners per joint. The Type 1 joint may be used with either annular or helical corrugations.

Type 2 and 3 connectors shall be used only with annular pipe or helical pipe with a requisite number of annular corrugations.

Type 4 and 5 connectors shall be used only with helical pipe.

All steel end section components shall be galvanized.

Toe of embankment shall be warped to match toe of skewed end section.

A berm shall be added to abnormal projections per Std. C-13:10.

The foregoing applies to all cross section configurations.
GENERAL NOTES

For lateral dimension of invert paving, use 72° control for CMP and span for CMFP.

Paving shall be scored longitudinally at 1'-6" min. lateral intervals.

Use bevel on inlet headwall only.

Wire mesh shall be fastened or welded to corrugation crests at intervals and in a manner approved by the Engineer. Laps shall be 6" min.

Paving shall not be placed until backfilling is completed.

Concrete shall be Class "5W."

See Std. O-II.20 for headwall and bevel dimensions not shown.
GENERAL NOTES
1. Payment limits shown include structural excavation for headwalls, cutoff walls, wingwalls, etc.
2. W = Width
   L = Length
   H = Height of barrel or headwall w/o cutoff wall
3. 6" max in rock & trench.
    1'-6" max all others
GENERAL NOTES
1. Placement of structure backfill around headwalls and wingwalls shall be the same as around structures.
2. 6" min in rock & trench
1"-6" min all others
1. Computation of Structure Backfill quantities for box culverts is based on the area of a typical installation times (the total length of the structure plus 2H). No measurement is necessary for wing areas. Use H for box extensions on each end extended.

2. $H$ = Height of barrel or headwall w/o cutoff wall.

3. $6''$ max in rock & trench
   $1''$-$5''$ max all others

GENERAL NOTES
GENERAL NOTES

This end treatment is to be used only for those cattle and/or vehicle passes not used for drainage.

All concrete shall be Class B. An optional 12" A.B. invert paving base course and 6" of concrete may be used in the 14" diameter pipe.

Anchor bolts shall be retained in a horizontal position during pour with final tightening a minimum of 7 days after pour.

Pipe shall be backfilled before concrete bond beam is constructed. Minimum forming may be used.

Edges of wire mesh shall be fastened or welded to corrugation crests at intervals and in a manner approved by the Engineer. Laps shall be 6" minimum.

For installation normal to roadway centerline only.
<table>
<thead>
<tr>
<th>D Type</th>
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<th>F</th>
<th>G</th>
<th>X</th>
<th>Conc. (CY)</th>
<th>Reinf. Steel (Lbs.)</th>
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<th>Conc. (CY)</th>
<th>Reinf. Steel (Lbs.)</th>
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**1/12 Embankment Slope**

- **Dimentions**
- **Conc. (CY)**
- **Reinf. Steel (Lbs.)**

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<td>6</td>
<td>23</td>
<td>9.30</td>
<td>9.21</td>
<td>625</td>
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</tbody>
</table>

**4:1 Embankment Slope**

- **Dimentions**
- **Conc. (CY)**
- **Reinf. Steel (Lbs.)**

For other headwall dimensions, steel reinforcing, inlet bevel and other details not shown, see Std. C-14,20.

For skewed installations, inlet and outlet headwall types are identical for equal embankment slopes.

For inlet and outlet wingwall flare differences for headwalls normal to pipe, see Std. C-14,20.

See Structures Section Standards for headwall design for pipes over 84” Dia.
GENERAL NOTES:
1. See also Std. O-13.10
2. High point of headwall shall not project more than 3" above slope.
3. All concrete shall be Class B
4. All reinforcing bars shall be number 4, 1'-0" c to c and 3" clear to inside of walls and floor.

<table>
<thead>
<tr>
<th>PIPE</th>
<th>W</th>
<th>DIMENSIONS</th>
<th>CONC. C.Y.</th>
<th>REINF. STEEL</th>
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<td>Double</td>
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<tr>
<td>I.D.</td>
<td>W</td>
<td></td>
<td>For Conc. Pipe Deduct</td>
<td>For Conc. Pipe Deduct</td>
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<td>C.M.P.</td>
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<tr>
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<td>1'-3&quot;</td>
<td>9&quot;</td>
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<tr>
<td>20&quot;</td>
<td>3'-0&quot;</td>
<td>1'-0&quot;</td>
<td>1'-7 1/2&quot;</td>
<td>1'-11 3/8&quot;</td>
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<td>3'-6&quot;</td>
<td>2'-0&quot;</td>
<td>1'-6&quot;</td>
<td>2'-3 1/4&quot;</td>
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<tr>
<td>36&quot;</td>
<td>3'-0&quot;</td>
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<td>42&quot;</td>
<td>4'-6&quot;</td>
<td>2'-9&quot;</td>
<td>2'-3&quot;</td>
<td>3'-10 3/4&quot;</td>
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</tbody>
</table>

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DIVISION OF HIGHWAYS
STANDARD DRAWINGS
HEADWALL, DROP INLET
CHECKING NO.
0-14.30
GENERAL NOTES

Pipes can be placed in any wall. Floor shall have a wood trowel finish and a minimum 1/2" slope in all directions to outlet.

All structural steel shall be ASTM A36.

Welding shall be in accordance with Sec. 15.70.

Concrete shall be Class B. Construction joints and drains shall be placed to meet field conditions. See Sec. 15.70.

Any specified gutter depression shall be warped to opening according to Sec. 15.70.

Curbing opening areas, sq. ft., for Type I Single and Type I-D double equal 0.25 and 0.5, respectively, for each inch of "h" gutter depression to 2.5".

See Sec. 15.70.

For grate and frame details and grate opening areas, see Secs. 15.50 & 15.40.

"3/16" for longitudinal and 3" for transverse bar grates.

See 2.0 for LW, LB, EP, TV, and TB series 1 grates. 1.5" for LW, LB, EF, TV and TB series 2 grates. Use 1"-6" with combined curb and gutter.

See 2.0 for LW, LB, TV and TB series 1 grates. 2.25" for LW, LB, TB and TB series 2 grates.

Φ 3/8" when Φ is 8' or less; 8' when Φ is over 8'. See Sec. B-B.
GENERAL NOTES

Type 3 - Sump Only
Type 3 - Wing (illustrated) sump with wing basin upstream.
Type 3 - Double wing, sump with symmetrical wing basin each side.
Pipes can be placed in any wall except wall adjacent to wing basin.
Sump floor shall have a wood trowel finish and a minimum slope of 1:4 in all directions toward center pipe.
Outlet depression shall be warped to opening according to Std. O-15.70.
All structural steel shall be ASTM A 36.
Rope anchor, grise and cover shall be given one shop coat of No. 1 paint.
All concrete shall be Class B.
All reinforcing bars shall be #2, 1'-6" c to c both ways and 1' 1/2" clear inside of walls and outside of wing basin floor except as shown.
Curb opening area (sq. ft.) per inch of curb "a" + gutters depression = curb opening length (ft.) X 0.037.
Welding shall be in accordance with Standard Welding Specifications.
* Construction joints at or below bottom of curb line. Construction joints and drains shall be placed to meet field conditions. See Std. O-15.70.

0 = 6" when H = 8' or less
8" when H is greater than 8'.
H = 2' - 3' min. when L = 3'
5' - 3' min. when L = 6'
5' - 3' min. when L = 10'
5' - 3' min. when L = 17'

NOTE: Provide Std. O-15.70 Construction Drain.
**GENERAL NOTES**

Pipes can be placed in any wall. Supp 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 without catch basin concrete set for a minimum of 24 hours.

For grate and frame details and opening areas, see Stds. C-15.50 & C-15.60.

Any specified gutter depression shall be warped to opening according to Std. C-15.70.

All structural steel shall be ASTM A 36.

Grate, frame, and beam shall be given one shop coat of No. 1 paint.

All concrete shall be Class B.

Construction joints & drains shall be placed to meet field conditions. See Std. C-15.70.

* 3/4" for longitudinal and 3" for transverse bar grates.

** 2'-0" for LW, LB, EF, TW and TB series 1 grates. 1'-6" for LW, LB, EF, TW and TB series 2 grates. Use 1'-6" with combined curb & gutter.  
1'-6" when 3'-0" or less; 3" when H is greater than 3'. See Section B-B.

---

**PLAN, CATCH BASIN TYPE 4 - SINGLE**

See Type 4-Single & Sect. A-A for reinf. details.

Dimensions are common to Type 4-single except as shown.

**PLAN, CATCH BASIN TYPE 4 - DOUBLE**

**SECTION B-B**

Use this section when t = 8"

**SECTION A-A**

**DETAIL NO. 1**

- Grate support for C.B. Type 4-Double only. See Detail No. 1.
- Grate frame and frame anchors.
- Curb or combined curb and gutter.

- NOTE: Provide Std. C-15.70 Construction Drain.

- Normal crown

- Specified gutter depression.

- ¾ bars, 1'-6" c to c, horiz. and vert., 1'-1/2" clear to inside of wall.

- No bottom reinforcing.

- 1/2" stove bolts, 2 per frame.

- Avoid conflict with grate.
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 trowel finish and a minimum slope of 4:1 in all directions toward outlet pipe.

Welding shall be in accordance with Std. Welding Specifications.

Gutter depression shall be warped to opening according to Std. 0-15.70

All structural steel shall be in accordance with ASTM A 36.

Note: reinforcing bars shown are for roof slab only. See sections for other reinforcing.

SECTION A-A

3/8" x 3 1/2" sq. head bolt anchor, 3/16" 2 1/2" x 2 1/2" x 1 1/2"

Gutter depression as specified 3" max., 1" min.

Curb support anchor, 1" 0" bar with 3", 90° bend.

SECTION B-B

Grind to 3/8" R

3/8" Normal crown

Curb opening area (Sq. Ft.) per inch of curb "b" + gutter depression = curb opening length (Ft.) x 0.0634.

For grate and frame details and opening areas, see Stds. C-15.50 & C-15.60.

Construction Joint shall be placed to meet field conditions.

NOTE: Provide Std. C-15.70

Construction Drain.

DEPARTMENT OF TRANSPORTATION
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STANDARD DRAWINGS

CATCH BASIN, TYPE 5

0-15.40
**FRAME**

**GRATES TYPE LM & EF**
Restrict to slopes of 3% or less.

<table>
<thead>
<tr>
<th>GRATE TYPE</th>
<th>CLEAR BAR SPACING</th>
<th>NO. BARS</th>
<th>X</th>
<th>GRATE OPENING SQ. FT.</th>
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<tbody>
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<td>5(\frac{1}{16}) &quot;</td>
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</table>

**SECTION A-A’**

- Use on longitudinal grades in excess of 3% or as an alternate to Types LM or EF on grades of 3% or less.

**GENERAL NOTES**

LM indicates longitudinal welded.

LM indicates longitudinal rolled.

EF indicates electroformed.

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

All welding shall be in accordance with Standard Welding Specifications.

The completed assembly shall be given a shop coat of No. 1 paint. Frames and grates shall fit to a maximum roof of 0.093" at any point.
**FRAME**

<table>
<thead>
<tr>
<th>Type</th>
<th>Clear Spacing</th>
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<th>Grate Opening Sq. Ft.</th>
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<td>3.21</td>
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**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 Standard Welding Specifications.

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

TW indicates transverse welded. TW indicates transverse bolted. Frame and grate shall be given max. roof of 0.093" at any point. Restrict use to grades of 3% or less.
CATCH BASIN TYPE 3

Gutter depression and spacing
Catch basin types 1, 4 & 5

Gutter depression
Catch basin type 3

Gutter Control grade
Meet normal crown

Curb opening

Gutter depression
Catch basin wall

Catch basin drain

Principal flow

Valley

Type EF, LB or LW grate.

2" A.C. Apron

Heat resisting terrain all around

4' 0" min.

20' 0" min.

3' 0" min.

Gutter depression: 3' max. (See detail No. 1)

C = Normal pavement or gutter flow line elev.

D = Depressed elevation.

S = Straight grade with downward slope.

W = Normal gutter width per Std. C-05.10

GENERAL NOTES

No gutter depression shall extend into a traffic lane.

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1/83

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CATCH BASIN MISC. DETAILS
G-15.70
Dike back sloped to intersect ditch grade. (Slope referenced to ditch grade.)

Catch basin and apron

Dike dimensions & side slopes per plans

PLAN PERSPECTIVE
ILLUSTRATING 1-WAY FLOW WITH DYKE

4 - 5/8" holes

7-bars, 5/8" X 2 1/2" 3" c to c

2 11/16" X 3" Zee, 12.6#ft.
or Detail No. 1 alternate.

4 - 1/2" X 4" bolt anchors.

3/16"

GRATING DETAIL

* 8" when wall height exceeds 8'.

SECTION A-A

4:1 dike slope or median ditch grade.
(1-way or 2-way flow respectively)

#4 bars. See Section B-B

6:1 Median ditch grade

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

GENERAL NOTES

Apron shall be A.G. or P.C. concrete as specified on Plans.
Concrete shall be Class B.
Grating shall be fabricated of structural steel.
Structural steel shall be in accordance with ASTM A 36.
Welding shall be in accordance with Standard Welding Specifications.
Grating assembly shall be given one shop coat of No. 1 paint.

DETAIL NO. 1

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DESIGN APPROVED

CONTRACTOR

CATCH BASIN, MEDIAN
PLOW

DRAWN

REV

ENGINEER

0-15.80
GENERAL NOTES:
1. Concrete shall conform to the requirements for Class S
Concrete. The minimum strength shall be 4,000 psi.
2. Grout shall be in accordance with Standard Specifications
except water content shall be such that the consistency is
proper for smooth troweling.
3. Grate cross rods shall be resistance welded, fillet welded or
electro-forged to bearing bars.
4. The completed grate shall be given one shop coat
of No. 1 paint.
5. Foundation soil and backfill shall be compacted to not less than
95% of the maximum density determined in accordance with the re-
Plan:
- Symmetry about the center line (x).
- 3/4" chamfer on all exposed corners.

Section A-A:
- 2" pipe with 6" wall thickness.
- 1"-0" to 1'-9" dimensions.

Section B-B:
- 2'-4" to 6" dimensions.
- 6" to 6'-1" dimensions.

Table:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Length</th>
<th>External Pipe Diameter</th>
<th>Internal Pipe Diameter</th>
<th>C.Y. Conc.</th>
<th>C.M.F.</th>
<th>R.C.F.</th>
<th>Reinf. Steel</th>
<th>Tons</th>
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<tr>
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<td>1'-9&quot;</td>
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<td>3'-0&quot;</td>
<td>6'-1&quot;</td>
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<td>4.02</td>
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<tr>
<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>
<td>410</td>
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</table>

General Notes:
- All concrete shall be Class B.
- All reinforcing bars shall be #6 except two #6 bars over pipe. Bar spacing approximately 1'-0" c to c unless otherwise noted.
- 30" wing wall flare shown; 45° normally desirable. See Hydraulics and Utility A.R.R. Eng., Divisions.
General Notes

Rock shall be sound and durable, of rounded or angular shape and with a nominal diameter of 8" min. and 12" max. Flat or needle shapes are not acceptable.

Type 3 Bank Protection

Min. 20# railroad rail or equal, 10' long, 7'-0" c to c

<table>
<thead>
<tr>
<th>TYPE</th>
<th>EMBANKMENT SLOPE RATE</th>
<th>&quot;H&quot;</th>
<th>TOP OF BANK PROTECTION ABOVE STREAM BED</th>
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<tbody>
<tr>
<td>2</td>
<td>2:1 or 1 1/2:1</td>
<td>0' to 2'</td>
<td>2' to 4'</td>
</tr>
<tr>
<td>3</td>
<td>2:1 or 1 1/2:1</td>
<td>0' to 3'</td>
<td>3' to 4'</td>
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</tbody>
</table>

*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.
**Types 4 & 5 Bank Protection**

- **6 x 6-W1/4 x W1/4 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 Galv. wire, 2'-0" o to c.

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

**General Notes**

Rock shall be sound and durable, of rounded or angular shape and with a nominal diameter of 8" min. and 21" max. Flat or needle shapes are not acceptable. Rock shall be comprised of 50% min. 8" to 12" and 5% max. 18" to 21".
GENERAL NOTES
1. Precast Manholes shall conform to the requirements of AASHTO M 199 except that the compressive strength of each unit will be determined and accepted in accordance with Section 1005.7 of the ADOT Specifications.
2. Concrete for all other manholes shall be Class B.
3. Every fifth course of bricks in Manhole No. 1 shall be laid as stretchers.
4. For manhole cut and replacement of bituminous or concrete pavement see Std. C-7.30.
5. For Std. 0-18.20 frame and cover type, see Plans.

REINFORCING shall be in accordance with AASHTO M-199
GENERAL NOTES

1. H 20 Loading minimum
2. Detail shown is typical.
3. Alternate design of Manhole frame and cover may be utilized with the approval of the Engineer, as long as minimum loading and weight are equivalent.

FRAME
APPROX. Wt. 200 LBS.

COVER
APPROX. Wt. 200 LBS.
CONCRETE SURFACE FORD CONCRETE WALLS

*Min. Distance Below Stream Bed

BITUMINOUS SURFACE FORD CONCRETE WALLS

ELEVATION LOOKING UPSTREAM

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

2 1/2" x 4" x 10 Ga. sheet metal number tabs, both sides. Fasten with 2-1/2" x 1/2" x 1/2" bolts through tube.

1 3/4" x 3"-0" perforated telescoping sq. tube, 12 ga., 7/10" holes 1" c to c, 4-9 sides.

2" x 2 1/4" x 1/2" numerals.

GENERAL NOTES

Ford walls shall be Class B concrete.

Depth Gauge tubing shall be protected against concrete entering through bottom or perforations.

Depth Gauge tubing and both sides of numeral tabs shall be painted 2-coats white enamel. Numerals and markers shall be 1-coat Gloss black enamel.
**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.

See Std. 0-19.1 for Depth Gauge details.

Depth Gauge foundation may be utility concrete.

---

**TYPE 1**

**BITUMINOUS SURFACE FORD**

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

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

**TYPE 2**

**BITUMINOUS SURFACE FORD**

**TIMBER CUTOFF WALLS**

3-40d common nails per board

---

**ELEVATION - TYPE 2**

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

2" nom. pipe. See Detail A.
A Survey monument, frame and cover, complete in place shall be considered a unit.

A Right-of-way marker, consisting of a survey monument and a reference marker, complete in place shall be considered a unit.

All markers shall be placed as shown on the plans or as directed by the engineer.

Frames may be either Type A or Type B. Frames shall weigh at least 63 pounds.

Covers shall weigh at least 16 pounds.

Portions of frame and cover to be machined is shown by the symbol "^f". The allowable tolerances for machined areas shall be ±1/64".

Concrete shall conform to the requirements of the specifications.
GENERAL NOTES

Standard marker shall be made of brass, bronze or aluminum.
Standard marker will be furnished by the Department.
Bench marks will be established by the Engineer on headwalls, bridge curbs or other permanent structures.
Aluminum marker shall not be used when calcium chloride is used in the concrete.
#6 bars 6" c to c

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

FOR SINGLE INSTALLATION

<table>
<thead>
<tr>
<th>Quantities per ft. of slab length</th>
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<tbody>
<tr>
<td>Concrete</td>
</tr>
<tr>
<td>0.31 C.Y.</td>
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</tbody>
</table>

GENERAL NOTES

Concrete shall be Class B

1 1/2" clear to base of slab

Utility line

SECTION A-A