SET RIGHT-OF-WAY MARKER SO THAT THE RIGHT-OF-WAY LINE PASSES THROUGH THE INTERSECTION OF THE 'X' ON THE TOP OF THE MARKER.

NOTES:
- INDENT THE LETTERS 'R/W' IN THE TOP OF EACH MARKER.
- IN LOCATIONS SUCH AS LAWNS, PRIVATE ENTRANCES, DRIVES, ETC. CONSTRUCT 'R/W' MARKER FLUSH WITH THE GROUND.
- PLACE 3/8" DIA. STEEL REINFORCING BAR 2'-9" IN EACH CORNER.
NOTE:
IN LOCATIONS SUCH AS LAWNS, PRIVATE ENTRANCES, DRIVES, ETC. CONSTRUCT 'R/W' MARKER FLUSH WITH THE GROUND.

SET RIGHT-OF-WAY MARKER SO THAT THE RIGHT-OF-WAY LINE PASSES THROUGH THE INTERSECTION OF THE 'X' ON THE TOP OF THE MARKER.
SET CONTROL-OF-ACCESS MARKER SO THAT THE CONTROL-OF-ACCESS LINE PASSES THROUGH THE INTERSECTION OF THE 'X' ON THE TOP OF THE MARKER.

NOTES:
INDENT THE LETTERS 'C/A' IN THE TOP OF EACH MARKER.
IN LOCATIONS SUCH AS LAWNS, PRIVATE ENTRANCES, DRIVES, ETC. CONSTRUCT 'C/A' MARKER FLUSH WITH THE GROUND.

PLACE ¾" DIA. STEEL REINFORCING BAR 2'-9" IN EACH CORNER
NOTES:
REFER TO SECTION 815 OF THE STANDARD SPECIFICATIONS FOR INSTALLATION DEPTHS OF DRAINAGE PIPES.
CONNECT PIPE OUTLET INTO DRAINAGE STRUCTURE WHEREVER POSSIBLE. IF NOT CONNECTED TO DRAINAGE STRUCTURE, PROTECT END OF PIPE BY CONCRETE PAD FOR OUTLET END OF DRAIN. PADS ARE NEEDED AT LOCATIONS WHERE PIPE IS NOT PLACED IN DRAINAGE STRUCTURE TO FACILITATE MAIN-TENANCE AND AID IN IDENTIFICATION. OUTLETS ARE REQUIRED EVERY 500' OR AS DIRECTED BY THE ENGINEER.

EXCAV. OR COURSE AGGREGATE
CU. YDS. PER FT. DEPTH/LIN. FT.

0.056

THE CONCRETE PAD CONSISTS OF 4" DRAIN 0.137 CUBIC YARDS, 6" DRAIN 0.177 CUBIC YARDS CLASS "B" CONCRETE.
NOTES:
REFER TO SECTION 815 OF THE STANDARD SPECIFICATIONS FOR INSTALLATION DEPTHS OF DRAINAGE PIPES.
CONNECT PIPE OUTLET INTO DRAINAGE STRUCTURE WHEREVER POSSIBLE. IF NOT CONNECTED TO DRAINAGE STRUCTURE, PROTECT END OF PIPE BY CONCRETE PAD FOR OUTLET END OF DRAIN. PADS ARE NEEDED AT LOCATIONS WHERE PIPE IS NOT PLACED IN DRAINAGE STRUCTURE TO FACILITATE MAINTENANCE AND AID IN IDENTIFICATION. OUTLETS ARE REQUIRED EVERY 500' OR AS DIRECTED BY THE ENGINEER.

<table>
<thead>
<tr>
<th>PIPE UNDERDRAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y = 12' WHEN &quot;H&quot; IS 4'-0&quot; OR LESS</td>
</tr>
<tr>
<td>Y = VARIABLE WHEN &quot;H&quot; IS OVER 4'-0&quot;</td>
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SUBDRAIN QUANTITIES

<table>
<thead>
<tr>
<th>TYPE</th>
<th>EXCAV. OR FINE AGGR.</th>
<th>CU. YDS. PER FT. DEPTH/LIN. FT.</th>
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</thead>
<tbody>
<tr>
<td>UNDER</td>
<td>DRAIN</td>
<td>0.056</td>
</tr>
<tr>
<td>BLIND DRAIN</td>
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<td>0.037</td>
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</table>

THE CONCRETE PAD CONSISTS OF 4" DRAIN 0.137 CUBIC YARDS, 6" DRAIN 0.177 CUBIC YARDS CLASS "B" CONCRETE.
THE CONCRETE PAD CONSISTS OF 0.137 CUBIC YARDS OF CLASS "B" CONCRETE.
AGGREGATE SHOULDER DRAIN

NOTE: DO NOT PERMIT CONNECTING OF OUTLET PIPES TO EXISTING OR PROPOSED DRAINAGE PIPES.

CONTINUOUS 4" PERFORATED PIPE

PROFILE

VARIABLE SPACING 300' ± TO SUIT COND. OR AS DIRECTED BY THE ENGINEER

NOTE: DO NOT PERMIT CONNECTING OF OUTLET PIPES TO EXISTING OR PROPOSED DRAINAGE PIPES.
GENERAL NOTES:
USE THE FOLLOWING CRITERIA AS A GUIDE FOR THE LOCATION, QUANTITY AND INSTALLATION OF AGGREGATE SHOULDER DRAIN.

1. INSTALL ON LOW SIDE OF PAVEMENT IN AREAS WITH GRADES FLATTER THAN 1%, AND SAG VERTICAL CURVES.

2. OTHER LOCATIONS AS DIRECTED BY THE ENGINEER.

3. PLACE OUTLETS AT THE LOW POINTS AND SPACE AS SHOWN ON THE PLAN VIEW.

4. CONNECT OUTLET PIPE INTO DRAINAGE STRUCTURE WHERE POSSIBLE. IF NOT CONNECTED TO DRAINAGE STRUCTURE, PROTECT END OF PIPE BY CONCRETE PAD. SEE DETAIL OF CONCRETE PAD.

5. OUTLET PIPE GRADE MIN. 3%.
GEOCOMPOSITE SHOULDER DRAIN

PLAN

VARIABLE SPACING 300' ± TO SUIT COND. OR AS DIRECTED BY THE ENGINEER
SEE INSET "A"

GEOCOMPOSITE TEE

OUTLET PIPE

DRAINAGE SYSTEM

NOTE: DO NOT PERMIT CONNECTING OF OUTLET PIPES TO EXISTING OR PROPOSED DRAINAGE PIPES

PROFILE

GEOCOMPOSITE SHOULDER DRAIN

PLAN

VARIABLE SPACING 300' ± TO SUIT COND. OR AS DIRECTED BY THE ENGINEER
SEE INSET "A"

GEOCOMPOSITE TEE

OUTLET PIPE

DRAINAGE SYSTEM

NOTE: DO NOT PERMIT CONNECTING OF OUTLET PIPES TO EXISTING OR PROPOSED DRAINAGE PIPES
GENERAL NOTES:

USE THE FOLLOWING CRITERIA AS A GUIDE FOR THE LOCATION, QUANTITY AND INSTALLATION OF GEOMCOMPOSITE SHOULDER DRAIN.

1. INSTALL ON LOW SIDE OF PAVEMENT IN AREAS WITH GRADES FLATTER THAN 1% ± AND SAG VERTICAL CURVES.
2. OTHER LOCATIONS AS DIRECTED BY THE ENGINEER.
3. PLACE OUTLETS AT THE LOW POINTS AND SPACE AS SHOWN ON THE PLAN VIEW.
4. CONNECT OUTLET PIPE INTO DRAINAGE STRUCTURE WHERE POSSIBLE. IF NOT CONNECTED TO DRAINAGE STRUCTURE, PROTECT END OF PIPE BY CONCRETE PAD.
   SEE DETAIL OF CONCRETE PAD.
5. PROVIDE 4" SCH. 40 PVC PIPE FOR OUTLET.
6. OUTLET PIPE GRADE MIN. 3%.
MARKERS FOR DRAINAGE STRUCTURE AND CONCRETE PAD

INSET "A"

PAINTED SHOULDER AND VERTICAL MARKER

SHOULDER PAINT STRIPE
PAVEMENT

ROADWAY PAVEMENT

PAVED SHOULDER

PAINTED SHOULDER

PAINTED WITH WHITE

OFFSET

MOWING LIMITS

3' OFFSET FROM SHOULDER MARKER

DETAIL OF PAINTED SHOULDER

MOWING LIMITS

PAVED SHOULDER

PAINT STRIPE

SHOULDER PAINT STRIPE

PAVEMENT

PAINT STRIPE

VARIABLE

SHOULDERS MARKER

SEE INSET "A" DETAIL OF PAINTED SHOULDER MARKER

SHOULDER DRAINS
SEE STD. DWGS 816.02 AND 816.03

MAINTENANCE MOWING LIMITS

VERTICAL MARKER WITH YELLOW TOP

SHOULDER DRAINS
SEE STD. DWGS 816.02 AND 816.03

VERTICAL MARKER WITH YELLOW TOP

PAINTED SHOULDER AND VERTICAL MARKER

WIDE PAVEMENT

SHOULDER PAVEMENT

90° WIDE MEDIAN

OFFSET

WHITE PAINTED WITH YELLOW TOP VERTICAL MARKER INSET "A"
AND CONCRETE PAD MARKERS FOR DRAINAGE STRUCTURE

GENERAL NOTES:
USE A36 GRADE STEEL. USE FLAT BLACK PAINT AS FIRST APPLICATION.
USE YELLOW AS SECOND APPLICATION FOR THE TOP HALF OF THE MARKER.
USE EXTERIOR OIL BASE FOR ALL PAINT.
USE MARKERS FOR SUBSURFACE AND SHOULDER DRAIN CONCRETE PADS.
PLACE MARKERS FOR OUTLETS AT DRAINAGE STRUCTURES WHERE APPLICABLE.
CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

DIMENSIONS AND CONCRETE QUANTITIES

DOWELS IN ENDWALL WITH REINFORCED CONCRETE PIPE

<table>
<thead>
<tr>
<th>LOC.</th>
<th>PIPE DIA.</th>
<th>SINGLE PIPE</th>
<th>DOUBLE PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X&quot;</td>
<td>X&quot;</td>
</tr>
<tr>
<td>BARS QTY.</td>
<td>G</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>G QTY.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>G QTY.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL LBS.</td>
<td></td>
<td>9</td>
<td>9</td>
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COMMON DIMENSIONS

<table>
<thead>
<tr>
<th>D</th>
<th>H</th>
<th>B</th>
<th>G</th>
<th>T</th>
<th>S</th>
<th>L</th>
<th>YD³</th>
<th>M</th>
<th>L</th>
<th>YD³</th>
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</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td>3'</td>
<td>3&quot;</td>
<td>1&quot;</td>
<td>8&quot;</td>
<td>2&quot;</td>
<td>9&quot;</td>
<td>21/8&quot;</td>
<td>0&quot;</td>
<td>1/2&quot;</td>
<td>0.6</td>
</tr>
<tr>
<td>18&quot;</td>
<td>3'</td>
<td>7&quot;</td>
<td>1&quot;</td>
<td>10&quot;</td>
<td>3&quot;</td>
<td>2&quot;</td>
<td>10&quot;</td>
<td>6&quot;</td>
<td>8&quot;</td>
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<td>2&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
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<td>7&quot;</td>
<td>4&quot;</td>
<td>11&quot;</td>
<td>2&quot;</td>
<td>9&quot;</td>
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<td>36&quot;</td>
<td>5'</td>
<td>8&quot;</td>
<td>2&quot;</td>
<td>8&quot;</td>
<td>5&quot;</td>
<td>6&quot;</td>
<td>4&quot;</td>
<td>11½&quot;</td>
<td>1&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>6'</td>
<td>2&quot;</td>
<td>3&quot;</td>
<td>1&quot;</td>
<td>6&quot;</td>
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<td>5&quot;</td>
<td>11½&quot;</td>
<td>12&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>6'</td>
<td>9&quot;</td>
<td>3&quot;</td>
<td>5&quot;</td>
<td>7&quot;</td>
<td>2&quot;</td>
<td>5&quot;</td>
<td>11½&quot;</td>
<td>14&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

SLOPE AS INDICATED ON PLANS

PLACE GROOVE OR BELL END OF PIPE TO FACE OF WALL

FOOTING (IF CONSTR. JOINT IS USED)

SINGLE PIPED

DOWEL BAR - "X"

DOUBLE PIPED

OPTIONAL CONSTRUCTION JOINT

PLAN

ELEVATION

END ELEVATION

DOWEL

OPTIONAL CONSTRUCTION JOINT

3'-7"

4'-2"

1'-8"

1'-10"

2'-1"

2'-8"

2'-9"

3'-2"

4'-0"

4'-7"

5'-6"

6'-4"

7'-2"

9" THRU 48" PIPE - 90° SKEW

DOWELS IN ENDWALL WITH REINFORCED CONCRETE PIPE

LOC.

PIPE DIA.

BARS

X" | X" | X" | X" | X" | Y" | Y" | X" | X" | X" | X" | Y" | Y" | X" | Y" | Y" |

G QTY.

2 2 3 3 4 4 2 5 2 2 3 3 4 4 2 5 2 2 3 3 4 4 2 5 2 2 3 3 4 4 2 5 2 2 3 3 4 4 2 5 2 2 3 3 4 4 2 5 2 2 3 3 4 4 2 5 2 2 3 3 4 4 2 5 2 2 3 3 4 4 2 5
CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

DIMENSIONS AND CONCRETE QUANTITIES

DOWELS IN ENDWALL WITH C. S. PIPE

<table>
<thead>
<tr>
<th>PIPE LOC.</th>
<th>SINGLE PIPE</th>
<th>DOUBLE PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIA.</td>
<td>15&quot; 18&quot; 24&quot;</td>
<td>15&quot; 18&quot; 24&quot;</td>
</tr>
<tr>
<td>BARS</td>
<td>&quot;X&quot; &quot;X&quot; &quot;X&quot;</td>
<td>&quot;X&quot; &quot;X&quot; &quot;X&quot;</td>
</tr>
<tr>
<td>G QTY.</td>
<td>2 2 3 3 4</td>
<td>2 2 3 3 4</td>
</tr>
<tr>
<td>M QTY.</td>
<td>2 2 3 3 4</td>
<td>2 2 3 3 4</td>
</tr>
<tr>
<td>G QTY.</td>
<td>2 2 3 3 4</td>
<td>2 2 3 3 4</td>
</tr>
<tr>
<td>TOTAL LBS.</td>
<td>9 9 14 14 19 53</td>
<td>12 12 16 19 23 73</td>
</tr>
</tbody>
</table>

*SEE SHEET 3

DIMENSIONS AND CONCRETE QUANTITIES USING CORRUGATED STEEL PIPE

<table>
<thead>
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<th>DIA.</th>
<th>COMMON</th>
<th>SINGLE PIPE</th>
<th>DOUBLE PIPE</th>
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<tr>
<td>15&quot;</td>
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<td>1'-11&quot; 6'-11&quot;</td>
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<td>18&quot;</td>
<td>3'-7&quot;</td>
<td>1'-11&quot; 5'-10&quot;</td>
<td>1.2</td>
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<tr>
<td>24&quot;</td>
<td>4'-1&quot;</td>
<td>2'-1&quot; 3'-8&quot;</td>
<td>1.8</td>
</tr>
<tr>
<td>30&quot;</td>
<td>4'-7&quot;</td>
<td>2'-4&quot; 7'-4&quot;</td>
<td>3.8</td>
</tr>
<tr>
<td>36&quot;</td>
<td>5'-1&quot;</td>
<td>2'-7&quot; 10'-4&quot;</td>
<td>3.8</td>
</tr>
<tr>
<td>42&quot;</td>
<td>5'-7&quot;</td>
<td>2'-10&quot; 11'-10&quot;</td>
<td>4.9</td>
</tr>
<tr>
<td>48&quot;</td>
<td>6'-1&quot;</td>
<td>3'-1&quot; 16'-4&quot;</td>
<td>9.5</td>
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</tbody>
</table>

*SEE SHEET 3
AND DOUBLE PIPE CULVERTS
CONCRETE ENDWALL FOR SINGLE
AND DOUBLE PIPE CULVERTS
CONCRETE ENDWALL FOR SINGLE

GENERAL NOTES:
15” THRU 48” PIPE - 90° SKEW

1-12

15” THRU 48” PIPE - 90° SKEW

GENERAL NOTES:

CHAMFER ALL CORNERS 1” OR HAVE A RADIUS OF 1”.

DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS
ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM
OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.

SPACE BARS APPROXIMATELY ON 12” CENTERS UNLESS OTHERWISE DIRECTED.

PLACE 2 #6 “Y” BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42”
AND OVER WITH A MINIMUM OF 3” COVER AND A LENGTH OF 6” LESS THAN
ENDWALL LENGTH.

CONSTRUCT BOTTOM SLAB WITH FORMS.

CHRON UP ALL CORNERS 1” OR HAVE A RADIUS OF 1”.

DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS
ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM
OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.

SPACE BARS APPROXIMATELY ON 12” CENTERS UNLESS OTHERWISE DIRECTED.

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ENDWALL LENGTH.

CONSTRUCT BOTTOM SLAB WITH FORMS.

CHAMFER ALL CORNERS 1” OR HAVE A RADIUS OF 1”.

DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS
ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM
OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.

SPACE BARS APPROXIMATELY ON 12” CENTERS UNLESS OTHERWISE DIRECTED.

PLACE 2 #6 “Y” BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42”
AND OVER WITH A MINIMUM OF 3” COVER AND A LENGTH OF 6” LESS THAN
ENDWALL LENGTH.

CONSTRUCT BOTTOM SLAB WITH FORMS.

CHAMFER ALL CORNERS 1” OR HAVE A RADIUS OF 1”.

DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS
ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM
OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.

SPACE BARS APPROXIMATELY ON 12” CENTERS UNLESS OTHERWISE DIRECTED.

PLACE 2 #6 “Y” BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42”
AND OVER WITH A MINIMUM OF 3” COVER AND A LENGTH OF 6” LESS THAN
ENDWALL LENGTH.

CONSTRUCT BOTTOM SLAB WITH FORMS.

CHAMFER ALL CORNERS 1” OR HAVE A RADIUS OF 1”.

DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS
ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM
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SPACE BARS APPROXIMATELY ON 12” CENTERS UNLESS OTHERWISE DIRECTED.

PLACE 2 #6 “Y” BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42”
AND OVER WITH A MINIMUM OF 3” COVER AND A LENGTH OF 6” LESS THAN
ENDWALL LENGTH.

CONSTRUCT BOTTOM SLAB WITH FORMS.

CHAMFER ALL CORNERS 1” OR HAVE A RADIUS OF 1”.

DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS
ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM
OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.

SPACE BARS APPROXIMATELY ON 12” CENTERS UNLESS OTHERWISE DIRECTED.

PLACE 2 #6 “Y” BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42”
AND OVER WITH A MINIMUM OF 3” COVER AND A LENGTH OF 6” LESS THAN
ENDWALL LENGTH.

CONSTRUCT BOTTOM SLAB WITH FORMS.

CHAMFER ALL CORNERS 1” OR HAVE A RADIUS OF 1”.

DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS
ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM
OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.

SPACE BARS APPROXIMATELY ON 12” CENTERS UNLESS OTHERWISE DIRECTED.

PLACE 2 #6 “Y” BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42”
AND OVER WITH A MINIMUM OF 3” COVER AND A LENGTH OF 6” LESS THAN
ENDWALL LENGTH.

CONSTRUCT BOTTOM SLAB WITH FORMS.
### Dimensions and Quantities for RCP or CSP

**Calculations Based on Concrete Pipe**

<table>
<thead>
<tr>
<th>DIA</th>
<th>H²</th>
<th>B</th>
<th>G</th>
<th>T</th>
<th>L</th>
<th>O.D.</th>
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</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td>3'-3&quot;</td>
<td>1'8&quot;</td>
<td>2'9&quot;</td>
<td>3'6&quot;</td>
<td>4'3&quot;</td>
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<td>18&quot;</td>
<td>3'-7&quot;</td>
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<td>8'2&quot;</td>
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<td>36&quot;</td>
<td>6'-9&quot;</td>
<td>2'8&quot;</td>
<td>6'6&quot;</td>
<td>8'1&quot;</td>
<td>9'3&quot;</td>
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**H² Quantities**

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<th>D</th>
<th>LBS/100FT</th>
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<td>12.8</td>
</tr>
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<td>36&quot;</td>
<td>36'</td>
<td>15.3</td>
</tr>
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**Rebar in Endwall** (H¹ Min.)

<table>
<thead>
<tr>
<th>USE WITH</th>
<th>RCP OR CSP PIPE</th>
<th>#4 REBAR HORIZ.</th>
</tr>
</thead>
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<tr>
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<td>36&quot;</td>
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<tr>
<td>TOTAL LBS</td>
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</tr>
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</table>

### Sluice Gate Dimensions

**PIPE DIAMETER**

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<tr>
<th>DIA</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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**FRAME HEIGHT, MIN.**

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**GATE DIAMETER**

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<td>24&quot;</td>
<td>30&quot;</td>
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<td></td>
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</tbody>
</table>

### General Notes:

1. Limit variable height dimension (H) to frame height of sluice gate; 3' above the H¹ dimension or 10' whichever is less.
2. Attachment of gate may require specific positioning of pipe and/or modification of endwall. Confirmation of gate dimensions and attachment method is recommended prior to construction of endwall.
3. Place no. 4 rebar on 12" horizontal and vertical centers with 2" minimum concrete coverage.
4. Construct 1" chamfer or radius on all exterior corners.
5. Use forms to construct the bottom slab.
6. Wall thickness (T) is used to compute quantities, not to infer size.
7. When the base is poured separately, leave the pour rough.
8. Use class 'B' concrete.
9. Cut or bend rebar as needed to accommodate pipe.
**DOWELS IN ENDWALL AND DOUBLE PIPE CULVERTS**

**CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS**

---

**PLAN**

- **Footing (If Const. Joint is Used)**: Use Class "B" concrete.
- **Dowel Bar "X"**: Chamfer all corners 1".
- **Double Pipe Culverts 42" and Over**: Place 2 #6 "Y" bars in the top of all endwall for pipe culverts 42" and over with a minimum of 3" cover and a length of 6" less than endwall length.
- **Construct Bottom Slab With Forms**: Approximate on 12" centers unless otherwise directed by the engineer.
- **When the Contractor Elects to Use a Construction Joint at the Bottom of the Pipe, Place Bar "X" Dowels in the Base as Shown on Plans**: Space bars approximately on 12" centers unless otherwise directed by the engineer.
- **Construct Bottom Slab With Forms**: Approximate on 12" centers unless otherwise directed by the engineer.
- **When the Contractor Elects to Use a Construction Joint at the Bottom of the Pipe and Pour the Base Separately Leave the Pour Rough**: Do not interpret wall thickness (T) shown for the thickness acceptable, but is used in computing endwall quantities.

---

**ELEVATION**

- **Slopes**: 113/4": Use Class "B" concrete.
- **Dowel Bar "X"**: Chamfer all corners 1".
- **Double Pipe Culverts 42" and Over**: Place 2 #6 "Y" bars in the top of all endwall for pipe culverts 42" and over with a minimum of 3" cover and a length of 6" less than endwall length.
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- **When the Contractor Elects to Use a Construction Joint at the Bottom of the Pipe and Pour the Base Separately Leave the Pour Rough**: Do not interpret wall thickness (T) shown for the thickness acceptable, but is used in computing endwall quantities.

---

**Dimensions and Concrete Quantities**

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**Common Dimensions Using C.S. Pipe Arch**

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<th>Span</th>
<th>Rise</th>
<th>Thick</th>
<th>H</th>
<th>B</th>
<th>G</th>
<th>M</th>
<th>L</th>
<th>YD³</th>
<th>L</th>
<th>YD³</th>
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<td>1'-5&quot;</td>
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<td>1'-11&quot;</td>
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<td>3'-2&quot;</td>
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<td>2'-8&quot;</td>
<td>6'-10&quot;</td>
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<td>9'-6&quot;</td>
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<td>15'-4&quot;</td>
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<td>6.770</td>
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</table>
**General Notes:**

- Chamfer all corners 1". Use Class "B" concrete.
- Place 2 #6 "Y" bars in the top of all endwalls for pipe culverts 42" and over with a minimum of 3" cover and a length of 6" less than endwall length.
- Construct bottom slab with forms.
- When the contractor elects to use a construction joint at the bottom of the pipe, place bar "X" dowels in the base as shown on plans. Space bars approximately on 12" centers unless otherwise directed by the engineer.
- When the contractor elects to use a construction joint at the bottom of the pipe and pour the base separately leave the pour rough.
- Do not interpret wall thickness (T) shown for the thickness acceptable, but is used in computing endwall quantities.

**Reinforcing Quantities**

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<tr>
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<td>&quot;X&quot;</td>
<td>&quot;X&quot;</td>
<td>&quot;X&quot;</td>
<td>&quot;X&quot;</td>
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<td>&quot;X&quot;</td>
<td>&quot;X&quot;</td>
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*Quantities based on 2'-0"*

**Dimensions and Concrete Quantities**

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<th>Rise</th>
<th>Thick</th>
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<th>B</th>
<th>G</th>
<th>M</th>
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<td>8'-4&quot;</td>
<td>3'-3&quot;</td>
<td>4.603</td>
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Concrete Endwall for Single and Double Pipe Culverts

**General Notes:**
- Chamfer all corners 1". Use Class "B" concrete.
- Place 2 #6 "Y" bars in the top of all endwall for pipe culverts 42" and over with a minimum of 3" cover and a length of 6" less than endwall length.
- Construct bottom slab with forms.
- When the contractor elects to use a construction joint at the bottom of the pipe, place bar "X" dowels in the base as shown on plans. Space bars approximately on 12" centers unless otherwise directed by the engineer.
- When the contractor elects to use a construction joint at the bottom of the pipe and pour the base separately leave the pour rough.
- Do not interpret wall thickness (T) shown for the thickness acceptable, but is used in computing endwall quantities.

**Dimensions and Concrete Quantities**

<table>
<thead>
<tr>
<th>Loc.</th>
<th>Pipe</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
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<tr>
<td>BARS</td>
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<td>45°</td>
<td>52°</td>
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<tr>
<td>G - QTY.</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>M - QTY.</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G - QTY.</td>
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<td>4</td>
<td>4</td>
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<tr>
<td>TOT. LBS.</td>
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<td>19</td>
<td>19</td>
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**Dimensions and Concrete Quantities**

- Common dimensions using C.S. pipe arch
- Single pipe
- Double pipe

<table>
<thead>
<tr>
<th>Span</th>
<th>Rise</th>
<th>Thick</th>
<th>H</th>
<th>B</th>
<th>G</th>
<th>M</th>
<th>L</th>
<th>YD³</th>
<th>L</th>
<th>YD³</th>
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<tr>
<td>40°</td>
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<td>4.3&quot;</td>
<td>2.2&quot;</td>
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<td>15°-5&quot;</td>
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<td>24°-10&quot;</td>
<td>7.759</td>
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**GENERAL NOTES:**
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- Place 2 #6 "Y" bars in the top of all endwall for pipe culverts 42" and over with a minimum of 3" cover and a length of 6" less than endwall length.
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- Do not interpret wall thickness (T) shown for the thickness acceptable, but is used in computing endwall quantities.

**PLAN**

**ELEVATION**

**END ELEVATION**

**DIMENSIONS AND CONCRETE QUANTITIES**

<table>
<thead>
<tr>
<th>SPAN</th>
<th>RISE</th>
<th>THICK</th>
<th>H</th>
<th>B</th>
<th>G</th>
<th>N</th>
<th>TOTAL CONC.</th>
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<tr>
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**ENGLISH STANDARD DRAWING FOR CONCRETE "L" ENDWALL FOR SINGLE PIPE CULVERTS**

**COMMON DIMENSIONS**

<table>
<thead>
<tr>
<th>M</th>
<th>G</th>
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</tr>
</thead>
<tbody>
<tr>
<td>10&quot;</td>
<td>9&quot;</td>
<td>32&quot;</td>
</tr>
</tbody>
</table>

**OPTIONAL CONSTRUCTION JOINT**

- Approximate on 12" centers unless otherwise directed by the engineer.

**DOVELED BAR - "X"**

**FOOTING (IF CONST. JOINT IS USED)**

- Construct bottom slab with forms.
- Place 2 #6 "Y" bars in the top of all endwall for pipe culverts 42" and over with a minimum of 3" cover and a length of 6" less than endwall length.

**R.A. EIGHT, N.C.**

**DIVISION OF HIGHWAYS**

**DEPT. OF TRANSPORTATION**

**STATE OF NORTH CAROLINA**

**RALEIGH, N.C.**

**ENGLISH STANDARD DRAWING FOR CONCRETE "L" ENDWALL FOR SINGLE PIPE CULVERTS**

**PLAN**

**ELEVATION**

**END ELEVATION**

**DIMENSIONS AND CONCRETE QUANTITIES**

<table>
<thead>
<tr>
<th>SPAN</th>
<th>RISE</th>
<th>THICK</th>
<th>H</th>
<th>B</th>
<th>G</th>
<th>N</th>
<th>TOTAL CONC.</th>
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GENERAL NOTES:
CHAMFER ALL CORNERS 1".
USE CLASS "B" CONCRETE.

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<th>CONCRETE QUANTITIES</th>
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<tr>
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ENGLISH STANDARD DRAWING FOR USE CLASS "B" CONCRETE.
CHAMFER ALL CORNERS 1".

DEPT. OF TRANSPORTATION
Raleigh, N.C.

RALEIGH, N.C.
DIVISION OF HIGHWAYS

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

SHEET 1 OF 1
838.10
GENERAL NOTES:

- ALL MORTAR JOINTS ARE 1/2" = 1/2".
- BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.
- CONCAVE TOOL ALL EXPOSED JOINTS.
- DO NOT INTERPRET WALL THICKNESS (T) SHOWN AS THE THICKNESS ACCEPTABLE, BUT IS USED ONLY IN COMPUTING ENDWALL DIMENSIONS AND QUANTITIES.
- CONSTRUCT THE BASE WITH FORMS.
- USE CLASS 'B' CONCRETE.
- PAY FOR CONCRETE AS BRICK MASONRY.
- CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.
- JUMBO BRICK WILL BE PERMITTED.

THRU WALL SLOPE AS INDICATED ON PLANS

USING CONCRETE PIPE

<table>
<thead>
<tr>
<th>COMMON DIMS.</th>
<th>SINGLE PIPE</th>
<th>DOUBLE PIPE</th>
<th>COMMON DIMS.</th>
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<th>DOUBLE PIPE</th>
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<td>L</td>
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USING CORRUGATED METAL PIPE

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<td>3&quot;</td>
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</table>

NOTE: JUMBO BRICK WILL BE PERMITTED.

- CONSTRUCT THE BASE WITH FORMS.
- USE CLASS 'B' CONCRETE.
- PAY FOR CONCRETE AS BRICK MASONRY.
- CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.
- JUMBO BRICK WILL BE PERMITTED.

GENERAL NOTES:

- ALL MORTAR JOINTS ARE 1/2" = 1/2".
- BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.
- CONCAVE TOOL ALL EXPOSED JOINTS.
- DO NOT INTERPRET WALL THICKNESS (T) SHOWN AS THE THICKNESS ACCEPTABLE, BUT IS USED ONLY IN COMPUTING ENDWALL DIMENSIONS AND QUANTITIES.
- CONSTRUCT THE BASE WITH FORMS.
- USE CLASS 'B' CONCRETE.
- PAY FOR CONCRETE AS BRICK MASONRY.
- CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.
- JUMBO BRICK WILL BE PERMITTED.
GENERAL NOTES:
- All mortar joints are ½" ± ¼".
- Bond brickwork with full headers every three courses.
- Concave tool all exposed joints.
- Construct the base with forms.
- Use Class 'B' concrete.
- Pay for concrete as brick masonry.
- Concrete brick may be used in lieu of clay brick.
- Jumbo brick will be permitted.

DIMENSIONS AND BRICK QUANTITIES

COMMON DIMENSIONS

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<tr>
<th>SPAN</th>
<th>RISE GAGE</th>
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<th>B</th>
<th>G</th>
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<th>L</th>
<th>YD²</th>
<th>TD³</th>
<th>M</th>
<th>L</th>
<th>DOUBLE PIPE BRICK CONC.</th>
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<th>YD²</th>
<th>TD³</th>
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</table>

Typical Section Thru Wall and End Elevation

Jumbo Brick Will Be Permitted.

Concrete Brick May Be Used In Lieu Of Clay Brick.

Bond Brickwork With Full Headers Every Three Courses.

Concave Tool All Exposed Joints.

Construct The Base With Forms.

Use Class 'B' Concrete.

Pay For Concrete As Brick Masonry.

General Notes:
GENERAL NOTES:
- All mortar joints are $\frac{1}{4}''$ ± $\frac{1}{8}''$.
- Bond brickwork with full headers every three courses.
- Conceal tool all exposed joints.
- Do not interpret wall thickness (T) shown as the thickness acceptable, but is used only in computing endwall dimensions and quantities.
- Construct the base with forms.
- Use class 'B' concrete.
- Pay for concrete as brick masonry.
- Concrete brick may be used in lieu of clay brick.
- Jumbo brick will be permitted.

TYPICAL SECTION THRU WALL

*QUANTITIES BASED ON 2'-0''

- Jumbo brick will be permitted.
- Concrete brick may be used in lieu of clay brick.
- Pay for concrete as brick masonry.
- Use class 'B' concrete.
- Construct the base with forms.
- Do not interpret wall thickness (T) shown as the thickness acceptable, but is used only in computing endwall dimensions and quantities.

**DIMENSIONS AND CONCRETE QUANTITIES**

<table>
<thead>
<tr>
<th>Common Dimensions</th>
<th>Using R.C.P.</th>
<th>Common Dimensions</th>
<th>Using C.S.P.</th>
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<tbody>
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<td>B</td>
<td>G</td>
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<td>54''</td>
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</table>
GENERAL NOTES:
- All mortar joints are 1/2" ± 1/8".
- Bond brickwork with full headers every three courses.
- Concave tool all exposed joints.
- Construct the base with forms.
- Use Class 'B' concrete.
- Pay for concrete as brick masonry.
- Concrete brick may be used in lieu of clay brick.
- Jumbo brick will be permitted.

**DIMENSIONS AND QUANTITIES**

<table>
<thead>
<tr>
<th>SPAN</th>
<th>RISE</th>
<th>COMMON DIMENSIONS</th>
<th>QUANTITIES</th>
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<td>H 4'-10&quot; G 8'-10&quot;</td>
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* Quantities based of 2'-0"
GENERAL NOTES:
- ALL MORTAR JOINTS ARE 3/8" ± 1/4".
- BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.
- CONCAVE TOOL ALL EXPOSED JOINTS.
- CONSTRUCT THE BASE WITH FORMS.
- USE CLASS 'B' CONCRETE.
- PAY FOR CONCRETE AS BRICK MASONRY.
- CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.
- JUMBO BRICK WILL BE PERMITTED.

SLOPE AS INDICATED ON PLANS

COMMON DIMENSIONS

<table>
<thead>
<tr>
<th>SPAN</th>
<th>RISE</th>
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<th>H</th>
<th>B</th>
<th>G</th>
<th>L</th>
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<th>CONC. YD.</th>
<th>L</th>
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GENERAL NOTES:
- All mortar joints are ½” ± ½.”
- Bond brickwork with full headers every three courses.
- Concave tool all exposed joints.
- Construct the base with forms.
- Use Class ‘B’ concrete.
- Pay for concrete as brick masonry.
- Concrete brick may be used in lieu of clay brick.
- Jumbo brick will be permitted.

VARIOUS TO SUIT CONDITION

11½”:1 SLOPE

SLOPE AS INDICATED ON PLANS

1-12

TYPICAL SECTION THRU WALL

DIMENSIONS AND QUANTITIES

<table>
<thead>
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<th>COMMON DIMENSIONS</th>
<th>QUANTITIES</th>
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<tr>
<td>SPAN</td>
<td>RISE</td>
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<tr>
<td>40”</td>
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<td>46”</td>
<td>36”</td>
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<td>53”</td>
<td>41”</td>
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<tr>
<td>60”</td>
<td>46”</td>
</tr>
<tr>
<td>66”</td>
<td>51”</td>
</tr>
</tbody>
</table>

* QUANTITIES BASED OF 2’-0”
GENERAL NOTES:
- All mortar joints are \( \frac{1}{2}'' \) ± \( \frac{1}{4}'' \).
- Bond brickwork with full headers every three courses.
- Concave tool all exposed joints.
- Concrete brick may be used in lieu of clay brick.
- Jumbo brick will be permitted.

<table>
<thead>
<tr>
<th>D</th>
<th>H</th>
<th>REINF. CONC.</th>
<th>BIT. CORR. PLASTIC OR METAL</th>
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<tr>
<td></td>
<td></td>
<td>YD³</td>
<td>YD³</td>
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<td>4''</td>
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<td>0.141</td>
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<td>6''</td>
<td>2'-0&quot;</td>
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<td>8''</td>
<td>2'-3&quot;</td>
<td>0.186</td>
<td>0.187</td>
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</tbody>
</table>

- Jumbo brick will be permitted.
- Concrete brick may be used in lieu of clay brick.
- Bond brickwork with full headers every three courses.
- Concave tool all exposed joints.
- All mortar joints are \( \frac{1}{2}'' \) ± \( \frac{1}{4}'' \).

1'-4" 8" 6" 12" H D

1'-4" 8" 6" 12" H D

2'-6"

2'-3" W/8" PIPE

1'-9" W/4" PIPE

2'-0" W/6" PIPE

1'-4"

ELEVATION

END ELEVATION

TYPICAL SECTION THRU WALL
BILL OF MATERIAL FOR ENDWALL

**REINFORCED CONCRETE ENDWALL**

**PLAN**

- "H" bars
- "N" bars
- "Z" bars

**ELEVATION**

- "H", "N", & "Z" bar dimensions are out to out.

**SECTION - BB**

- "H" bars
- "N" bars
- "Z" bars

**SECTION - AA**

- "H" bars
- "N" bars
- "Z" bars

**BILL OF MATERIAL FOR ENDWALL**

<table>
<thead>
<tr>
<th>REINF. STEEL</th>
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<tbody>
<tr>
<td>BAR SIZE</td>
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</tr>
<tr>
<td>B1 #4</td>
<td>5'-6&quot;</td>
</tr>
<tr>
<td>B2 #4</td>
<td>4'-6&quot;</td>
</tr>
<tr>
<td>G1 #7</td>
<td>8'-2&quot;</td>
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<tr>
<td>H1 #4</td>
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<tr>
<td>H2 #4</td>
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<tr>
<td>N1 #4</td>
<td>7'-11&quot;</td>
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<td>N2 #4</td>
<td>6'-7&quot;</td>
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<td>T1 #4</td>
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<tr>
<td>T5 #4</td>
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<tr>
<td>V1 #4</td>
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**REINF. STEEL LBS.**

- ENGLISH STANDARD DRAWING FOR SINGLE 54" PIPE - 90° SKEW

**SEE STD. DWG. 838.45 FOR GENERAL NOTES.**
BILL OF MATERIAL FOR ENDWALL

REINFORCED CONCRETE ENDWALL

SECTION - AA

TAPER DETAIL

SECTION - BB

ELEVATION

PLAN

WING ELEVATION

"N" BARS"Z" BARS "H" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL FOR ENDWALL

<table>
<thead>
<tr>
<th>REINF. STEEL</th>
<th>1 PIPE</th>
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</thead>
<tbody>
<tr>
<td>BAR SIZE</td>
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<tr>
<td>B2</td>
<td>#4</td>
</tr>
<tr>
<td>G1</td>
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</table>

REINF. STEEL LBS. 354

CON./C.S. CU. YDS 5.2

SEE STD. DWG. 838.45 FOR GENERAL NOTES.
BILL OF MATERIAL FOR ENDWALL

ELEVATION

PLAN

SECTION - BB

SECTION - AA

REINF. STEEL
BARSIZE LENGTH NO. WEIGHT

CON./R.C. CU. YDS

BILL OF MATERIAL FOR ENDWALL

REINF. STEEL LBS.

10 PIPES 3 PIPES
BAR SIZE LENGTH NO. WEIGHT NO. WEIGHT

1 PIPES 2 PIPES
BAR SIZE LENGTH NO. WEIGHT

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.
BILL OF MATERIAL FOR ENDWALL

838.28

SECTION - BB

REINFORCED CONCRETE ENDWALL

838.28

SECTION - AA

REINFORCED STEEL

BAR SIZE LENGTH NO. WT.

B1 #4 5'-6" 8 29 12 44
B2 #4 4'-6" 4 12 4 12
B3 #4 6'-6" 4 17 8 35
G2 #7 17'-2" 2 70 - -
G3 #7 17'-8" - - 2 105
H1 #6 9" 10 40 10 40
H2 #4 4'-9" 4 11 4 11
N1 #4 3'-11" 14 57 18 74
N2 #4 3'-5" 6 14 6 14
T1 #4 21'-2" 6 85 - -
T2 #4 29'-8" 6 119
T4 #4 5'-6" 6 22 6 22
T5 #4 2'-6" 70 117 104 174
V1 #4 8'-3" 12 50 18 75
V2 #4 5'-1" 6 20 6 20
V3 #4 3'-11" 6 16 6 16
V4 #4 2'-9" 6 11 6 11
Z1 #5 4'-4" 4 18 4 18
Z2 #4 3'-10" 4 10 4 10
Z3 #4 3'-2" 4 8 4 8

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.
BILL OF MATERIAL FOR ENDSWALL

**SECTION - AA**

**SECTION - BB**

**ELEVATION**

**WING ELEVATION**

**PLAN**

**TABLE**

<table>
<thead>
<tr>
<th>BARSIZE</th>
<th>LENGTH</th>
<th>NO.</th>
<th>WEIGHT</th>
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<tr>
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<td>37</td>
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**REINF. STEEL LBS.**

CON./R.C. CU. YDS

**REINF. STEEL**

**PIPING**

**HDG.**

**DRAWING**

SEE STD. DWG. 838.45 FOR GENERAL NOTES.
BILL OF MATERIAL FOR ENDMALL

<table>
<thead>
<tr>
<th>REINF. STEEL LBS.</th>
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<tbody>
<tr>
<td>H1 7&quot;</td>
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<td>H2 6&quot;</td>
<td>2'-6&quot;</td>
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<tr>
<td>H3 4&quot;</td>
<td>1'-6&quot;</td>
</tr>
<tr>
<td>Z1 6&quot;</td>
<td>1'-6&quot;</td>
</tr>
<tr>
<td>Z2 5&quot;</td>
<td>2'-6&quot;</td>
</tr>
<tr>
<td>Z3 3&quot;</td>
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SEE STAND. # 838.45 FOR GENERAL NOTES.

FOR DOUBLE & TRIPLE 66" PIPE - 90° SKEW
BILL OF MATERIAL FOR ENDWALL

REINFORCED CONCRETE EN DWALL

838.34

BILL OF MATERIAL FOR EN DWALL

REINF. STEEL 12 PIPES 3 PIPES

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</table>

"H", "N", & "Z" Bar Dimensions are Out to Out.
BILL OF MATERIAL FOR ENDMALL

PLAN

"H" BARS
"N" BARS
"Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.

ELEVATION

SECTION - BB

SECTION - AA

TAPER DETAIL

WING ELEVATION

PLAN

"H" BARS
"N" BARS
"Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL FOR ENDMALL

REINF. STEEL 1 PIPE

<table>
<thead>
<tr>
<th>BAR SIZE</th>
<th>LENGTH</th>
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<th>WT</th>
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<tbody>
<tr>
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<tr>
<td>G1</td>
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SHOWN PIPE NOT
SEE STD. # 838.45 FOR GENERAL NOTES.

REINF. STEEL LBS.
CON./C.S. CU. YDS

555
7.5
**Bill of Material for Endwall**

<table>
<thead>
<tr>
<th>Type</th>
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<tr>
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</tbody>
</table>

*Diameter of steel:*

- 8" diameter:
  - Z1
  - Z2
  - T1
  - T2
  - T3
  - T4
  - T5

- 6" diameter:
  - Z3
  - N1
  - N2
  - N3

*Note:* Dimensions are out to out.
GENERAL NOTES:

USE CLASS "A" CONCRETE.

CHAMFER ALL EXPOSED CORNERS 1".

ALL DIMENSIONS RELATIVE TO PLACEMENT OF REINFORCING STEEL ARE TO CENTERS OF BARS.

PLACE A STONE DRAIN CONSISTING OF ONE (1) CUBIC FOOT OF NUMBER 78M STONE CONTAINED IN A POROUS FABRIC AT EACH WEEP HOLE. PLACE SUBDRAIN FINE AGGREGATE BENEATH, AROUND AND OVER THE STONE DRAIN SO THE STONE DRAIN IS COMPLETELY COVERED BY A LAYER OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT THICK. WHERE THERE IS MORE THAN ONE WEEP HOLE IN A WING WALL, PLACE A HORIZONTAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION TO CONNECT ALL STONE DRAINS. PLACE A VERTICAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION AT EACH WEEP HOLE TO AN ELEVATION OF TWO (2) FEET BELOW THE SURFACE OF THE EMBANKMENT.
BILL OF MATERIAL FOR ENDWALL

"N" BARS "Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL FOR ENDWALL

REINF. STEEL 1 PIPE

<table>
<thead>
<tr>
<th>BAR SIZE</th>
<th>LENGTH</th>
<th>NO.</th>
<th>WEIGHT</th>
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<tbody>
<tr>
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</table>

REINF. STEEL LBS. 322

*PAY FOR CONCRETE AS BRICK MASONRY

SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.
**BILL OF MATERIAL FOR ENDWALL**

**REINFORCED BRICK ENDWALL**

- "N" BARS
- "Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

### PLAN

- 12'-0" THREE PIPES
- 8'-2" TWO PIPES

### SECTION A-A

- 7'-0"
- 3'-0"
- 10" recess
- 3'-0"

### SECTION B-B

- 10" recess
- 6" T-BARS

### WING ELEVATION

- 3 SPA. @ 12" 2-N1, 2-N2, 2-N3

---

**REINFORCED STEEL BILL OF MATERIAL FOR ENDWALL**

<table>
<thead>
<tr>
<th>REINFORCED STEEL</th>
<th>2 PIPES</th>
<th>3 PIPES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAR</td>
<td>SIZE</td>
<td>LENGTH</td>
</tr>
<tr>
<td>B1</td>
<td>#5</td>
<td>5'-3&quot;</td>
</tr>
<tr>
<td>B2</td>
<td>#5</td>
<td>3'-9&quot;</td>
</tr>
<tr>
<td>B3</td>
<td>#5</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>G2</td>
<td>#7</td>
<td>15'-4&quot;</td>
</tr>
<tr>
<td>G3</td>
<td>#7</td>
<td>23'-0&quot;</td>
</tr>
<tr>
<td>H1</td>
<td>#4</td>
<td>5'-3&quot;</td>
</tr>
<tr>
<td>H2</td>
<td>#4</td>
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<td>6'-9&quot;</td>
</tr>
<tr>
<td>N2</td>
<td>#5</td>
<td>5'-7&quot;</td>
</tr>
<tr>
<td>N3</td>
<td>#4</td>
<td>4'-4&quot;</td>
</tr>
<tr>
<td>N4</td>
<td>#4</td>
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<td>#4</td>
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<td>T3</td>
<td>#4</td>
<td>27'-4&quot;</td>
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<tr>
<td>T4</td>
<td>#4</td>
<td>4'-11&quot;</td>
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<tr>
<td>T5</td>
<td>#4</td>
<td>2'-6&quot;</td>
</tr>
<tr>
<td>Z1</td>
<td>#5</td>
<td>4'-4&quot;</td>
</tr>
<tr>
<td>Z2</td>
<td>#5</td>
<td>3'-10&quot;</td>
</tr>
<tr>
<td>Z3</td>
<td>#4</td>
<td>3'-1&quot;</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>486</strong></td>
<td><strong>646</strong></td>
</tr>
</tbody>
</table>

*Pay for concrete as brick masonry.*

---

**FLOOR LINE**

- 6" above top of footing

---

**FLOW LINE**

- 1'-6"

---

**10'-0" TOP & BOTTOM**

- 5 SPA. @ 12" 2-N1, 2-N2, 2-N3

---

**RECESSION**

- 1'-6"
- 3'-0"

---

SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.
BILL OF MATERIAL FOR ENDEWALL

"N" BARS "Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

*PAY FOR CONCRETE AS BRICK MASONRY

BILL OF MATERIAL FOR ENDEWALL MASONRY

<table>
<thead>
<tr>
<th>BAR SIZE</th>
<th>LENGTH</th>
<th>NO.</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>#5</td>
<td>5'-3&quot;</td>
<td>2</td>
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<tr>
<td>B2</td>
<td>#5</td>
<td>3'-9&quot;</td>
<td>2</td>
</tr>
<tr>
<td>G1</td>
<td>#7</td>
<td>8'-0&quot;</td>
<td>2</td>
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<tr>
<td>H1</td>
<td>#4</td>
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<td>6</td>
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<tr>
<td>H2</td>
<td>#4</td>
<td>4'-0&quot;</td>
<td>2</td>
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<tr>
<td>H3</td>
<td>#4</td>
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<td>T1</td>
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<td>T4</td>
<td>#4</td>
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<td>6</td>
</tr>
<tr>
<td>T5</td>
<td>#4</td>
<td>2'-6&quot;</td>
<td>36</td>
</tr>
<tr>
<td>V1</td>
<td>#4</td>
<td>6'-4&quot;</td>
<td>6</td>
</tr>
<tr>
<td>V2</td>
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<td>4</td>
</tr>
<tr>
<td>Z3</td>
<td>#5</td>
<td>3'-1&quot;</td>
<td>4</td>
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</tbody>
</table>

TOTAL REINF. STEEL: 377 LBS.

SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.
BILL OF MATERIAL FOR ENDWALL

REINFORCED BRICK ENDWALL

838.58

ELEVATION

"N" BARS "Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

SECTION A-A

PLAN

SECTION B-B

FLOW LINE

6" ABOVE TOP OF FOOTING

TOP & BOTTOM

REINF. STEEL LBS. 567 765

"CL. "A" CONC. FOOT. C.Y. 4.4 5.6
BR. MASONRY/C.S. C.Y. 4.0 5.3
BR. MASONRY/R.C. C.Y. 3.5 4.5

SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.
**BILL OF MATERIAL FOR ENDWALL**

**REINFORCED BRICK ENDWALL**

**“N” BARS & “Z” BARS**

"N" & "Z" bar dimensions are out to out.

### REINF. STEEL

<table>
<thead>
<tr>
<th>BAR SIZE</th>
<th>LENGTH</th>
<th>NO.</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 #5</td>
<td>5'-3&quot;</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>B2 #5</td>
<td>4'-0&quot;</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>G1 #7</td>
<td>8'-8&quot;</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>H1 #4</td>
<td>6'-3&quot;</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>H2 #4</td>
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<td>7</td>
</tr>
<tr>
<td>H3 #4</td>
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</tr>
<tr>
<td>N1 #5</td>
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<td>14</td>
<td>47</td>
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<td>T1 #4</td>
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<td>55</td>
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<td>T4 #4</td>
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<td>27</td>
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<tr>
<td>V2 #4</td>
<td>6'-2&quot;</td>
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<td>8</td>
</tr>
<tr>
<td>V3 #4</td>
<td>5'-3&quot;</td>
<td>4</td>
<td>14</td>
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<tr>
<td>V4 #4</td>
<td>4'-2&quot;</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>V5 #4</td>
<td>3'-2&quot;</td>
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<td>8</td>
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<tr>
<td>Z1 #6</td>
<td>4'-9&quot;</td>
<td>6</td>
<td>43</td>
</tr>
<tr>
<td>Z2 #6</td>
<td>4'-2&quot;</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>Z3 #4</td>
<td>3'-6&quot;</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Z4 #4</td>
<td>3'-3&quot;</td>
<td>2</td>
<td>4</td>
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</table>

**REINF. STEEL LBS.**

<table>
<thead>
<tr>
<th>#4 CL. &quot;A&quot; CONC. FOOT</th>
<th>3.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR. MASONRY/G.C. C.Y.</td>
<td>3.2</td>
</tr>
<tr>
<td>BR. MASONRY/R.C. C.Y.</td>
<td>2.8</td>
</tr>
</tbody>
</table>

*PAY FOR CONCRETE AS BRICK MASONRY*

SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.
BILL OF MATERIAL FOR ENDWALL

"N" BARS  "Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

*PAY FOR CONCRETE AS BRICK MASONRY

REINF. STEEL LBS.   728 952

*CL. "A" CONC. FOOT. C.Y.  5.3  6.8
BR. MASONRY/C.S. C.Y.  5.3  7.0
BR. MASONRY/R.C. C.Y.  4.6  5.9

SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.
NOTES FOR REINFORCED BRICK ENDWALL

GENERAL NOTES:

SELECT BRICK FROM SAMPLES SUBMITTED TO THE ENGINEER PRIOR TO BEGINNING CONSTRUCTION. USE BRICK OF SIZE 2 1/4" x 3 5/8" x 7 5/8". CONTRACTOR MAY SUBSTITUTE A LARGER BRICK BUT NOT EXCEEDING 3 5/8" x 3 5/8" x 11 5/8". IF A LARGER SIZE IS USED, KEEP BRICK FALL WITHIN NEAT LINES SHOWN ON PLANS. USE ONLY ONE SIZE BRICK IN ANY ONE STRUCTURE. USE CLASS "B" OR BETTER CONCRETE FOR GROUT. GROUT THE CAVITY AREA AT INTERVALS FROM ONE TO NOT MORE THAN FOUR BRICK COURSES AT A TIME. STOP EACH GROUT POUR AT LEAST 1" BELOW TOP OF BRICK COURSE AND ROD TO INSURE FILLING OF ALL VOIDS.

DO NOT PERMIT HEADERS TO CROSS THE GROUTED AREA. PLACE HORIZONTAL REINFORCEMENT LOOSE IN THE GROUT SPACE AS WORK PROGRESSES. PLACE VERTICAL REINFORCEMENT IN THE CENTER OF THE GROUT SPACE. PERMANENT TIES ARE NOT NECESSARY. USE TEMPORARY TIES TO HOLD VERTICAL BARS IN PLACE. CONSTRUCT NEITHER SIDE OF THE WALL ABOVE THE OTHER SIDE TO A HEIGHT EXCEEDING SIX (6) COURSES. CONCAVE ALL EXPOSED JOINTS.

USE CLASS 'A' CONCRETE IN THE FOOTINGS. CONSTRUCT ALL MORTAR JOINTS 3/8" ± 1/8".

PLACE A STONE DRAIN CONSISTING OF ONE (1) CUBIC FOOT OF NUMBER 78M STONEcontained in a porous fabric at each weep hole. Place subdrain fine aggregate beneath, around and over the stone drain so the stone drain is completely covered by a layer of subdrain fine aggregate at least one (1) foot thick. WHERE MORE THAN ONE WEEP HOLE IN A Wing WALL EXISTS, PLACE A HORIZONTAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION TO CONNECT ALL STONE DRAINS. PLACE A VERTICAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION AT EACH WEEPホール TO AN ELEVATION OF TWO (2) FEET BELOW THE SURFACE OF THE EMBANKMENT.
ENGLISH STANDARD DRAWING FOR
PRECAST CONCRETE ENDWALL

ELEVATION

SIDE

PLAN

ENDWALL DIMENSIONS

<table>
<thead>
<tr>
<th>PIPE DIA.</th>
<th>BAR SIZE</th>
<th>H1 (FT.)</th>
<th>H2 (FT.)</th>
<th>W1</th>
<th>W2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>#5 @ 8&quot;</td>
<td>1.25/2.00</td>
<td>2.00/3.75</td>
<td>1.25/1.75</td>
<td>3.00/3.75</td>
</tr>
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<td>1.25</td>
<td>#5 @ 8&quot;</td>
<td>1.25/2.00</td>
<td>3.00/3.75</td>
<td>1.25/2.00</td>
<td>3.60/3.75</td>
</tr>
<tr>
<td>1.50</td>
<td>#5 @ 8&quot;</td>
<td>1.25/2.00</td>
<td>4.00/4.75</td>
<td>1.50/2.50</td>
<td>3.60/3.75</td>
</tr>
<tr>
<td>2.0</td>
<td>#5 @ 8&quot;</td>
<td>1.50/2.50</td>
<td>4.00/4.75</td>
<td>1.75/2.50</td>
<td>4.00/4.25</td>
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<tr>
<td>2.5</td>
<td>#6 @ 8&quot;</td>
<td>2.50/3.50</td>
<td>4.00/6.00</td>
<td>2.00/3.00</td>
<td>4.50/5.50</td>
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<tr>
<td>3.0</td>
<td>#6 @ 8&quot;</td>
<td>3.00/3.50</td>
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<td>2.75/3.50</td>
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<td>6.00/6.75</td>
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<td>6.50/8.50</td>
<td>3.25/4.00</td>
<td>7.00/9.25</td>
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<td>5.0</td>
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<td>4.50/5.00</td>
<td>7.00/8.50</td>
<td>3.25/4.00</td>
<td>7.25/9.25</td>
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<td>4.50/5.00</td>
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<td>3.25/4.00</td>
<td>7.25/9.25</td>
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<td>#6 @ 8&quot;</td>
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<td>7.50/8.50</td>
<td>3.25/4.00</td>
<td>7.75/9.25</td>
</tr>
</tbody>
</table>

* INSTALL PRECAST ENDWALLS WITH WINGS AND PAY FOR IN ACCORDANCE WITH SPECIFICATION SECTION 838.
* USE 4000 PSI CONCRETE.
* PROVIDE ALL REINFORCING STEEL WHICH MEETS ASTM A615 FOR GRADE 60 AND WELDED WIRE FABRIC CONFORMING TO ASTM A185 WITH 2" MIN. CLEARANCE.
* PLACE LIFT HOLES OR PINS IN ACCORDANCE WITH OSHA STANDARD 1926.704.
* PIPE TO BE GROUTED INTO HEADWALL AT JOB SITE BY CONTRACTOR.
* ALL ELEMENTS PRECAST TO MEET ASTM C913.
* WELDED WIRE FABRIC MAY BE SUBSTITUTED FOR REBAR AS LONG AS THE SAME AREA OF STEEL IS PROVIDED.
* CHAMFER ALL CORNERS 1" OR HAVE A RADIUS OF 1".

NOTE: THE MINIMUM BAR SIZE SHALL BE #5 BARS AT 8" O.C. THE CONTRACTOR WILL HAVE THE OPTION TO INCREASE THIS BAR SIZE AS NEEDED.

&

FOR SINGLE 12" THRU 72" PIPE - 90° SKEW

NOTE: CHAMFER ALL CORNERS 1" OR HAVE A RADIUS OF 1".

&

REFER TO CHART FOR BAR SIZE

FOR SINGLE 12" THRU 72" PIPE - 90° SKEW

FOR GRADE 60 AND WELDED WIRE FABRIC CONFORMING TO ASTM A185 WITH 2" MIN. CLEARANCE.

FOR IN ACCORDANCE WITH SPECIFICATION SECTION 838.

INSTALL PRECAST ENDWALLS WITH WINGS AND PAY FOR IN ACCORDANCE WITH SPECIFICATION SECTION 838.

USE 4000 PSI CONCRETE.

PROVIDE ALL REINFORCING STEEL WHICH MEETS ASTM A615 FOR GRADE 60 AND WELDED WIRE FABRIC CONFORMING TO ASTM A185 WITH 2" MIN. CLEARANCE.

PLACE LIFT HOLES OR PINS IN ACCORDANCE WITH OSHA STANDARD 1926.704.

PIPE TO BE GROUTED INTO HEADWALL AT JOB SITE BY CONTRACTOR.

ALL ELEMENTS PRECAST TO MEET ASTM C913.

WELDED WIRE FABRIC MAY BE SUBSTITUTED FOR REBAR AS LONG AS THE SAME AREA OF STEEL IS PROVIDED.

CHAMFER ALL CORNERS 1" OR HAVE A RADIUS OF 1".

NOTE: THE MINIMUM BAR SIZE SHALL BE #5 BARS AT 8" O.C. THE CONTRACTOR WILL HAVE THE OPTION TO INCREASE THIS BAR SIZE AS NEEDED.

ENDWALL DIMENSIONS

<table>
<thead>
<tr>
<th>FT.</th>
<th>MINIMUM</th>
<th>MIN. / MAX.</th>
<th>MIN. / MAX.</th>
<th>MIN. / MAX.</th>
<th>MIN. / MAX.</th>
<th>MIN. / MAX.</th>
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<tbody>
<tr>
<td>D</td>
<td>W1</td>
<td>W2</td>
<td>W1</td>
<td>W2</td>
<td>W1</td>
<td>W2</td>
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<tr>
<td>1.0</td>
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<td></td>
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<td>6.50/6.75</td>
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<td>1.50</td>
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<td>2.0</td>
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<td>7.00/6.25</td>
</tr>
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<td>2.5</td>
<td>#6 @ 8&quot;</td>
<td></td>
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<td></td>
<td></td>
<td>10.00/11.50</td>
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<td></td>
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</tbody>
</table>

* CHAMFER ALL CORNERS 1" OR HAVE A RADIUS OF 1".
* WELDED WIRE FABRIC MAY BE SUBSTITUTED FOR REBAR AS LONG AS THE SAME AREA OF STEEL IS PROVIDED.

NOTE: THE MINIMUM BAR SIZE SHALL BE #5 BARS AT 8" O.C. THE CONTRACTOR WILL HAVE THE OPTION TO INCREASE THIS BAR SIZE AS NEEDED.

FOR GRADE 60 AND WELDED WIRE FABRIC CONFORMING TO ASTM A185 WITH 2" MIN. CLEARANCE.

PLACE LIFT HOLES OR PINS IN ACCORDANCE WITH OSHA STANDARD 1926.704.

PIPE TO BE GROUTED INTO HEADWALL AT JOB SITE BY CONTRACTOR.

ALL ELEMENTS PRECAST TO MEET ASTM C913.

WELDED WIRE FABRIC MAY BE SUBSTITUTED FOR REBAR AS LONG AS THE SAME AREA OF STEEL IS PROVIDED.

CHAMFER ALL CORNERS 1" OR HAVE A RADIUS OF 1".

NOTE: THE MINIMUM BAR SIZE SHALL BE #5 BARS AT 8" O.C. THE CONTRACTOR WILL HAVE THE OPTION TO INCREASE THIS BAR SIZE AS NEEDED.
**PART SECTION**

- **6" WALL**
- **Part Section**
- **6" WALL WITH 4" LIP**
- **Part Section**
- **8" WALL**
- **Part Section**
- **8" WALL WITH 4" LIP**

**TABLES OF QUANTITIES FOR PIPE SET IN PAD**

<table>
<thead>
<tr>
<th>PIPE</th>
<th>&quot;W&quot;</th>
<th>&quot;W1&quot;</th>
<th>&quot;T&quot;</th>
<th>C.Y. QUANTITIES WHEN L IS</th>
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</tbody>
</table>

**PART SECTION**

**OF END ELEVATION**

**GENERAL NOTES:**

- Use this standard with all drainage structures using reinforced concrete pipe set in base slab.

**ENGLISH STANDARD DRAWING FOR CONCRETE BASE PAD FOR DRAINAGE STRUCTURES**

**RAL EIGH, N.C.**

**DIVISION OF HIGHWAYS**

**DEPT. OF TRANSPORTATION**

**STATE OF NORTH CAROLINA**

**840.00**

**SHEET 1 OF 1**

**840.00**

**SHEET 1 OF 1**
WHERE 30" TO 36" PIPE IS USED

WHERE 42" TO 54" PIPE IS USED

PLAN

SECTION X-X

SECTION Y-Y

SECTION J-J

SECTION M-M

NOTES:

MORTAR JOINTS 1/2" +/- 1/8" THICK.

USE CLASS "B" CONCRETE THROUGHOUT.

DEDUCT FOR PIPE(S) FROM TOTAL CU. YDS. OF BRICK MASONRY.

USE #4 BAR DOWELS AT 12" CENTERS.

PROVIDE ALL CATCH BASINS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.06.

USE TYPE "E", "F" AND "G" GRATES UNLESS OTHERWISE INDICATED.

USE BRICK OR CONCRETE BLOCK WHICH COMPLIES WITH THE REQUIREMENTS OF SECTION 840 OF THE STANDARD SPECIFICATIONS.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

FOR 8'-0" IN HEIGHT OR LESS, USE 8" WALL. OVER 8'-0" IN HEIGHT, USE 12" WALL TO 6'-0" FROM TOP OF WALL AND 8" WALL FOR THE REMAINING 6'-0". QUANTITIES TO BE ADJUSTED ACCORDINGLY.

CONSTRUCT WITH PIPE CROWNS MATCHING.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

WHERE 30" TO 36" PIPE IS USED

WHERE 42" TO 54" PIPE IS USED

DETAIL SHOWING METHOD OF RISER CONSTRUCTION

PLAN

TOP ELEVATION

8" MIN.

TOP ELEVATION

8" MIN.

TOP ELEVATION

8" MIN.

TOP ELEVATION

8" MIN.
CONCRETE CATCH BASIN

PLAN

SECTION X-X

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL CATCH BASINS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.06.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

USE TYPE "E", "F" AND "G" GRATES UNLESS OTHERWISE INDICATED.

FOR 8'-0" IN HEIGHT OR LESS USE 6" WALLS AND BOTTOM SLAB. OVER 8'-0" TO 16'-0" IN HEIGHT USE 8" WALLS AND BOTTOM SLAB. ADJUST QUANTITIES ACCORDINGLY.

CONSTRUCT WITH PIPE CROWNS MATCHING.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL CATCH BASINS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.06.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

USE TYPE "E", "F" AND "G" GRATES UNLESS OTHERWISE INDICATED.

FOR 8'-0" IN HEIGHT OR LESS USE 6" WALLS AND BOTTOM SLAB. OVER 8'-0" TO 16'-0" IN HEIGHT USE 8" WALLS AND BOTTOM SLAB. ADJUST QUANTITIES ACCORDINGLY.

CONSTRUCT WITH PIPE CROWNS MATCHING.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.
### Minimum Dimensions and Quantities for Concrete Catch Basin (Based on Min. Height, H, with No Riser)

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<td>0.145</td>
<td>0.18</td>
<td>0.145</td>
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</table>

* Riser has .228 cubic yards of concrete per foot height
NOTE: USE TYPE "E", "F" AND "G" GRATE UNLESS OTHERWISE NOTED.

ALIGN FRAME WITH INSIDE EDGE OF WALL TO ALLOW FOR VERTICAL ADJUSTMENT.

FRAME, GRATE, & HOOD ASS'Y

FOR USE ON STANDARD CATCH BASIN

FRAME PLAN

SECTION - KK

SECTION - AA

SECTION - LL

SECTION - LL

SECTION - MM

SECTION - NN

SECTION - PP

SECTION - RR

HOOD ELEVATION

FOR USE ON STANDARD CATCH BASIN

RAL LEIGH, N.C.

DIVISION OF HIGHWAYS

DEPT. OF TRANSPORTATION

STATE OF NORTH CAROLINA

ENGLISH STANDARD DRAWING FOR

WALL SECTION

1'-1 1/2"

FRAME, GRATES, AND HOOD
DETAIL SHOWING TYPES OF GRATES
USE ACCORDING TO WATER FLOW.

SECTION A-A

SECTION B-B

SECTION A-A

FRAME, GRATES, AND HOOD
FOR USE ON STANDARD CATCH BASIN

RAISED FLOW ARROW
\( \frac{3}{8} \text{"}\) HIGH

RAISED FLOW ARROW
\( \frac{3}{8} \text{"}\) HIGH

FOR USE ON STANDARD CATCH BASIN
**Concrete Open Throat Catch Basin**

Top Slab

**SHOWING DETAILS AT OPENING**

Concrete Open Throat Catch Basin

**PLAN**

**SECTION X-X**

**SECTION Y-Y**

Notes:
- Use Class "B" concrete throughout.
- Provide all catch basins over 3'-6" in depth with steps 12" on center.
- Use steps which comply with STD. Drawing 840.06.
- Optional construction - monolithic pour, 2" keyway, or #4 bar domels at 12" centers as directed by the Engineer.
- Use forms for the construction of the bottom slab.
- If reinforced concrete pipe is set in bottom slab of box, add to slab as shown on STD. No. 840.00.
- For 6"-0" in height or less use 6" walls and bottom slab. Over 6"-0" to 16"-0" in height use 8" walls and bottom slab. Adjust quantities accordingly.
- Construct with pipe crowns matching.
- Install 2" weepholes as directed by the Engineer.
- Install stone drains, of a minimum of 1 cubic foot of No. 78M stone in a porous fabric bag or wrap, at each weep hole or as directed by the Engineer.
- Chamfer all exposed corners 1/2".
- Drawing not to scale.
- Increase the size of the 6" opening to 8" max., as directed by the Engineer by adding 2" to the wall height above the top elevation. Adjust quantities accordingly.
- Use class "B" concrete throughout.
- Use forms for the construction of the bottom slab.
- Construct with pipe crowns matching.
- Quantities accordingly.
- Install 2" weepholes as directed by the Engineer.
- Chamfer all exposed corners 1/2".
- Drawing not to scale.
- Increase the size of the 6" opening to 8" max., as directed by the Engineer by adding 2" to the wall height above the top elevation. Adjust quantities accordingly.
- Notes: Use class "B" concrete throughout.
- Provide all catch basins over 3'-6" in depth with steps 12" on center. Use steps which comply with STD. Drawing 840.06.
- Optional construction - monolithic pour, 2" keyway, or #4 bar domels at 12" centers as directed by the Engineer.
- Use forms for the construction of the bottom slab.
- If reinforced concrete pipe is set in bottom slab of box, add to slab as shown on STD. No. 840.00.
- For 6"-0" in height or less use 6" walls and bottom slab. Over 6"-0" to 16"-0" in height use 8" walls and bottom slab. Adjust quantities accordingly.
- Construct with pipe crowns matching.
- Install 2" weepholes as directed by the Engineer.
- Install stone drains, of a minimum of 1 cubic foot of No. 78M stone in a porous fabric bag or wrap, at each weep hole or as directed by the Engineer.
- Chamfer all exposed corners 1/2".
- Drawing not to scale.
- Increase the size of the 6" opening to 8" max., as directed by the Engineer by adding 2" to the wall height above the top elevation. Adjust quantities accordingly.
- Use class "B" concrete throughout.
- Use forms for the construction of the bottom slab.
- Construct with pipe crowns matching.
- Quantities accordingly.
- Install 2" weepholes as directed by the Engineer.
- Chamfer all exposed corners 1/2".
- Drawing not to scale.
- Increase the size of the 6" opening to 8" max., as directed by the Engineer by adding 2" to the wall height above the top elevation. Adjust quantities accordingly.

### Dim's of Box & Pipe

<table>
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<tr>
<th>Pipe</th>
<th>span</th>
<th>width</th>
<th>height</th>
<th>barrels - X</th>
<th>barrels - Y</th>
<th>barrels - Z</th>
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<td>5'-0&quot;</td>
<td>4'-10&quot;</td>
<td>5</td>
<td>5'-9&quot;</td>
<td>13</td>
</tr>
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</table>

### Min. Dimensions and Quantities for Concrete Catch Basin (Based on Min. Height, H)

- Use class "B" concrete throughout.
- Use forms for the construction of the bottom slab.
- Optional construction - monolithic pour, 2" keyway, or #4 bar domels at 12" centers as directed by the Engineer.
- Use forms for the construction of the bottom slab.
- If reinforced concrete pipe is set in bottom slab of box, add to slab as shown on STD. No. 840.00.
- For 6"-0" in height or less use 6" walls and bottom slab. Over 6"-0" to 16"-0" in height use 8" walls and bottom slab. Adjust quantities accordingly.
- Construct with pipe crowns matching.
- Install 2" weepholes as directed by the Engineer.
- Install stone drains, of a minimum of 1 cubic foot of No. 78M stone in a porous fabric bag or wrap, at each weep hole or as directed by the Engineer.
- Chamfer all exposed corners 1/2".
- Drawing not to scale.
- Increase the size of the 6" opening to 8" max., as directed by the Engineer by adding 2" to the wall height above the top elevation. Adjust quantities accordingly.
- Use class "B" concrete throughout.
- Use forms for the construction of the bottom slab.
- Construct with pipe crowns matching.
- Quantities accordingly.
- Install 2" weepholes as directed by the Engineer.
- Chamfer all exposed corners 1/2".
- Drawing not to scale.
- Increase the size of the 6" opening to 8" max., as directed by the Engineer by adding 2" to the wall height above the top elevation. Adjust quantities accordingly.
**Concrete Open Throat Catch Basin**

**Detail of Handle**
- 3/4" RAD.
- 2 - HEX NUT
- 2 - 3" x 1/4" THICK ROUND OR SQUARE CUT WASHER

**Countersink part where handle is located 1" and allow handle to move vertically.**

**Part Section**
- 1" PIPE SLEEVE X 3" LONG.

**Plan**
- Precast or cast in place top slab

**Section V-V**
- 12" THRU 48" PIPE
- #4 bars "Y" and #3 bars "X" equally spaced
- 4" G
- 11/2" CLR.
- 11/2" CLR.

**Section W-W**
- 12" THRU 48" PIPE
- #4 bars "Y" and #3 bars "X" equally spaced
- 6" DOWEL
### MIN. DIMENSIONS AND QUANTITIES FOR CATCH BASIN (BASED ON MIN. HEIGHT, H)

**Pipe:** Use #4 bar dowels at 12" centers.

**Reinforcing Bars:**
- **No. of Bars - X:**
- **No. of Bars - Y:**
- **Total Lbs:**
- **Top Slab:**
- **Bottom Slab:**
- **Total in Box:**
- **Total Brick Masonry:**
- **C.S.R.C. DED. One 6" Opening:**
- **C.S. R.C. Cu. Yds:**

**Dimensions of Pipe & Box:**
- **Pipe Span:**
- **Pipe Width:**
- **Pipe Height:**
- **LBS:**
- **Top Slab:**
- **Bottom Slab:**
- **Total in Box:**
- **Total Brick Masonry:**
- **C.S.R.C. DED. One 6" Opening:**
- **C.S. R.C. Cu. Yds:**

**Notes:**
- Mortar joints 1/2" +/- 1/8" thick.
- Use Class "B" concrete throughout.
- Use forms for construction of the bottom slab.
- Deduct for pipe(s) from total cu. yds. of brick masonry.
- Provide all catch basins over 3'-6" in width with steps 1/2" on center. Use steps which comply with std. drawing 840.06.
- Concave tool all exposed mortar joints.
- Use brick or concrete block which complies with the requirements of section 840 of the standard specifications.
- If reinforced concrete pipe is set in bottom slab of box, add to slab as shown on std. no. 840.06.
- For 8'-0" to 10'-0" in height use 8" walls and bottom slab. Adjust quantities accordingly.
- Construct with pipe crowns matching.
- Chamfer all exposed corners 1".
- Drawing not to scale.
- Increase the size of the 6" opening to 8" max., as directed by the engineer by adding 2" to the wall height above the top elevation. Adjust quantities accordingly.

**Special Notes:**
- Concave tool all exposed mortar joints.
- Drawing not to scale.
- As shown on std. no. 840.00.
- If reinforced concrete pipe is set in bottom slab of box, add to slab on center.
- Use steps which comply with std. drawing 840.66.
- Provide all catch basins over 3'-6" in depth with steps 12" on center.
- Use reinforced concrete pipe which complies with the requirements of section 840 of the standard specifications.

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<th>HEIGHT</th>
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<th>NO. LENGTH</th>
<th>LBS</th>
<th>F</th>
<th>G</th>
<th>TOP SLAB</th>
<th>BOTTOM SLAB</th>
<th>TOTAL</th>
<th>PER FT. H</th>
<th>TOTAL</th>
<th>C.S. R.C.</th>
<th>DED. ONE 6&quot;</th>
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<td>4'-0&quot;</td>
<td>2'-8&quot;</td>
<td>2'-4&quot;</td>
<td>6</td>
<td>3'-9&quot;</td>
<td>8</td>
<td>5'-1&quot;</td>
<td>36</td>
<td>5'-4&quot;</td>
<td>4'-0&quot;</td>
<td>0.263</td>
<td>0.395</td>
<td>0.658</td>
<td>0.395</td>
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<td>0.044</td>
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<td>2'-10&quot;</td>
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<td>8</td>
<td>5'-1&quot;</td>
<td>36</td>
<td>5'-4&quot;</td>
<td>4'-0&quot;</td>
<td>0.263</td>
<td>0.395</td>
<td>0.658</td>
<td>0.395</td>
<td>1.136</td>
<td>0.078</td>
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<td>3'-4&quot;</td>
<td>6</td>
<td>4'-7&quot;</td>
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<td>5'-1&quot;</td>
<td>44</td>
<td>5'-4&quot;</td>
<td>4'-10&quot;</td>
<td>0.318</td>
<td>0.477</td>
<td>0.795</td>
<td>0.436</td>
<td>1.472</td>
<td>0.122</td>
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<td>4'-6&quot;</td>
<td>4'-0&quot;</td>
<td>3'-10&quot;</td>
<td>6</td>
<td>5'-1&quot;</td>
<td>11</td>
<td>5'-7&quot;</td>
<td>52</td>
<td>5'-10&quot;</td>
<td>5'-4&quot;</td>
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<td>0.576</td>
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<td>4'-4&quot;</td>
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<td>5'-7&quot;</td>
<td>13</td>
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<td>6'-4&quot;</td>
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<td>0.456</td>
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<td>4'-10&quot;</td>
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<td>0.743</td>
<td>1.238</td>
<td>0.559</td>
<td>2.725</td>
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</tr>
</tbody>
</table>
SINGLE AND MULTIPLE PIPES

BRICK CATCH BASIN WITH

840.05

PLAN

PRECAST OR CAST IN PLACE TOP SLAB

SECTION V-V

#3 BARS "X" EQUALLY SPACED

#4 BARS "Y" EQUALLY SPACED

SECTION W-W

#4 BARS "Y" EQUALLY SPACED

#3 BARS "X" EQUALLY SPACED

DETAIL OF HANDLE

DOWEL

#4 BAR

1-1/2" CLR.

3/4" RAD.

3/4" DIA. SMOOTH BAR

2 - 3" X 1" THICK ROUND OR SQUARE CUT WASHER

2 - Hex Nut

COUNTERSINK PART WHERE HANDLE IS LOCATED 1"

AND ALLOW HANDLE TO MOVE VERTICALLY.

PART SECTION

THRU COVER SHOWING HANDLE

1" PIPE SLEEVE X 3" LONG.
A MINIMUM DIMENSIONS AND QUANTITIES FOR CONCRETE DROP INLET PLAN

SECTION X-X

SECTION Y-Y

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER.

USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

OPTIONAL CONSTRUCTION - MONOLITHIC FOUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

#4 BAR DOWELS "B" AT 12" CENTERS.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET.

FOR LOCATIONS OF DROP INLET, SEE BRIDGE APPROACH SLABS IN THE STRUCTURE PLANS.

CONSTRUCT WITH PIPE CROWNS MATCHING.

DRAWING NOT TO SCALE.

MINIMUM DIMENSIONS AND QUANTITIES FOR CONCRETE DROP INLET

<table>
<thead>
<tr>
<th>PIPE</th>
<th>SPAN</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>CUBIC YARDS OF CONCRETE IN BOX</th>
<th>DEDUCTIONS FOR ONE PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>A</td>
<td>B</td>
<td>H1</td>
<td>H2</td>
<td>H PER FT. HT.</td>
</tr>
<tr>
<td>12&quot;</td>
<td>3'-6&quot;</td>
<td>2'-0&quot;</td>
<td>2'-6&quot;</td>
<td>1'-6&quot;</td>
<td>0.259</td>
</tr>
<tr>
<td>15&quot;</td>
<td>3'-6&quot;</td>
<td>2'-0&quot;</td>
<td>2'-9&quot;</td>
<td>1'-9&quot;</td>
<td>0.259</td>
</tr>
<tr>
<td>18&quot;</td>
<td>3'-6&quot;</td>
<td>2'-0&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>0.259</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-6&quot;</td>
<td>2'-0&quot;</td>
<td>3'-6&quot;</td>
<td>2'-6&quot;</td>
<td>0.259</td>
</tr>
</tbody>
</table>
GENERAL NOTES:

- Use Class "H" concrete throughout.
- Provide all drop inlets over 3'-6" in depth with steps 12" on center. Use steps which comply with STD. DRAWING 840.66.
- Optional construction - monolithic pour 2" keyway or #4 bar dowels at 12" centers as directed by the engineer.
- Use forms for the construction of the bottom slab.
- If reinforced concrete pipe is set in bottom slab of box, add to slab as shown on STD. NO. 840.00.
- Construct with pipe crowns matching.
- See standard drawing 840.25 for attachment of frames and grates not shown.
- Install 2" weep holes as directed by the engineer.
- Install stone drains, of a minimum of 1 cubic foot of No. 78M stone in a porous fabric bag or wrap, at each weep hole as directed by the engineer.
- Chamfer all exposed corners 1".
- Drawing not to scale.

DIMENSIONS AND QUANTITIES FOR DROP INLET (BASED ON MIN. HEIGHT, H)

<table>
<thead>
<tr>
<th>PIPE</th>
<th>SPAN</th>
<th>WIDTH</th>
<th>MIN. HEIGHT</th>
<th>CUBIC YARDS</th>
<th>DEDUCTIONS FOR ONE PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>D</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>12&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>0.222</td>
<td>0.222</td>
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<tr>
<td>15&quot;</td>
<td>2'-3&quot;</td>
<td></td>
<td>2'-6&quot;</td>
<td>0.648</td>
<td>0.023</td>
</tr>
<tr>
<td>18&quot;</td>
<td></td>
<td>2'-6&quot;</td>
<td>2'-6&quot;</td>
<td>0.703</td>
<td>0.023</td>
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<td>24&quot;</td>
<td>3'-0&quot;</td>
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<td>3'-0&quot;</td>
<td>0.814</td>
<td>0.059</td>
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<tr>
<td>30&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>3'-6&quot;</td>
<td>0.222</td>
<td>0.222</td>
</tr>
</tbody>
</table>
GENERAL NOTES:

- MORTAR JOINTS \( \frac{3}{4}" \pm \frac{1}{4}" \) THICK.
- USE CLASS "B" CONCRETE THROUGHOUT.
- USE FORMS FOR CONSTRUCTION OF THE BOTTOM SLAB.
- USE #4 BAR DOWELS AT 12" CENTERS.
- DEDUCT FOR PIPE(S) FROM TOTAL CU. YDS. OF BRICK MASONRY.

- PROVIDE ALL CATCH BASINS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.06.
- USE BRICK OR CONCRETE BLOCK WHICH COMPLIES WITH THE REQUIREMENTS OF SECTION 840 OF THE STANDARD SPECIFICATIONS.

- IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

- FOR 8'-0" IN HEIGHT OR LESS, USE 8" WALL. OVER 8'-0" IN HEIGHT, USE 12" WALL TO 6'-0" FROM TOP OF WALL AND 8" WALL FOR THE REMAINING 6'-0" QUANTITIES TO BE ADJUSTED ACCORDINGLY.

- CONSTRUCT WITH PIPE CROWNS MATCHING.

SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES.

DO NOT USE BRICK MASONRY DROP INLET IN LOCATIONS SUBJECT TO TRAFFIC.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

**DIMENSIONS AND QUANTITIES FOR DROP INLET (BASED ON MIN. HEIGHT, H)**

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>SPAN (D)</th>
<th>WIDTH (A)</th>
<th>H</th>
<th>BOTTOM SLAB</th>
<th>WALL PER FT. HT. (C.S.)</th>
<th>TOTAL BRICK MASONRY PER FT. HT. (R.C.)</th>
<th>DEDUCTIONS FOR ONE PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>H</td>
<td>0.268</td>
<td>0.313</td>
<td>0.522</td>
<td>0.020, 0.032</td>
</tr>
<tr>
<td>15&quot;</td>
<td>2'-3&quot;</td>
<td></td>
<td>H</td>
<td>0.268</td>
<td>0.313</td>
<td>0.600</td>
<td>0.031, 0.047</td>
</tr>
<tr>
<td>18&quot;</td>
<td>2'-6&quot;</td>
<td></td>
<td>H</td>
<td>0.268</td>
<td>0.313</td>
<td>0.678</td>
<td>0.044, 0.065</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-0&quot;</td>
<td></td>
<td>H</td>
<td>0.268</td>
<td>0.313</td>
<td>0.695</td>
<td>0.078, 0.113</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-0&quot;</td>
<td>2'-6&quot;</td>
<td>H</td>
<td>0.268</td>
<td>0.313</td>
<td>0.891</td>
<td>0.122, 0.170</td>
</tr>
</tbody>
</table>

**NOTES:**

- See Note
- Top elevation
- Bottom elevation
- Frame and grate
- Brick coping (incidental)
- See note.
- Drawn not to scale.

**REFERENCES:**

- Use #4 Bar dowels at 12" centers.
- Deduct for pipe(s) from total cu. yds. of brick masonry.
- Refer to Section 840 of the Standard Specifications.
- Use reinforced concrete pipe set in bottom slab of box, add to slab as shown on Std. No. 840.00.
- For 8'-0" in height or less, use 8" wall. Over 8'-0" in height, use 12" wall to 6'-0" from top of wall and 8" wall for the remaining 6'-0" quantities to be adjusted accordingly.
- Construct with pipe crowns matching.
- See standard drawing 840.25 for attachment of frames and grates.
- Do not use brick masonry drop inlet in locations subject to traffic.
- Chamfer all exposed corners 1".
- Drawing not to scale.
CONCRETE APRON

GENERAL NOTES:

- USE CLASS "B" CONCRETE THROUGHOUT.
- PROVIDE ALL GRATED DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12"
  ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.06.
- OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT
  12" CENTERS AS DIRECTED BY THE ENGINEER.
- USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.
- IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB
  AS SHOWN ON STD. NO. 840.00.
- CONSTRUCT WITH PIPE CROWNS MATCHING.
- USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24 (SHOWN),
  840.20 (NOT SHOWN) OR 840.29 (NOT SHOWN).
- SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES.
- CHAMFER ALL EXPOSED CORNERS 1".
- DRAWING NOT TO SCALE.
- MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION
  IS 12 FEET.

FLOW LINE

SECTION X-X

SECTION Y-Y

CONCRETE APRON

DITCH

CONCRETE APRON

CONCRETE SNAP SEALANT

CONC. WALL

CONC. ANCHOR BAR

FLUSH CONCRETE APRON

GRATED D.I.

DOWEL "A"

DOWEL "A"

#4 BAR

#4 BAR

"G" BARS
8 6" CTS.
8 6" CTS.

"H" BARS
8 6" CTS.

"E" BARS
8 6" CTS.

"F" BARS
8 6" CTS.

"E" BARS
8 6" CTS.

"G" BARS

CONCRETE WALL

ANCHOR BAR

EXP. MAT.

14"

1"

6"

6"

6"

3"

3"

2"

2"

13/2"

6"

6"

6"

13/2"

13/2"
GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL GRATED DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24 (SHOWN), 840.20, 840.29, AND 840.33.

SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

MINIMUM DIMENSIONS AND QUANTITIES FOR CONCRETE GRATED DROP INLET

<table>
<thead>
<tr>
<th>PIPE</th>
<th>SPAN</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>CUBIC YARDS OF CONCRETE IN BOX</th>
<th>DEDUCTIONS FOR ONE PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td>BOTTOM SLAB H</td>
<td>H PER FT. HT.</td>
</tr>
<tr>
<td>D</td>
<td>A</td>
<td>B</td>
<td>H</td>
<td></td>
<td></td>
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<tr>
<td>12&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>2'-6&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>15&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>2'-9&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>18&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>3'-0&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>3'-6&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>4'-0&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>36&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>4'-6&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
</tbody>
</table>

MINIMUM DIMENSIONS AND QUANTITIES FOR CONCRETE GRATED DROP INLET

<table>
<thead>
<tr>
<th>PIPE</th>
<th>SPAN</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>CUBIC YARDS OF CONCRETE IN BOX</th>
<th>DEDUCTIONS FOR ONE PIPE</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td>BOTTOM SLAB H</td>
<td>H PER FT. HT.</td>
</tr>
<tr>
<td>D</td>
<td>A</td>
<td>B</td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>2'-6&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>15&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>2'-9&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>18&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>3'-0&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>3'-6&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>4'-0&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
<tr>
<td>36&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>4'-6&quot;</td>
<td>0.362</td>
<td>0.247</td>
</tr>
</tbody>
</table>
CONCRETE GRATED DROP INLET TYPE `D'

**General Notes:**
- Use Class "B" Concrete throughout.
- Provide all drop inlets over 3'-6" in depth with steps 12" on center. Use steps which comply with Std. Drawing 840.06.
- Optional construction - monolithic pour, 2" keyway, or #4 bar dowels at 12" centers as directed by the engineer.
- Use forms for the construction of the bottom slab.
- If reinforced concrete pipe is set in bottom slab of box, add to slab as shown on Std. No. 840.00.
- Construct with pipe crowns matching.
- Max. depth of this structure from top of bottom slab to top elevation is 12 feet.
- Use standard frames and grates 840.22 (shown), 840.24 (shown), 840.20, 840.29, and 840.33.
- See standard drawing 840.25 for attachment of frames and grates not shown.
- Chamfer all exposed corners 1".
- Drawing not to scale.

**Material**
- "EXPANSION SEALANT

**Diagram:**
- Plan
- Top Elevation
- Section X-X
- Section Y-Y

**Minimum Dimensions and Quantities for Concrete Grated Drop Inlet**

<table>
<thead>
<tr>
<th>Pipe</th>
<th>Span</th>
<th>Width</th>
<th>Height</th>
<th>Cubic Yards of Concrete in Box</th>
<th>Deductions for One Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>H Bottom Slab H per Ft. Ht. H Min. Total</td>
<td>C.S. R.C.</td>
</tr>
<tr>
<td>12&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>1'-8&quot;</td>
<td>0.362 0.247 0.391 0.753</td>
<td>0.020 0.032</td>
</tr>
<tr>
<td>15&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>1'-11&quot;</td>
<td>0.362 0.247 0.453 0.815</td>
<td>0.023 0.036</td>
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<tr>
<td>18&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>2'-2&quot;</td>
<td>0.362 0.247 0.515 0.877</td>
<td>0.033 0.049</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-6&quot;</td>
<td>2'-0&quot;</td>
<td>2'-8&quot;</td>
<td>0.362 0.247 0.659 1.021</td>
<td>0.059 0.085</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-6&quot;</td>
<td>2'-0&quot;</td>
<td>3'-2&quot;</td>
<td>0.382 0.247 0.782 1.144</td>
<td>0.082 0.127</td>
</tr>
<tr>
<td>36&quot;</td>
<td>3'-8&quot;</td>
<td>2'-0&quot;</td>
<td>3'-8&quot;</td>
<td>0.362 0.247 0.906 1.268</td>
<td>0.112 0.178</td>
</tr>
</tbody>
</table>
FRAMES AND WIDE SLOT SAG GRATES

PLAN

GRATE SECTION X-X

FRAME SECTION Y-Y

FOR 3½" DIA. BOLT

NOTE:
SEE STD. DWG. 840.25
FOR FRAME ANCHORAGE.
FRAMES AND NARROW SLOT SAG GRATES

PLAN

GRATE SECTION Y-Y

FRAME SECTION Y-Y

FRATE SECTION X-X

FRAME SECTION X-X

FOR 3/8" DIA. BOLT

NOTE:
SEE STD. DWG. 840.25
FOR FRAME ANCHORAGE.
DETAIL SHOWING ANCHORAGE OF FRAME FOR GRATED DROP INLET

NOTE:
CONSTRUCT GRATED DROP INLET TO COINCIDE WITH NORMAL OR SUPERELEVATED SHOULDER OR PAVEMENT SLOPE.
GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICKS.

PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE #4 BAR DOWELS AT 12" CENTERS.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24 (SHOWN), 840.20, 840.29, AND 840.33.

SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICKS.

ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE #4 BAR DOWELS AT 12" CENTERS.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24 (SHOWN), 840.20, 840.29, AND 840.33.

SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICKS.

ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE #4 BAR DOWELS AT 12" CENTERS.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24 (SHOWN), 840.20, 840.29, AND 840.33.

SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.
**MINIMUM DIMENSIONS AND QUANTITIES FOR BRICK GRATED DROP INLET**

<table>
<thead>
<tr>
<th>PIPE</th>
<th>SPAN</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>QL. YD. OF CONC IN BOX</th>
<th>QL. YD. OF BRICK MASONRY IN BOX</th>
<th>TOTAL QL. YD. IN BOX</th>
<th>G.S.</th>
<th>R.C.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>H</td>
<td>BOTTOM SLAB</td>
<td>H PER FT. HT.</td>
<td>TOTAL H</td>
<td></td>
</tr>
<tr>
<td>12&quot;</td>
<td>3'-6&quot;</td>
<td>2'-0&quot;</td>
<td>2'-6&quot;</td>
<td>1'-6&quot;</td>
<td>0.309</td>
<td>0.346</td>
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<tr>
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<td>1'-9&quot;</td>
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<td>0.346</td>
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<td>24&quot;</td>
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<td>1'-24&quot;</td>
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<td>0.346</td>
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<td>0.309</td>
<td>0.346</td>
<td>1.557</td>
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**GENERAL NOTES:**

- **USE CLASS "B" CONCRETE THROUGHOUT.**
- **JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICKS.**
- **PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.**
- **USE #4 BAR DOWELS AT 12" CENTERS.**
- **USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.**
- **IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.**
- **CONSTRUCT WITH PIPE CROWNS MATCHING.**
- **MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET.**
- **USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24 (SHOWN), 840.29, AND 840.33.**
- **SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.**
- **CHAMFER ALL EXPOSED CORNERS 1". DRAWING NOT TO SCALE.**
GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICKS.

PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE #4 BAR DOWELS AT 12" CENTERS.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24 (SHOWN), 840.20, 840.29, AND 840.33.

SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED Corners 1°.

DRAWING NOT TO SCALE.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET.
FRAMES AND NARROW SLOT FLAT GRATES

FRAME ELEVATION X-X
FOR 3/8" DIA. BOLT

FRAME ELEVATION Y-Y

NOTE:
SEE STD. DWG. 840.25
FOR FRAME ANCHORAGE.

PLAN

GRATE ELEVATION Y-Y

GRATE ELEVATION X-X

FRAME SECTION X-X

FRAME SECTION X-X

FOR FRAME ANCHORAGE.
SEE STD. DWG. 840.29
**GENERAL NOTES:**

ALL MASONRY COMPONENTS OF THIS DRAINAGE DEVICE (EXCLUDING PIPE) ARE TO BE CONSTRUCTED WITH CLASS `B' CONCRETE AND PAID FOR AT THE CONTRACT UNIT PRICE PER EACH FOR MASONRY DRAINAGE STRUCTURES.

* PAY FOR THE GRATE AND FRAME FOR THE DRIVEWAY DROP INLET AT THE CONTRACT UNIT PRICE PER LINEAR FOOT FOR GRATE WITH FRAME, DRIVEWAY DROP INLET. FABRICATE THE GRATE SECTION(S) TO FIT THE OPENINGS INDICATED IN THE PLANS.

THE CONTRACTOR MAY, AT HIS OPTION, SHORTEN LENGTHS FOR BARS 'B' AND LAP THEM TO OBTAIN THE PROPER LENGTH OF BARS. DO NOT OVERLAP BARS LESS THAN 1'-6" LONG.

INCLUDE THE COST OF ALL REINFORCING STEEL IN THE CONTRACT UNIT PRICE PER EACH FOR MASONRY DRAINAGE STRUCTURES.

DESIGN THE GRATES TO MEET HS-20 LOADING.

PROVIDE GRATES WITH A MINIMUM CLEAR WATERWAY OPENING OF 50in² PER 1'-0" LENGTH OF GRATE.

ADDITIONAL PER LINEAR FOOT QUANTITIES MAY BE USED TO ADJUST QUANTITIES FOR LENGTH INCREASE OR DECREASE AS INDICATED BY THE PLANS (SEE CHART BELOW).

---

**BILL OF MATERIAL**

**QUANTITIES BASED ON 30' GRATE LENGTH**

<table>
<thead>
<tr>
<th>BAR</th>
<th>NO.</th>
<th>SIZE</th>
<th>LENGTH</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>28</td>
<td>5</td>
<td>3'-'11&quot;</td>
<td>114.4</td>
</tr>
<tr>
<td>A3</td>
<td>4</td>
<td>5</td>
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<td>A4</td>
<td>10</td>
<td>5</td>
<td>2'-10&quot;</td>
<td>53.2</td>
</tr>
<tr>
<td>A5</td>
<td>4</td>
<td>5</td>
<td>3'-0&quot;</td>
<td>16.0</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>5</td>
<td>3'-10&quot;</td>
<td>52.0</td>
</tr>
<tr>
<td>B3</td>
<td>6</td>
<td>5</td>
<td>6'-0&quot;</td>
<td>37.5</td>
</tr>
<tr>
<td>B4</td>
<td>5</td>
<td>5</td>
<td>2'-10&quot;</td>
<td>14.8</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>5</td>
<td>2'-0&quot;</td>
<td>12.5</td>
</tr>
</tbody>
</table>

**TOTAL REINF. STEEL LBS.** 490.0

**CLASS `B' CONC. CU. YDS.** 3.20

**ADDITIONAL CONCRETE PER FT. CU. YDS. OVER 3'-0"** 0.22

**CLASS `B' CONC. CU. YDS.** 0.10

**PAY FOR**

- PER LINEAR FOOT QUANTITY ADJUSTMENTS FOR DRAINAGE STRUCTURES DEVIATING FROM THE 30' GRATE LENGTH:
- FOR DRAINAGE STRUCTURES:
  - A - 1'-1" - 4.1
  - B - 1'-0" - 7.3

**CLASS `B' CONC. CU. YDS.**
### General Notes:

- Chamfer all exposed corners 1".
- Use Class "B" concrete throughout.

Optional construction - monolithic pour, 2" keyway, or #4 bar dowels at 12" centers as directed by the engineer.

Use forms to construct the bottom slab.

If reinforced concrete pipe is set in base slab of box, add to base as shown on Standard No. 840.00.

Provide all junction boxes over 3'-6" in depth with steps 12" on centers in accordance with Std. No. 840.66.

Adjust the steel, concrete and brick masonry quantities to include the addition of the manhole (i.e., diagonal bars shortened around opening in top slab, additional variable height brick masonry, opening in top slab.)

Max. depth of this structure from top of bottom slab to top elevation is 12 feet.

---

#### Dimensions and Quantities for Concrete Junction Boxes

<table>
<thead>
<tr>
<th>Pipe</th>
<th>Span</th>
<th>Width</th>
<th>Height</th>
<th>No. Bars</th>
<th>Length</th>
<th>Top Slab</th>
<th>Lbs. Reinforcement</th>
<th>C.S.</th>
<th>R.C.</th>
<th>Total Quantities</th>
<th>Deduction for One Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-3&quot;</td>
<td>12</td>
<td>2'-9&quot;</td>
<td>0.167</td>
<td>0.167</td>
<td>0.165</td>
<td>0.015</td>
<td>0.024</td>
<td>0.015</td>
</tr>
<tr>
<td>15&quot;</td>
<td>2'-3&quot;</td>
<td>2'-3&quot;</td>
<td>2'-6&quot;</td>
<td>12</td>
<td>3'-0&quot;</td>
<td>0.196</td>
<td>0.196</td>
<td>0.204</td>
<td>0.023</td>
<td>0.036</td>
<td>0.023</td>
</tr>
<tr>
<td>18&quot;</td>
<td>2'-6&quot;</td>
<td>2'-6&quot;</td>
<td>2'-9&quot;</td>
<td>14</td>
<td>3'-3&quot;</td>
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<td>0.227</td>
<td>0.222</td>
<td>0.033</td>
<td>0.049</td>
<td>0.033</td>
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<tr>
<td>24&quot;</td>
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<td>3'-3&quot;</td>
<td>16</td>
<td>3'-9&quot;</td>
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<td>0.296</td>
<td>0.259</td>
<td>0.058</td>
<td>0.085</td>
<td>0.058</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
<td>3'-9&quot;</td>
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<td>4'-3&quot;</td>
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<td>36&quot;</td>
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<td>4'-9&quot;</td>
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<td>0.463</td>
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<td>0.132</td>
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<td>0.317</td>
<td>0.235</td>
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<tr>
<td>54&quot;</td>
<td>5'-10&quot;</td>
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<td>5'-9&quot;</td>
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<td>6'-7&quot;</td>
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<td>0.518</td>
<td>0.444</td>
<td>0.589</td>
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</tr>
</tbody>
</table>

**Add to base as shown on Standard No. 840.00.**
GENERAL NOTES:
CHAMFER ALL EXPOSED CORNERS 1".
USE CLASS "B" CONCRETE THROUGHOUT.
USE #4 BAR DOWELS AT 12" CENTERS.
MORTAR JOINTS 1/2" x 1/4" THICK.
CONCAVE TOO ALL EXPOSED JOINTS.
USE FORMS TO CONSTRUCT THE BOTTOM SLAB.
JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICK.
FOR 6'-0" IN HEIGHT OR LESS, USE 8" WALL. OVER 6'-0" IN HEIGHT, USE 12" WALL TO 6'-0" FROM TOP OF WALL, AND 8" WALL FOR THE REMAINING 6'-0". ADJUST DIMENSIONS AND QUANTITIES ACCORDINGLY.
IF REINFORCED CONCRETE PIPE IS SET IN BASE SLAB OF BOX, ADD TO BASE AS SHOWN ON STANDARD NO. 840.30.
PROVIDE ALL JUNCTION BOXES OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTERS IN ACCORDANCE WITH STD. NO. 840.66.
ADJUST THE STEEL, CONCRETE AND BRICK MASONRY QUANTITIES TO INCLUDE THE ADDITION OF THE MANHOLE (I.E. DIAGONAL BARS SHORTENED AROUND OPENING IN TOP SLAB, ADDITIONAL VARIABLE HEIGHT BRICK MASONRY, OPENING IN TOP SLAB.)
MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET.

DIMENSIONS AND QUANTITIES FOR BRICK JUNCTION BOXES

<table>
<thead>
<tr>
<th>PIPE</th>
<th>SPAN</th>
<th>WIDTH</th>
<th>HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-3&quot;</td>
</tr>
<tr>
<td>15&quot;</td>
<td>2'-0&quot;</td>
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</tr>
<tr>
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</tr>
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CHAMFER ALL EXPOSED CORNERS 1".
CONC. BRICK MASONRY

DEPT. OF TRANSPORTATION
NORTH CAROLINA
STATE OF
RALEIGH, N.C.
DIVISION OF HIGHWAYS

ENGLISH STANDARD DRAWING FOR
BRICK JUNCTION BOX
WITH OPTIONAL MANHOLE
12" THRU 66" PIPE

SHEET 1 OF 1
840.32
RAISED DIRECTIONAL FLOW INDICATOR

GRATE SECTION Y-Y

GRATE SECTION Z-Z

INSET "A"
(TYPICAL UNIT FOR SECTION Z-Z)

NOTE: SEE STD. DWG. 840.25 FOR FRAME ANCHORAGE.

FRAME SECTION X-X

FRAME SECTION Y-Y

FRAME SECTION Z-Z

FOR 3/8" DIA. BOLT

RAL EIGH, N.C.
DIVISION OF HIGHWAYS
DEPT. OF TRANSPORTATION
NORTH CAROLINA
STATE OF
RALEIGH, N.C.
DIVISION OF HIGHWAYS
DEPT. OF TRANSPORTATION
NORTH CAROLINA
STATE OF

ENGLISH STANDARD DRAWING FOR ANGLED VANE GRATES AND FRAMES

ENGLISH STANDARD DRAWING FOR ANGLED VANE GRATES AND FRAMES

840.33
**PLAN OF TOP SLAB**

- "Y" BARS
- BAR DIMENSIONS ARE OUT TO OUT

**PLAN OF BOTTOM SLAB**

- INSET "A"
- CONCRETE BLOCK

**NOTE 1:** CONSTRUCT SECTION "B" OF THE PROPOSED WALL 8" THICK.
- NOTE 2: IF PROPOSED STRUCTURE EXCEEDS 12'-0" VERTICAL HEIGHT A DESIGN WILL BE REQUIRED FOR APPROVAL.
- NOTE 3: USE SINGLE MAT REINFORCING STEEL EXCEPT DOUBLE MAT STEEL MAY BE USED IN LIEU OF HOOK BARS IN BASE SLAB.

**SECTION X-X**

- Concrete Bottom Slab
- Concrete Top Slab
- "Y" Bars @ 11'-0" CTS.

**GENERAL NOTES**

- STEPS - SEE GENERAL NOTES

**STANDARD 840.54**

- FOR MANHOLE COVER & FRAME

**FOR USE WITH PIPES 42" AND UNDER**

**RADIUS**

- 2 3/22"
GENERAL NOTES:

USE STANDARD OR JUMBO BRICK FOR WALL CONSTRUCTION. SOLID
CONCRETE BRICK OR BLOCK ARE OPTIONAL WALL CONSTRUCTION MATERIAL

PRECicted UNITS MADE OF CLASS "AA" CONCRETE MAY BE USED IN LIEU
OF BRICK MASONRY CONSTRUCTION. SUBMIT DESIGN OF PRECicted UNITS
FOR APPROVAL PRIOR TO CONSTRUCTION.

INCLUDE ALL ADJUSTMENTS TO WALLS, SLABS OR REINFORCING MATERIAL
IN THE UNIT PRICE BID FOR EACH UNIT.

INSTALL OPTIONAL MANHOLE IN POSITION AS DIRECTED BY THE ENGINEER.
CUT OR BEND ALL REBAR CROSSING THIS OPENING TO ALLOW 2" MINIMUM
CONCRETE COVERAGE. ENCLOSE THE OPENING WITH 8 "A" BARS TIED TO
TO THE REBAR MAT AND SET SO A MINIMUM OF 3" CONCRETE COVER IS
ATTAINED. REFERENCE STD. NO. 840.54 FOR MANHOLE INFORMATION.

PROVIDE JUNCTION BOXES WITH MANHOLEs OVER 3'-6" IN DEPTH WITH
STEPS PLACED ON 12" CENTERS. REFERENCE STD. NO. 840.66.

SPACE DOWEL "C" BARS AT A MAXIMUM OF 12" CENTERS.

MAXIMUM DEPTH OF THIS UNIT AS SHOWN IS 12'.

CONSTRUCT THE JUNCTION BOX IN ACCORDANCE WITH
SECTIONS 830, 832, 834 AND 840 OF THE STANDARD SPECIFICATIONS.

<table>
<thead>
<tr>
<th>BAR</th>
<th>QTY.</th>
<th>SIZE</th>
<th>LENGTH</th>
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<td>B</td>
<td>14</td>
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<td>C</td>
<td>26</td>
<td>#4</td>
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<td>26.1</td>
</tr>
<tr>
<td>Y</td>
<td>14</td>
<td>#5</td>
<td>6'-11&quot;/3&quot;</td>
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</table>

STEEL TOTAL WEIGHT 217.6

CU. YDS. BRICK/FT. HT. (8") 0.53
CU. YDS. BRICK/FT. HT. (12") 0.84

CU. YDS. CLASS "AA" CONC. 2.6
- DEPTH OF STEEL GRATE WILL REQUIRE DEEPER SEAT ALONG SHORT WALLS.

- MAX. PIPE DIAMETER IS 18" R.C.P.

- MAX. PIPE DIAMETER IS 36" R.C.P.

**NOTES:**
- HORIZONTAL AND VERTICAL DIMENSIONS MAY BE ADJUSTED AS THE FIELD CONDITIONS AND/OR ALTERNATE DESIGN REQUIRE.
- MAXIMUM HEIGHT FOR THIS STRUCTURE IS 14'-0".
- MAKE ALL ADJUSTMENTS AS DIRECTED BY THE ENGINEER.
- DEPTH OF STEEL GRATE WILL REQUIRE DEEPER SEAT ALONG SHORT WALLS.
**PLAN OF BASE**

**BILL OF MATERIALS**

<table>
<thead>
<tr>
<th>COMMON</th>
<th>CONCRETE ALT.</th>
<th>BRICK ALT.</th>
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<tr>
<td>C</td>
<td>#5</td>
<td>4'-0&quot;</td>
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<tr>
<td>D</td>
<td>#5</td>
<td>5'-0&quot;</td>
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<tr>
<td>E</td>
<td>#5</td>
<td>6'-0&quot;</td>
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</tbody>
</table>

REINF. STEEL (TOTAL WEIGHT LBS.)

| CONCRETE IN BASE CLASS 'AA' (CUBIC YARDS) | 0.56 |
| CONCRETE IN WALLS CLASS 'AA' (CUBIC YARDS) | 0.82 |
| BRICK IN WALLS (CUBIC YARDS) | 0.36 |
| CONCRETE TOTAL (CUBIC YARDS) | 1.49 |
| BRICK & CONCRETE TOTAL (CUBIC YARDS) | 1.85 |
| CONC. YARDS IN WALL/FOOT OF HEIGHT | 0.35 |
| BRICK YARDS IN WALL/FOOT OF HEIGHT | 0.14 |
| LBS. OF REINF. STEEL IN WALL/FOOT OF HEIGHT | 94.9 |

FRAME AND GRATES ARE SEPARATE CONTRACT ITEMS.

-USE CLASS 'AA' CONCRETE FOR CAST IN PLACE CONCRETE BOX.
-USE CLASS 'B' CONCRETE IN THE WALL CAVITY FOR REINFORCED BRICK CONSTRUCTION AND CLASS 'AA' FOR THE FOOTING BASE.
-CHAMFER ALL EXPOSED CONCRETE CORNERS 1".
-USE FORMS TO CONSTRUCT THE BOTTOM SLAB.
-CONCRETE FOR BRICK BOX REFER TO SECTION 832 OF THE STANDARD SPECIFICATIONS.
-PRECAST UNITS MADE OF CLASS 'AA' CONCRETE MAY BE USED IN LIEU OF BRICK MASONRY CONSTRUCTION.
-INCLUDE REINFORCING STEEL COST IN THE UNIT OR LINLEY FOOT BID PRICE FOR "MASONRY DRAINAGE STRUCTURE".
-REFERENCE STD. DWG. 840.25 FOR FRAME ANCHORAGE.
-CONCRETE BRICK, JUMBO BRICK AND 4" SOLID CONCRETE BLOCK WILL BE PERMITTED.
-CONCRETE FOR BRICK BOX REFER TO SECTION 832 OF THE STANDARD SPECIFICATIONS.
-PROVIDE GRATED DROP INLETS OVER 3'-0" DEEP WITH STEPS SPACED 12" ON CENTER AS DIRECTED BY STD. DWG. 840.86.
-FRAME AND GRATES ARE SEPARATE CONTRACT ITEMS.
TRAFFIC BEARING DROP INLET

SECTION X-X

SECTION Y-Y

TRAFFIC BEARING DROP INLET

NOTES:
- HORIZONTAL AND VERTICAL DIMENSIONS MAY BE ADJUSTED AS THE FIELD CONDITIONS AND/OR ALTERNATE DESIGN REQUIRE.
- MAXIMUM HEIGHT FOR THIS STRUCTURE IS 14'-0".
- MAKE ALL ADJUSTMENTS AS DIRECTED BY THE ENGINEER.
- ANCHOR STEEL FRAME AND GRATES IN ACCORDANCE WITH DETAILS SHOWN.
- NO BRICK RISERS ARE PERMITTED ON ANY PART OF THIS DRAINAGE STRUCTURE.

MAX. PIPE DIAMETER IS 18" R.C.P.

MAX. PIPE DIAMETER IS 36" R.C.P.
BILL OF MATERIALS

<table>
<thead>
<tr>
<th>COMMON</th>
<th>CONCRETE</th>
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<tbody>
<tr>
<td>BAR</td>
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REINF. STEEL (TOTAL WEIGHT LBS.) 327.2
CONCRETE IN BASE (CUBIC YARDS) 0.58
CONCRETE IN WALLS (CUBIC YARDS) 0.92
CONCRETE TOTAL (CUBIC YARDS) 1.48

CONC. CUBIC YARDS IN WALL/FOOT OF HEIGHT 0.35
LBS. OF REINF. STEEL IN WALL/FOOT OF HEIGHT 94.9

GENERAL NOTES:
- USE CLASS "AA" CONCRETE FOR CAST IN PLACE BOX.
- CHAMFER ALL EXPOSED CONCRETE CORNERS 1".
- USE FORMS TO CONSTRUCT THE BOTTOM SLAB.
- IF PIPES ARE SET IN THE BASE FOLLOW CONSTRUCTION PROCEDURES SHOWN BY STD. DWG. 840.00.
- INCLUDE REINFORCING STEEL COST IN THE BID PRICE FOR "MASONRY DRAINAGE STRUCTURE".
- PROVIDE GRATED DROP INLETS OVER 3'-6" DEEP WITH STEPS SPACED 12" ON CENTER AS DIRECTED BY STD. DWG. 840.66.
- FRAME AND GRATES ARE SEPARATE CONTRACT ITEMS.
ELEVATION OF GRATES IN FRAME SYSTEM SECTION 'C-C'

SECTION 'C-C'
FRAME
3'-10 3/4""}

FRAME OPENING
3'-8"

CLEAR FRAME OPENING
THROUGH CENTER CONNECTION SHOWN BELOW

SECTION 'D-D'

ELEVATION OF GRATE IN FRAME SYSTEM SHOWN THROUGH SECTION 'D-D'.

DETAIL 'A' STUD ANCHOR

1'-6"
1'-6"

3'-8"
3'-8"

3/8"" TYP.
3/8"" TYP.

3'-10 3/4"
1 3/4"

SEE DETAIL 'A'

4 3/8" x 1 3/4" x 3/8" ANGLE - MITERED CORNERS

4"
8" MIN.

3'-8"
3'-8"

3/8"" TYP.
3/8"" TYP.

3'-10 3/4"
3/8"" TYP.

1 3/4"
8" MIN.

3/8"
1 3/4"

1 3/4"
1 1/8"

3/8"
1 3/4"

3 5/8"
1 3/8"

3 1/4"
1 3/8"

SEE DETAIL 'B'

8" MIN.
STRUCTURE WALL

WELD J-STUD
(1/2" X 4 3/4")

1 1/4"
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NOTES:

1. HOT DIP GALVANIZE FRAME AND GRATE IN ACCORDANCE WITH ASTM DESIGNATION A-123 AND AASHTO M-111.

2. GRATE IS DESIGNED TO WITHSTAND HS25-44 LOADING.

3. TWO (2) GRATES REQUIRED PER FRAME. ONE (1) GRATE DEPICTED FOR CLARITY.

4. PROVIDE STEEL CONFORMING TO THE REQUIREMENTS OF A.S.T.M. DESIGNATION A-36.

5. WELD IN ACCORDANCE WITH THE ANSI/AASHTO/AWS D1.5 WELDING CODE. SEAL WELD ALL CONNECTIONS ALONG TOP AND BOTTOM HORIZONTAL SEAMS OF CONNECTIONS IN ADDITION TO ANY REQUIRED STRUCTURAL WELDS.

6. USE 5/8" DOUBLE FILLET WELDS FOR CONNECTING MAIN BARS TO EDGE BARS AND 3/4" FILLETS AT ALL THEIR LOCATIONS.

7. NOTCHING OF BEARING BARS TO ACCEPT CROSS BAR IS PROHIBITED.
**General Notes:**

- Use Class "B" concrete throughout.
- Optional construction of concrete box - monolithic pour, 2" keyway, or #4 bar dowels at 12" centers as directed by the engineer.
- Reinforcing steel (A-bars) to be #3 straight bars, 12 bars required 2'-9" long for concrete box and 3'-1" long for brick box.
- Dimensions of box may be changed by the engineer.
- Mortar joints 1/2" = 3/8" thick.
- Concave tool all exposed joints.
- Use forms to construct the bottom slab.
- Jumbo brick will be permitted. Concrete brick or 4" solid concrete blocks may be used in lieu of clay brick.

**Fill Height**

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<td>25' or less</td>
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<td>0.722</td>
<td>12</td>
</tr>
<tr>
<td>26' thru 50'</td>
<td>6 1/2&quot;*</td>
<td>0.737</td>
<td>22</td>
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<tr>
<td>51' thru 75'</td>
<td>7 1/2&quot;</td>
<td>0.742</td>
<td>34</td>
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<tr>
<td>76' thru 100'</td>
<td>8 1/2&quot;</td>
<td>0.792</td>
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**Table of Quantities for Brick Spring Box**

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<td>76' thru 100'</td>
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<td>0.620</td>
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</table>

* Use this top slab for live load up to 2' of fill.

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**Table of Quantities for Conc. Spring Box**

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<tr>
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<td>6 1/2&quot;*</td>
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<tr>
<td>51' thru 75'</td>
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</tr>
<tr>
<td>76' thru 100'</td>
<td>8 1/2&quot;</td>
<td>0.792</td>
<td>34</td>
</tr>
</tbody>
</table>
THE PATTERN OF THE KNOCK-OUT PANELS ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.
GENERAL NOTES:

* This precast box may be used for the following standards: 840.01, 840.02, 840.04, 840.05, 840.11, 840.12, 840.14, 840.15, 840.17, 840.18, 840.19, 840.26, 840.27, 840.28, 840.31, 840.32 and 840.41.
* Install precast drainage structures and pay for in accordance with specification section 840.
* Do not place precast drainage structures under traffic or where traffic will be detoured.
* Use 4000 psi concrete.
* Provide all reinforcing steel which meets ASTM A615 for grade 60 and welded wire fabric conforming to ASTM A185.
* Limit maximum depth to top of bottom slab for waffle wall structure to 10'-0"; limit solid wall structure to 15'-0".
* Place lift holes or pins in accordance with OSHA standard 1926.704.
* Cut or form openings for pipe to provide required size and location. Orient waffle wall structures so that pipes enter through the knockout/waffle panels only. Pipes may enter through the corners of solid wall boxes if a minimum of 6" of wall is provided above the hole.
* All elements precast to meet ASTM C913.
* Frame and grate height may be adjusted with concrete or brick in accordance with standard 840.25.
* Provide precast structures over 4'-0" in depth with steps as directed by the engineer.
* Welded wire fabric may be substituted for rebar as long as the same area of steel is provided.
* Seal joints with a flexible butyl rubber base conforming to federal specification SS-S-21A, AASHTO M-198, Type B - Butyl Rubber.
* Limit maximum structure size to inside clear dimensions of 5'-0" x 5'-0".
* The outside pipe diameter plus 2" or the opening required for frame and grate is the minimum structure size whichever is greater.
* Use manhole frame and cover as indicated on the plans. Reinforce opening as shown on this sheet.
GENERAL NOTES:

- THIS PRECAST BOX MAY BE USED FOR THE FOLLOWING STANDARDS:
- INSTALL AND PAY FOR PRECAST DRAINAGE STRUCTURES IN ACCORDANCE
  WITH NCDOT STANDARD SPECIFICATION SECTION 840.
- USE 4000 PSI MINIMUM COMPRESSIVE STRENGTH CONCRETE.
- USE ASTM A615 GRADE 60 REINFORCING STEEL. USE ASTM A185
  WELDED WIRE FABRIC (WWF).
- LIMIT MAXIMUM DEPTH TO TOP OF BOTTOM SLAB TO 15'-0".
- PLACE LIFT HOLES OR PINS IN ACCORDANCE WITH OSHA STANDARD
  1926.704.
- ORIENT STRUCTURES SO THAT CORNERS WILL NOT BE CUT OR MODIFIED
  UNLESS ALLOWED BY DETAIL IN PLANS.
- PRECAST ALL ELEMENTS TO MEET ASTM C913.
- FRAME AND GRATE HEIGHT MAY BE ADJUSTED WITH CONCRETE
  OR BRICK IN ACCORDANCE WITH STANDARD 840.25.
- PROVIDE PRECAST STRUCTURES OVER 4'-0" IN DEPTH WITH
  STEPS 12" ON CENTERS IN ACCORDANCE WITH STD. NO. 840.66.
- WELDED WIRE FABRIC MAY BE SUBSTITUTED FOR REBAR IF
  THE SAME MIN. AREA OF STEEL IS PROVIDED.
- SEAL JOINTS WITH AN APPROVED SEALANT (SEE SECTION 840 OF NCDOT
  STANDARD SPECIFICATIONS).
- LIMIT MAXIMUM STRUCTURE SIZE INSIDE CLEAR DIMENSIONS
  TO 6'-0" X 6'-0".
- THE OUTSIDE PIPE DIAMETER PLUS 2" IS THE MINIMUM STRUCTURE
  SIZE OR THE OPENING REQUIRED FOR GRATE AND FRAME WHICHEVER
  IS GREATER.
- ROUND MANHOLE MAY BE USED IN LIEU OF SQUARE PROVIDED 2 EXTRA
  #5'S ARE PLACED ON EVERY SIDE NOT ADJACENT TO A WALL. SEE STD.
  DWG. 840.34 FOR MANHOLE INSTALLATION.
MINIMUM DIMENSIONS AND QUANTITIES FOR MANHOLE

<table>
<thead>
<tr>
<th>PIPE DIM.</th>
<th>CU. YDS. CONCRETE</th>
<th>TOTAL BRICK MASONRY</th>
<th>CU. YDS. BRICK MASONRY</th>
<th>DEDUCTIONS FOR ONE PIPE (CU. YDS.)</th>
</tr>
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<tbody>
<tr>
<td>D</td>
<td>BASE</td>
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<td>BELOW S-L</td>
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<td>0.323</td>
<td>0.020 0.032</td>
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<td>0.530</td>
<td>0.323</td>
<td>0.122 0.170</td>
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</table>
| 36"       | 0.560             | 0.530               | 0.323                  | 0.176 0.238                       

GENERAL NOTES:

MORTAR JOINTS 3/4" ± 3/8" THICK.
CONCAVE TOOL ALL EXPOSED JOINTS.
USE CLASS "B" CONCRETE THROUGHOUT.

USE FORMS TO CONSTRUCT THE BASE SLAB.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICK.
IF REINFORCED CONCRETE PIPE IS SET IN BASE SLAB OF BOX, ADD TO BASE AS SHOWN IN STD. NO. 840.00.
WHERE THE MANHOLE IS EXPOSED TO ROAD TRAFFIC, CONSTRUCT THE TOP OF THE MANHOLE FLUSH WITH THE GROUND. AT OTHER LOCATIONS CONSTRUCT A MINIMUM OF 9" ABOVE THE GROUND.

PROVIDE MANHOLES OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTERS IN ACCORDANCE WITH STD. NO. 840.66.

GENERAL NOTES:

MORTAR JOINTS ± 3/8" THICK.
CONCAVE TOOL ALL EXPOSED JOINTS.
USE CLASS "B" CONCRETE THROUGHOUT.

USE FORMS TO CONSTRUCT THE BASE SLAB.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICK.
IF REINFORCED CONCRETE PIPE IS SET IN BASE SLAB OF BOX, ADD TO BASE AS SHOWN IN STD. NO. 840.00.
WHERE THE MANHOLE IS EXPOSED TO ROAD TRAFFIC, CONSTRUCT THE TOP OF THE MANHOLE FLUSH WITH THE GROUND. AT OTHER LOCATIONS CONSTRUCT A MINIMUM OF 9" ABOVE THE GROUND.

PROVIDE MANHOLES OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTERS IN ACCORDANCE WITH STD. NO. 840.66.
**General Notes**

Use 4000 psi minimum compressive strength concrete.

Fabricate, assemble and design precast manhole components according to AASHTO M199.

Assemble riser and grade rings with the steps spaced 12" from the top to the bottom of the manhole.

Where the manhole is exposed to road traffic, construct the top of the manhole flush with the ground and a minimum of 9" above the ground at other locations.

Limit depth of fill to 30'-0" from finish grade to top of bottom slab.

The min. slab thickness 'T' is the dimension of the thinnest portion of the top/bottom slab.

*Top mat of reinforcement may be neglected if top slab has a distinguishable top and bottom.*

——

**Frame and Grates**

- BDL. NO.
- TRAFFIC REINFORCEMENT: 840.37
- NONTRAFFIC REINFORCEMENT: 840.32, 840.28, 840.20, 840.30

**Additional #4 Each**

- Side of opening (1")
- Clear of bottom face
- Place bars diagonal to corners (typ.)

**Frame & Grate**

- Use min. area of steel in top slab of #4's @ 8" cts.
- Each way/each face *.

**Locate Wall Reinforcement**

- In middle third of wall

**See Std. 840.54**

- For manhole ring and cover

**Use Min. Area of Steel**

- In base slab of 0.12 in² per linear foot each way

**Fabricate, Assemble and Design Precast Manhole Components**

- Use 4000 psi minimum compressive strength concrete.

**Dimensions**

- Internal Diameter (ft.): 4', 5', 6'
- Min. Wall Thickness (in.): 4, 5, 6
- Min. Top/Bottom Slab Thickness (in.): 6
- Min. Circumferential Area of Steel per Vertical Ft. (sq. in.): 0.12, 0.15, 0.18

**Notes**

- Assemble riser and grade rings with the steps spaced 12" from the top to the bottom of the manhole.
- Limit depth of fill to 30'-0" from finish grade to top of bottom slab.
- Construct the top of the manhole flush with the ground and a minimum of 9" above the ground at other locations.
- Where the manhole is exposed to road traffic, construct the top of the manhole flush with the ground and a minimum of 9" above the ground at other locations.
- Limit depth of fill to 30'-0" from finish grade to top of bottom slab.
- Min. slab thickness 'T' is the dimension of the thinnest portion of the top/bottom slab.
- Top mat of reinforcement may be neglected if top slab has a distinguishable top and bottom.
- Use min. area of steel in top slab of #4's @ 8" cts. each way/each face *.
PRECAST MANHOLE WITH MASONRY BASE

12'' THRU 42'' PIPE

ENGLISH STANDARD DRAWING FOR

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
RALEIGH, N.C.

DIMENSIONS

<table>
<thead>
<tr>
<th>PIPE DIM</th>
<th>BRICK HEIGHT</th>
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<tr>
<td>D</td>
<td>H1 (MIN)</td>
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<tr>
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<td>1-3/8</td>
</tr>
<tr>
<td>13''</td>
<td>1-5/8</td>
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<tr>
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<td>1-11/16</td>
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<td>2-7/8</td>
</tr>
<tr>
<td>42''</td>
<td>4-2/8</td>
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</table>

GENERAL NOTES:
- MORTAR JOINTS 1/4'' ± 1/8'' THICK.
- USE CLASS "B" CONCRETE THROUGHOUT.
- USE FORMS TO CONSTRUCT THE BASE SLAB.
- JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4'' SOLID CONCRETE BLOCK WILL BE USED IN LIEU OF CLAY BRICK.
- USE PRECAST MANHOLE COMPONENTS MEETING REQUIREMENTS OF STD.NO.840.52 AND AASHTO M199.
- FOR MANHOLE OVER 12' VERTICAL WALL DEPTH, CONSTRUCT BRICK MASONRY WALL 12'' THICK. FOR MANHOLES WITH A VERTICAL WALL DEPTH LESS THAN 12', CONSTRUCT BRICK MASONRY WALL 8'' THICK.
- ASSEMBLE RISERS AND GRADE RINGS WITH THE STEPS SPACED 12'' FROM THE TOP TO THE BOTTOM OF THE MANHOLE.
- WHERE THE MANHOLE IS EXPOSED TO ROAD TRAFFIC, CONSTRUCT THE TOP OF THE MANHOLE FLUSH WITH THE GROUND AND A MINIMUM OF 9'' ABOVE THE GROUND AT OTHER LOCATIONS
- IF REINFORCED CONCRETE PIPE IS SET IN BASE SLAB OF BOX, ADD TO BASE AS SHOWN IN STD. NO. 840.00.
MANHOLE FRAME AND COVER

ENGLISH STANDARD DRAWING FOR

40.54

STATE OF NORTH CAROLINA

DEPT. OF TRANSPORTATION

DIVISION OF HIGHWAYS

RALEIGH, N.C.

SOLID COVER SHOWN PERFORATED. PERFORATED AVAILABLE IF SPECIFIED.

STATE USE OF SYSTEM ON COVER

(I.E.: SEWER, STORM DRAIN, ELECTRICAL)

PLAN OF COVER

SECTION A-A

SECTION B-B

MINIMUM WEIGHTS - LBS.

FRAME - 180

COVER - 120

TOTAL - 300

TOP OF COVER

BOTTOM OF COVER

FRAME - 180

COVER - 120

TOTAL - 300
NOTES:
INSTALL ALL STEPS PROTRUDING 4" FROM INSIDE FACE OF STRUCTURE WALL.
STEPS DIFFERING IN DIMENSIONS, CONFIGURATION, OR MATERIALS FROM THOSE SHOWN MAY ALSO BE USED PROVIDED THE CONTRACTOR HAS FURNISHED THE ENGINEER WITH DETAILS OF THE PROPOSED STEPS AND HAS RECEIVED WRITTEN APPROVAL FROM THE ENGINEER FOR THE USE OF SUCH STEPS.
CONCRETE MAY BE USED. CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK. JUMBO BRICK WILL BE PERMITTED.

NOTE:

USE PAY LIMITS (C.Y.) FOR PIPE PLUGS 12" IN THICKNESS ONLY.

EITHER BRICK MASONRY OR CONCRETE MAY BE USED.
CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK. JUMBO BRICK WILL BE PERMITTED.
GENERAL NOTES:

USE PIPE COLLAR FOR EXTENDING EXISTING CONCRETE PIPE CULVERTS AT LOCATIONS SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER. THIS INCLUDES EXTENDING EXISTING PIPES WITH PIPES OF DIFFERENT MATERIALS.

CONSTRUCT THE PIPE COLLAR WITH CLASS "B" OR BETTER CONCRETE.

OBSERVE ALL REQUIREMENTS OF SECTION 840 OF THE STANDARD SPECIFICATIONS.

* USE 12 INCH DIAMETER VALUES FOR PIPE DIAMETERS LESS THAN 12 INCH.
GENERAL NOTES:
- PLACE CONTRACTION JOINTS AT 10' INTERVALS, EXCEPT THAT
A 15' SPACING MAY BE USED WHEN A MACHINE IS USED OR WHEN
SATISFACTORY SUPPORT FOR THE FACE FORM CAN BE OBTAINED
WITHOUT THE USE OF TEMPLATES AT 10' INTERVALS.
- JOINT SPACING MAY BE ALTERED IF REQUIRED BY THE ENGINEER.
- CONTRACTION JOINTS MAY BE INSTALLED WITH THE USE OF
TEMPLATES OR FORMED BY OTHER APPROVED METHODS.
- CONSTRUCT NON-TEMPLATE FORMED JOINTS A MIN. OF 1-1/2" DEEP.
- FILL ALL CONSTRUCTION JOINTS, EXCEPT IN 8"x6" MEDIAN CURB,
WITH JOINT FILLER AND SEALER.
- SPACE EXPANSION JOINTS AT 90' INTERVALS AND ADJACENT TO
ALL RIGID OBJECTS.

SECTION VIEW OF CURBS OR CURBS AND GUTTERS

FILL 3/8" x 1" DEEP
GROOVED OR SAWN
JOINT WITH JOINT
SEALER

LONGITUDINAL JOINT

SECTION VIEW OF JOINTS

TRANVERSE EXPANSION JOINT IN CURB AND GUTTER

EXPRESSWAY GUTTER

SHOULDER BERM GUTTER

8" X 12" OR 18"
CONCRETE CURB

9" X 12" OR 18"
CONCRETE CURB

8" X 6" MEDIAN CURB

VALLEY GUTTER

4'-0" MIN.
1'-0" RADIUS
8"
5"
SECTION VIEWS OF EXPRESSWAY GUTTER IN SUPER ELEVATION

SECTION VIEWS OF 2'-6" CURB AND GUTTER SUPERELEVATION RATES

DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-12

846.01

ENGLISH STANDARD DRAWING FOR CONCRETE CURB & GUTTER
AND CURB & GUTTER
CONCRETE CURB, GUTTER

PLAN VIEW OF TRANSITION
EXPRESSWAY GUTTER TO 2'-6" CURB AND GUTTER

PLAN VIEW OF TYPICAL CURB AND GUTTER OCCURRENCES

EXPRESSWAY GUTTER TO 2'-6" CURB AND GUTTER
TRANSITION
DRIVEWAY WITH 2'-6" CURB AND GUTTER

NOTES:
- IN THE TRANSITION FROM 4'-0" CONCRETE EXPRESSWAY GUTTER TO 2'-6" CONCRETE CURB AND GUTTER, PLACE 1/2" EXPANSION JOINTS AT 25' INTERVALS.
- PLACE GROOVE JOINTS 1" DEEP AT 12'-6" INTERVALS BETWEEN EXPANSION JOINTS.
- FILL AND SEAL THE TOP 1/2" OF THE EXPANSION JOINTS AND 1" OF CONTRACTION JOINTS WITH APPROVED JOINT SEALING COMPOUND.
DROP INLET INSTALLATION IN EXPRESSWAY GUTTER

GENERAL NOTES:
- PAY FOR TRANSITION SECTION AS CONCRETE EXPRESSWAY GUTTER.
- GUARDRAIL OPTIONAL

EARTH MATERIAL

OFFSET BLOCK

POST

MATTING FOR EROSION CONTROL

1" OFFSET FROM BACK OF CURB TO FACE OF GUARDRAIL POST.

FLOW LINE

OFFSET BLOCK

POST

EARTH MATERIAL

PIPE

SEE TYPICAL SECTION FOR SHOULDER COMPOSITION

SECTION X-X

TOTAL SHOULDER WIDTH

3'

SEE STD. 862.02 FOR GUARDRAIL POST AND OFFSET BLOCKS

EXPRESSWAY GUTTER

SEE STANDARD 846.01

FLOW LINE

RAIL

PERMISSIBLE CONSTRUCTION JOINT

5'-/-

5'-/-

5'-/-

15'-/- TRANSITION SECTION

PLAN

SEE STD.'S 840.20, 840.29 AND 840.37 FOR FRAME AND GRATE AS INDICATED BY THE ROADWAY PLANS.

TOP OF EXPRESSWAY GUTTER

FLOW LINE

SEE STD.'S 840.17, 840.18, 840.19, 840.26, 840.27, 840.28, 840.35 AND 840.36 FOR DROP INLETS AS INDICATED BY THE ROADWAY PLANS. BUILD DROP INLETS WITHOUT APRON.

SECTION Y-Y

DROP INLET

GUARDRAIL (STD. DWG. 862.01)

GUARDRAIL POST SPACING

6'-3"

6'-3"

6'-3"

PERMISSIBLE CONSTRUCTION JOINT

FLOW LINE

SEE STAND. 846.02 FOR GUARDRAIL POST AND OFFSET BLOCKS

EXPRESSWAY GUTTER

SEE STANDARD 846.01

FLOW LINE

RAIL

PERMISSIBLE CONSTRUCTION JOINT

5'-/-

5'-/-

5'-/-

15'-/- TRANSITION SECTION

PLAN

SEE STD.'S 840.20, 840.29 AND 840.37 FOR FRAME AND GRATE AS INDICATED BY THE ROADWAY PLANS.

TOP OF EXPRESSWAY GUTTER

FLOW LINE

SEE STD.'S 840.17, 840.18, 840.19, 840.26, 840.27, 840.28, 840.35 AND 840.36 FOR DROP INLETS AS INDICATED BY THE ROADWAY PLANS. BUILD DROP INLETS WITHOUT APRON.

SECTION Y-Y
GUIDE FOR PLACING FUNNELS IN MINIMUM LENGTHS OF SHOULDER BERM GUTTER

LENGTHS OF SHOULDER BERM GUTTER

25'-0" 'NESTED' GUARDRAIL (ONE RAIL INSIDE ANOTHER)

6'-3"
12'-6"
6'-3"

GUARDRAIL POST SPACING

SECTION Y-Y

FUNNEL INSTALLATION IN SHOULDER BERM GUTTER

FLOW LINE

FUNNEL DRAIN

SEE STD. 820.01 FOR METAL FUNNEL AND CONCRETE APRON

* CENTER FUNNEL DRAIN AND APRON IN THIS LOCATION.

'NESTED' GUARDRAIL (ONE RAIL INSIDE ANOTHER)

GUARDRAIL OFFSET BLOCK AND POST

SEE STD. 820.01 FOR POST AND OFFSET BLOCKS

SEE STD. 862.02 FOR POST AND OFFSET BLOCKS

* CENTER FUNNEL DRAIN AND APRON IN THIS LOCATION.

P.I.

(SAG VERTICAL CURVE)

P.I.

(CREST VERTICAL CURVE)
DRAIN ADJACENT TO GUARDRAIL

SECTION A-A
SHOULDER BERM WITH SHOULDER BERM GUTTER

SECTION B-B
SHOULDER BERM WITH MATTING FOR EROSION CONTROL

SHOULDER BERM, SHOULDER BERM GUTTER AND FUNNEL DRAIN ADJACENT TO GUARDRAIL
**PLAN**

CENTER DROP INLET IN THIS LOCATION.

- 5' - 5'-6" - 2' - 2' - 5' - 5'-6" - 50' - 5'-6" - 50' - 5'-6" - 2' - 5'-6" - 5'

**SECTION X-X**

- TOTAL SHOULDER WIDTHS

- 2'-4" MIN.

- 1" OFFSET FROM CURB TO FACE OF GUARDRAIL POST

- 2'-4" MIN.

**SECTION Y-Y**

- DROP INLET 3'-1½"

- TOP OF SHOULDER BERM GUTTER

- SEE TYPICAL SECTION FOR SHOULDER COMPOSITION

- SEE STD.'S 840.20, 840.26 AND 840.37 FOR FRAME AND GRATE AS INDICATED BY THE ROADWAY PLANS.

**GUIDE FOR PLACING DROP INLETS IN MINIMUM LENGTHS OF SHOULDER BERM GUTTER**

- (SAG VERTICAL CURVE)

- (CREST VERTICAL CURVE)

- GUARDRAIL POST SPACING

- GUARDRAIL (STD. DWG. 862.01)

- PIPE

- DROP INLET

- SEE TYPICAL SECTION FOR SHOULDER COMPOSITION

- SEE STD.'S 840.17, 840.18, 840.19, 840.26, 840.27, 840.28, 840.35 AND 840.36 FOR DROP INLETS AS INDICATED BY THE ROADWAY PLANS. BUILD DROP INLETS WITHOUT APRON.

**SHOULDER BERM GUTTER**

- METHOD OF INSTALLATION IN SHOULDER BERM GUTTER (SEE STD. NO. 846.01)

- SEE STD. 862.02 FOR GUARDRAIL POST AND OFFSET BLOCKS

- DETAIL, GRATE(S) AND DROP INLET (PLACE AND SEAL 1½" EXPANSION JOINT AROUND FRAME)

- SHOULDER BERM GUTTER (SEE STD. 840.26, 840.27, 840.28, 840.35 AND 840.36 FOR DROP INLETS AS INDICATED BY THE ROADWAY PLANS. BUILD DROP INLETS WITHOUT APRON.)

- SEE TYPICAL SECTION FOR SHOULDER COMPOSITION

- SEE STD.'S 840.20, 840.26 AND 840.37 FOR FRAME AND GRATE AS INDICATED BY THE ROADWAY PLANS.

- DROP INLET INSTALLATION IN SHOULDER BERM GUTTER
NOTES:

CONSTRUCT STANDARD SIDEWALK 5' WIDE AND 4" THICK UNLESS OTHERWISE DENOTED ON PLANS.

PLACE A GROOVE JOINT 1" DEEP WITH 3/8" RADII IN THE CONCRETE SIDEWALK AT 5' INTERVALS.

ONE 1/2" EXPANSION JOINT WILL BE REQUIRED AT 50' INTERVALS. A 3/2" EXPANSION JOINT WILL BE REQUIRED WHERE THE SIDEWALK JOINS ANY RIGID STRUCTURE.

SEE STD. DWG. 848.05 FOR WHEELCHAIR RAMP LOCATION REQUIREMENTS AND CONSTRUCTION GUIDELINES.

T = SIDEWALK THICKNESS

1/2" JOINT WIDTH

1/8" RAD

SURFACE OF SIDEWALK

JOINT SEALER

JOINT FILLER

TRANSVERSE EXPANSION JOINT IN SIDEWALK

FILL 3/8" WIDE X 1" DEEP GROOVED OR SAWN JOINT WITH JOINT SEALING COMPOUND

BUILDING, WALL, ETC.
METHOD OF TIE IN

WHEN EXISTING DRIVEWAY PAVEMENT IS CONCRETE,
SAW JOINT PERPENDICULAR TO EDGE OF EXISTING
DRIVEWAY PAVEMENT.

BUILD THIS PORTION OF DRIVEWAY PAVEMENT
ONLY AT LOCATIONS WHEN DIRECTED.

*SIDEWALK TAPERS DOWN
5' BACK FROM DRIVEWAY.

DETAIL OF DRIVEWAY

PLAN

SECTION C-C

1-12

RADIUS 3'-0" OR AS SHOWN ON PLANS

BETWEEN THESE LIMITS
DISSIPATE CURB

GRASS AREA

CUBB

GUTTER

STREET PAVEMENT

METHOD OF TIE IN

SAW JOINT PERPENDICULAR TO EDGE OF EXISTING
DRIVEWAY PAVEMENT.

BUILD THIS PORTION OF DRIVEWAY PAVEMENT
ONLY AT LOCATIONS WHEN DIRECTED.

*SIDEWALK TAPERS DOWN
5' BACK FROM DRIVEWAY.

DETAIL OF DRIVEWAY

PLAN

SECTION C-C

1-12

RADIUS 3'-0" OR AS SHOWN ON PLANS

BETWEEN THESE LIMITS
DISSIPATE CURB

GRASS AREA

CUBB

GUTTER

STREET PAVEMENT
DESIRABLE DRIVEWAY GRADES

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<tr>
<th>BERM WIDTH</th>
<th>A</th>
<th>B</th>
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<tr>
<td>8' OR LESS</td>
<td>2'-0&quot;</td>
<td>5'-0&quot;</td>
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<tr>
<td>2'-6&quot;</td>
<td>+4%</td>
<td>+2%</td>
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<tr>
<td>5'-0&quot;</td>
<td>-8%</td>
<td>-2%</td>
</tr>
<tr>
<td>5'-6&quot;</td>
<td>-15%</td>
<td>-15%</td>
</tr>
<tr>
<td>+15%</td>
<td>+15%</td>
<td></td>
</tr>
<tr>
<td>-15%</td>
<td>-15%</td>
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MAXIMUM DRIVEWAY GRADES

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<th>A</th>
<th>B</th>
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<td>2'-6&quot;</td>
<td>+2%</td>
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</tr>
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<td>2'-0&quot;</td>
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<td>-15%</td>
<td>-15%</td>
<td></td>
</tr>
<tr>
<td>+15%</td>
<td>+15%</td>
<td></td>
</tr>
</tbody>
</table>

SIDEWALK LOCATION
(Do not place sidewalk on berms less than 6' wide.)
**METHOD OF TIE IN**

When existing driveway pavement is concrete, saw cut 2" deep joint at the point of tie-in. Saw joint perpendicular to edge of existing driveway pavement.

**GENERAL NOTES:**

*No construction joint will be permitted if forms are used to cast driveway. Slip forming of curb and gutter permits the use of construction joint.*
PARTIAL PLAN OF PAVED STREET TURNOUT

USE ON PROPOSED AND EXISTING STREET INTERSECTIONS OR MAJOR TYPE COMMERCIAL ENTRANCES.
ISOMETRIC VIEW

NOTES:
1. DETECTABLE WARNING DOMES WILL COVER 2'-0" LENGTH AND FULL WIDTH OF THE RAMP FLOOR AS SHOWN ON THE DETAILS.
2. DETECTABLE WARNING DOMES WILL CONTRAST VISIBILITY WITH ADJOINING SURFACE, EITHER LIGHT-ON-DARK, OR DARK-ON-LIGHT SEQUENCE COVERING THE ENTIRE RAMP.

SECTION A-A

SECTION B-B

PLAN VIEW

DUAL RAMPS ANY RADII
(4' MIN. FLOOR WIDTH)

WARNING DOMES
2'-0" LENGTH AND FULL WIDTH OF THE SIDEWALK

NOTE: A PORTION OF ONE OR BOTH RAMPS MUST FALL WITHIN CROSSWALK LIMITS.
(SEE NOTE 10)

NOTE: A PORTION OF ONE OR BOTH RAMPS MAY EXTEND OUTSIDE THE RETURN.

DETECTABLE WARNING DOMES

RAMP WIDTH AREA IS VARIABLE

PAY LIMITS FOR CURB RAMP

B = (A+9")
B = DISTANCE FROM FRONT EDGE OF SIDEWALK TO BACK POINT OF 12:1 (8.33%) SLOPE.
* BACK OF SIDEWALK DROP REQUIRED FOR ALL SIDEWALK SLOPES.
** BACK OF SIDEWALK DROP REQUIRED FOR SIDEWALK SLOPES 0.04.

BASE DIAMETER
0.00' TO 1.40' R
TOP DIAMETER OF NO LESS THAN 50% TO NO MORE THAN 65% OF THE BASE DIAMETER

TRANSITION CURB 5' MIN.
TRANSITION CURB 5' MIN.

EXPANSION JOINT (SEE STD. 848.01)
EXPANSION JOINT (SEE STD. 848.01)

LANDING 4' X 4'
LANDING 4' X 4'

SEE NOTES 2, 12 & 14

NOTE:  A PORTION OF ONE OR BOTH RAMPS MUST FALL WITHIN CROSSWALK LIMITS.
(SEE NOTE 10)

DETECTABLE WARNING DOMES WILL CONTRAST VISIBILITY WITH ADJOINING SURFACE, EITHER LIGHT-ON-DARK, OR DARK-ON-LIGHT SEQUENCE COVERING THE ENTIRE RAMP.

NOTE: A PORTION OF ONE OR BOTH RAMPS MAY EXTEND OUTSIDE THE RETURN.

WARNING DOMES
2'-0" LENGTH AND FULL WIDTH OF THE SIDEWALK

NOTE: A PORTION OF ONE OR BOTH RAMPS MUST FALL WITHIN CROSSWALK LIMITS.
(SEE NOTE 10)

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WARNING DOMES
2'-0" LENGTH AND FULL WIDTH OF THE SIDEWALK

NOTE: A PORTION OF ONE OR BOTH RAMPS MUST FALL WITHIN CROSSWALK LIMITS.
(SEE NOTE 10)

NOTE: A PORTION OF ONE OR BOTH RAMPS MAY EXTEND OUTSIDE THE RETURN.
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
CURB RAMP AND GUTTER

DETAIL SHOWING TYPICAL LOCATION OF CURB RAMPS, PEDESTRIAN CROSSWALKS AND STOP LINES FOR TEE INTERSECTIONS

PROPOSED CURB RAMP W/ LANDING
PROPOSED OR FUTURE CURB RAMP
ALLOWSABLE LOCATIONS
DUAL RAMP RADII

SEE NOTE 10
SEE NOTE 12
SEE NOTE 4
SEE NOTE 10
NOTES:
1. CONSTRUCT THE RAMP SURFACE TO BE STABLE, FIRM, AND SLIP RESISTANT. CONSTRUCT THE CURB RAMP TYPE AS SHOWN IN THE PAVEMENT MARKING PLANS OR AS DIRECTED BY THE ENGINEER.

2. LOCATE CURB RAMPS AND PLACE PEDESTRIAN CROSSWALK MARKINGS AS SHOWN IN THE PAVEMENT MARKING PLANS. WHEN FIELD ADJUSTMENTS REQUIRE MOVING CURB RAMPS OR MARKINGS AS SHOWN, CONTACT THE SIGNING AND DELINEATION UNIT OR LOCATE AS DIRECTED BY THE ENGINEER.

3. COORDINATE THE CURB RAMP AND THE PEDESTRIAN CROSSWALK MARKINGS SO A 4'x4' CLEAR SPACE AT THE BASE OF THE CURB RAMP WILL FALL WITHIN THE PEDESTRIAN CROSSWALK LINES.

4. SET BACK DISTANCE FROM INSIDE CROSSWALK MARKING TO NEAREST EDGE OF TRAVEL LANE IS 4' MINIMUM.

5. REFER TO THE PAVEMENT MARKING PLANS FOR STOP BAR LOCATIONS AT SIGNALIZED INTERSECTIONS. IF A PAVEMENT MARKING PLAN IS NOT PROVIDED, CONTACT THE SIGNAL DESIGN SECTION FOR THE STOP BAR LOCATIONS OR LOCATE AS DIRECTED BY THE ENGINEER.

6. TERMINATE PARKING A MINIMUM OF 20' BACK OF A PEDESTRIAN CROSSWALK.

7. CONSTRUCT CURB RAMPS A MINIMUM OF 4' WIDE.

8. CONSTRUCT THE RUNNING SLOPE OF THE RAMP 8.33% MAXIMUM.

9. ALLOWABLE CROSS SLOPE ON SIDEWALKS AND CURB RAMPS WILL BE 2% MAXIMUM.

10. CONSTRUCT THE SIDE FLARE SLOPE A MAXIMUM OF 10% MEASURED ALONG THE CURB LINE.

11. CONSTRUCT THE COUNTER SLOPE OF THE GUTTER OR STREET AT THE BASE OF THE CURB RAMP A MAXIMUM OF 5% AND MAINTAIN A SMOOTH TRANSITION.

12. CONSTRUCT LANDINGS FOR SIDEWALK A MINIMUM OF 4'x4' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION. CONSTRUCT LANDINGS FOR MEDIAN ISLANDS A MINIMUM OF 5'x5' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION.

13. TO USE A MEDIAN ISLAND AS A PEDESTRIAN REFUGE AREA, MEDIAN ISLANDS WILL BE A MINIMUM OF 6' WIDE. CONSTRUCT MEDIAN ISLANDS TO PROVIDE PASSAGE OVER OR THROUGH THE ISLAND.

14. SMALL CHANNELIZATION ISLANDS THAT CAN NOT PROVIDE A 5'x5' LANDING AT THE TOP OF A RAMPS, WILL BE CUT THROUGH LEVEL WITH THE SURFACE STREET.

15. CURB RAMPS WITH RETURNED CURBS MAY BE USED ONLY WHERE PEDESTRIANS WOULD NOT NORMALLY WALK ACROSS THE RAMP. THE ADJACENT SURFACE IS PLANTING OR OTHER NON-WALKING SURFACE OR THE SIDE APPROACH IS SUBSTANTIALLY OBSTRUCTED.

16. PLACE A ½" EXPANSION JOINT WHERE THE CONCRETE CURB RAMP JOINS THE CURB AS SHOWN IN ROADWAY STANDARD DRAWING 848.01.

17. PLACE ALL PEDESTRIAN PUSH BUTTON ACTUATORS AND CROSSING SIGNALS AS SHOWN IN THE PLANS OR AS SHOWN IN THE MUTCD.

18. CURB RAMPS THROUGH MEDIAN ISLANDS, SINGLE RAMPS AT DUAL CROSSWALKS OR LIMITED R/W SITUATIONS, WILL BE HANDLED BY SPECIAL DETAILS. CONTACT THE CONTRACT STANDARDS AND DEVELOPMENT UNIT FOR THE DETAILS OR FOR A SPECIAL DESIGN.
Curb Ramp and Existing Sidewalk with Grass Strip

Isometric View

Detectable Warning Domes

Ramp Width Area is Variable

Base Diameter: 0.083 to 1.40
Top Diameter: No less than 50% to no more than 65% of the base diameter

Pay Limits of Curb Ramp

Plan View

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

Section A-A

Section B-B

10:1

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.

Drop Curb

Expansion Joint

Sidewalk Transition

Grass Existing Strip

Sidewalk Transitions

Existing Curb and Gutters

Detachable Warning Domes

Pay Limits

Covering the Entire Ramp.

Obtain Visible Contrast with Adjoining Surface.

Either Light-On-Dark, or Dark-On-Light Sequence.

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface: either light-on-dark, or dark-on-light sequence covering the entire ramp.

See Note 1

See Notes 2, 9 & 14

Crosswalk Limits.

Must fall within crosswalk limits.

2'-0" Length.

Pay Limits of Curb Ramp.
Curb ramps and existing sidewalk adjacent to curb

Isometric View

Pay limits of curb ramp

Ramp width area is variable

Base diameter: 0.80" to 1.00" R
Top diameter of no less than 50% to no more than 85% of the base diameter

Notes:
1. Place detectable warning domes to cover 3'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface, either light-on-dark, or dark-on-light sequence covering the entire ramp.

Detectable warning domes

Plan View

Dual ramps (any radii)
(40" min. floor width)

Section B-B

Section A-A

Notes:
2, 9 & 14 SEE NOTES
SEE NOTE 10

WARNING DOMES 2' DETECTABLE

Pay limits of curb ramp

RAMP WIDTH AREA IS VARIABLE

BASE DIAMETER
0.80" TO 1.0" R
TOP DIAMETER OF NO LESS THAN 50% TO NO MORE THAN 85% OF THE BASE DIAMETER

2'-0" LENGTH

MIN. 4' CURB RAMP
AND EXISTING SIDEWALK
RETROFITTED CURB RAMP AND EXISTING SIDEWALK

EXPANSION JOINT (SEE STD. 846.01)

MIN. DROP CURB
EXISTING CURB & GUTTER SHOWN

EXISTING CURB AND GUTTER
Retrofitting detectable warning domes onto existing curb ramp

Isometric view

Plan view

Detectable warning domes

Notes:
1. Place detectable warning domes to cover 2'-0" length and full width of the ramp floor as shown on the details.
2. Obtain visible contrast with adjoining surface, either light-on-dark, or dark-on-light sequence covering the entire ramp.

Base diameter: 0.80" R to 1.40" R
Top diameter of no less than 50% to no more than 50% of the base diameter

Length: 2'-0"

Ramp width area is variable

Pay limits of retrofit curb ramp

This portion of ramp must fall within crosswalk limits.

(See note 10)

Notes:
1. Retrofitting detectable warning domes on existing curb ramp.

Elevation

Side and existing sidewalk

Warning domes

Proposed detectable warning domes

Section A-A

Section B-B

Min. drop curb

Drop curb
Curb Ramps and Existing Sidewalk

Detail showing typical location of curb ramps, pedestrian crosswalks and stop lines for TEE intersections.

Resurfacing Projects

- Proposed curb ramp w/ landing for resurfacing projects
- Existing sidewalk

Allowable locations:
- Dual ramp radii
- Any
CURB RAMP AND EXISTING SIDEWALK

NOTES:

1. CONSTRUCT THE RAMP SURFACE TO BE STABLE, FIRM, AND SLIP RESISTANT. CONSTRUCT THE CURB RAMP TYPE AS SHOWN IN THE PAVEMENT MARKING PLANS OR AS DIRECTED BY THE ENGINEER.

2. LOCATE CURB RAMPS AND PLACE PEDESTRIAN CROSSWALK MARKINGS AS SHOWN IN THE PAVEMENT MARKING PLANS. WHEN FIELD ADJUSTMENTS REQUIRE MOVING CURB RAMPS OR MARKINGS AS SHOWN, CONTACT THE SIGNING AND DELINEATION UNIT OR LOCATE AS DIRECTED BY THE ENGINEER.

3. OR COORDINATE THE CURB RAMP AND THE PEDESTRIAN CROSSWALK MARKINGS SO A 4'x4' CLEAR SPACE AT THE BASE OF THE CURB RAMP WILL FALL WITHIN THE PEDESTRIAN CROSSWALK LINES.

4. SET BACK DISTANCE FROM INSIDE CROSSWALK MARKING TO NEAREST EDGE OF TRAVEL LANE IS 4' MINIMUM.

5. REFER TO THE PAVEMENT MARKING PLANS FOR STOP BAR LOCATIONS AT SIGNALIZED INTERSECTIONS. IF A PAVEMENT MARKING PLAN IS NOT PROVIDED, CONTACT THE SIGNAL DESIGN SECTION FOR THE STOP BAR LOCATIONS OR LOCATE AS DIRECTED BY THE ENGINEER.

6. TERMINATE PARKING A MINIMUM OF 20' BACK OF A PEDESTRIAN CROSSWALK.

7. CONSTRUCT CURB RAMPS A MINIMUM OF 4' WIDE.

8. CONSTRUCT THE RUNNING SLOPE OF THE RAMP 8.33% MAXIMUM.

9. ALLOWABLE CROSS SLOPE ON SIDEWALKS AND CURB RAMPS WILL BE 2% MAXIMUM.

10. CONSTRUCT THE SIDE FLARE SLOPE A MAXIMUM OF 10% MEASURED ALONG THE CURB LINE.

11. OR CONSTRUCT THE COUNTER SLOPE OF THE GUTTER OR STREET AT THE BASE OF THE CURB RAMP A MAXIMUM OF 5% AND MAINTAIN A SMOOTH TRANSITION.

12. CONSTRUCT LANDINGS FOR SIDEWALK A MINIMUM OF 4'x4' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION. CONSTRUCT LANDINGS FOR MEDIAN ISLANDS A MINIMUM OF 5'x5' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION.

13. OR CONSTRUCT LANDINGS FOR SIDEWALK A MINIMUM OF 4'x4' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION. CONSTRUCT LANDINGS FOR MEDIAN ISLANDS A MINIMUM OF 5'x5' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION.

14. OR CONSTRUCT LANDINGS FOR SIDEWALK A MINIMUM OF 4'x4' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION. CONSTRUCT LANDINGS FOR MEDIAN ISLANDS A MINIMUM OF 5'x5' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION.

15. OR USE A MEDIAN ISLAND AS A PEDESTRIAN REFUGE AREA, MEDIAN ISLANDS WILL BE A MINIMUM OF 6' WIDE. OR CONSTRUCT MEDIAN ISLANDS TO PROVIDE PASSAGE OVER OR THROUGH THE ISLAND.

16. OR SMALL CHANNELIZATION ISLANDS THAT CAN NOT PROVIDE A 5'x5' LANDING AT THE TOP OF A RAMPS, WILL BE CUT THROUGH LEVEL WITH THE SURFACE STREET.

17. OR CURB RAMPS WITH RETURNED CURBS MAY BE USED ONLY WHERE PEDESTRIANS WOULD NOT NORMALLY WALK ACROSS THE RAMP. THE ADJACENT SURFACE IS PLANTING OR OTHER NON-WALKING SURFACE OR THE SIDE APPROACH IS SUBSTANTIALLY OBSTRUCTED.

18. OR PLACE A ½" EXPANSION JOINT WHERE THE CONCRETE CURB RAMP JOINS THE CURB AS SHOWN IN ROADWAY STANDARD DRAWING 848.01.

19. OR PLACE ALL PEDESTRIAN PUSH BUTTON ACTUATORS AND CROSSING SIGNALS AS SHOWN IN THE PLANS OR AS SHOWN IN THE MUTCD.

20. OR CURB RAMPS THROUGH MEDIAN ISLANDS, SINGLE RAMPS AT DUAL CROSSWALKS OR LIMITED R/W SITUATIONS, WILL BE HANDLED BY SPECIAL DETAILS. CONTACT THE CONTRACT STANDARDS AND DEVELOPMENT UNIT FOR THE DETAILS OR FOR A SPECIAL DESIGN.
GENERAL NOTES:

IN THE 4" CONC. PAVED DITCHES, PLACE 1/2" EXPANSION JOINTS AT 30' INTERVALS AND AT ALL OTHER POINTS WHERE PROPOSED DITCHES ABUT RIGID OBJECTS. PLACED GROOVED JOINTS 1" DEEP AT 10' INTERVALS BETWEEN EXPANSION JOINTS.

CONSTRICT WIDTH AND SHAPE OF PROPOSED 4" CONCRETE PAVED DITCHES AS SHOWN OR AS DIRECTED BY THE ENGINEER.

FOR DITCH GRADES ABOVE 2% EROSION CONTROL, INSTALL MATTING ON BOTH SIDES OF THE PAVING FOR A MINIMUM WIDTH OF 36" OR AS DIRECTED BY THE ENGINEER.

CONSTRUCT WIDTH AND SHAPE OF PROPOSED 4" CONCRETE PAVED DITCHES AS SHOWN OR AS DIRECTED BY THE ENGINEER.

SHOWING GROOVED JOINT
SHOWING EXPANSION JOINT

PART LONGITUDINAL SECTION OF PAVED DITCH
SHOWING 1'-6" CURTAIN WALL REQUIRED AT EACH END

* WHEN CURTAIN WALL FOR PAVED DITCH IS LOCATED ADJACENT TO A DRAINAGE STRUCTURE AND THE PIPE FROM THE STRUCTURE INTERFERES WITH THE 1'-6" DEPTH, THE DEPTH OF THE CURTAIN WALL MAY BE REDUCED BELOW 1'-6" TO CLEAR THE TOP OF THE PIPE.
GENERAL NOTES:
WHERE NECESSARY, ELBOWS MAY BE USED TO SKEW PIPE TO FIT INLETS WHERE THERE IS OFFSET BETWEEN THE INLET END AT BERM AND THE D.I.

LENGTH OF PAVED DITCH AS DIRECTED BY THE ENGINEER (5'-0" MIN.)

GROUND LINE

ROADWAY DITCH SLOPE

ELEVATION FOR SLOPE GREATER THAN 3:1

ELEVATION FOR SLOPE 3:1 OR LESS
GENERAL NOTES:
WHERE NECESSARY, ELBOWS MAY BE USED TO SKIN PIPE 
TO FIT INLETS WHERE THERE IS OFFSET BETWEEN THE INLET END AT BERM AND THE D.I.

LENGTH OF PAVED DITCH AS DIRECTED 
BY THE ENGINEER (0' MIN.)

C.S. ELBOW MAY BE USED WHEN 
SLOPE IS STEEPER THAN 3:1

C.S. PIPE

GROUND LINE

SECTION B-B

SECTION A-A

ELEVATION
**5" MONOLITHIC CONCRETE ISLAND (SURFACE MOUNTED)**

*ON ASPHALT CONCRETE PAVEMENT*

(USE ON ISLAND 4' WIDE OR GREATER)

**5" MONOLITHIC CONCRETE ISLAND (KEYED IN)**

*ON ASPHALT CONCRETE PAVEMENT*

(USE ON ISLAND LESS THAN 4' WIDE)

**PARTIAL LONGITUDINAL SECTIONS OF PAVED ISLANDS**

**NOTE:**

WHEN MONOLITHIC CONCRETE ISLAND IS ON TOP OF SURFACE COURSE, DRIVE 40d SPIKES INTO SURFACE UNDER MONOLITHIC CONCRETE ISLAND. STAGGER SPIKES ON 2' CENTERS EACH WAY.

IN THE CONCRETE PAVEMENT (ISLAND) AND CONCRETE ISLAND (MONOLITHIC) PLACE ½" EXPANSION JOINTS AT 30' INTERVALS AND GROOVED JOINTS 1" DEEP AT 10' INTERVALS BETWEEN EXPANSION JOINTS.

LINE UP THE JOINTS IN THE CONCRETE PAVEMENT (ISLAND) WITH THE JOINTS IN THE CURB OR CURB AND GUTTER. FILL AND SEAL THE TOP ½" OF THE EXPANSION JOINTS AND THE ENTIRE DEPTH OF GROOVED JOINTS WITH JOINT SEALER.

FOR JOINTS IN THE CURB AND/OR CURB AND GUTTER, SEE STANDARD NO. 846.01

**SHOWING EXPANSION JOINT**

**SHOWING GROOVED JOINT**

**CURB AND GUTTER AS CALLED FOR ON PLANS.**

**SURFACING**

**PAVED CONCRETE ISLAND**
GENERAL NOTES:
PLACE 1/2" EXPANSION JOINTS AT 30' INTERVALS AND AT ALL OTHER POINTS WHERE PROPOSED MEDIAN ABUTS RIGID OBJECTS. PLACE GROOVED JOINTS 1/2" DEEP AT 10' INTERVALS BETWEEN EXPANSION JOINTS. FILL THE TOP 1/2" OF EXPANSION JOINTS AND 1/2" GROOVED JOINTS WITH JOINT SEALER.

DETAIL - A

TRANSVERSE SECTION FOR CONCRETE PAVEMENT

TRANSVERSE SECTION FOR FLEXIBLE PAVEMENT

PART LONGITUDINAL SECTIONS OF CONCRETE MEDIAN
NOTES:
REFER TO STD. NO. 840.14 AND 840.15 FOR DRAINAGE STRUCTURE.

CONSTRUCT THE CURB FACE AT THE SAME SLOPE AS FACE OF 1'-6" CURB & GUTTER (STD. 846.01)

EARTH MATERIAL WITH GRASS COVER

6'-0" F.F. MIN.
1'-6" CURB & GUTTER

CONCRETE TRANSITIONAL SECTION FOR DROP INLETS

WATER FLOW

PAY LIMITS FOR

3'-6" MIN.

1 1/4" EXPANSION JOINT

1'-6" CURB & GUTTER

EARTH MATERIAL WITH GRASS COVER

WATER FLOW

PAY LIMITS FOR

9" VAR.

6'-0" MIN.

3"

1'-6" CURB & GUTTER

1/4" EXPANSION JOINT

DRAINAGE STRUCTURE.
REFER TO STD. NO. 840.14 AND 840.15 FOR NOTES:

(U.SING 1'-6" CURB & GUTTER)
DROP INLETS IN CONCRETE ISLANDS

METHOD FOR PLACEMENT OF

DRAINAGE STRUCTURE.

NOTES:
- REFER TO STD. NO. 840.14 AND 840.15 FOR DRAINAGE STRUCTURE.
- REFER TO STD. NO. 840.16 FOR GRATE AND FRAME.
4" CONCRETE COVER

VARIABLE GRADE SEPARATIONS

NOTE: SLOPE MEDIANS WIDTHS 10'-0" AND OVER FROM CENTERLINE OF MEDIANS TO BACK OF EACH CONCRETE CURB.

NOTE: GRASS ISLAND CONSTRUCTION MAY BE APPLICABLE AS DIRECTED BY THE ENGINEER.
DOUBLE FACED CONCRETE BARRIER
TYPES I, II, III & IV

SECTION X-X
TYPE I - GLARE SCREEN PERMITTED

SECTION X-X
TYPE III - NO GLARE SCREEN PERMITTED

SECTION X-X
TYPE II - GLARE SCREEN PERMITTED

SECTION X-X
TYPE IV - NO GLARE SCREEN PERMITTED

NOTE:
REFER TO PLAN SHEET AND/OR TYPICAL SECTIONS FOR PROPER BARRIER ORIENTATION.

*THE 2" DIMENSION FROM FINISH GRADE TO THE BASE IS A MINIMUM DIMENSION.
REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH.

GENERAL NOTES:
CONSTRUCT CONCRETE BARRIER OF CLASS ‘AA’ CONCRETE. (SEE SPECIFICATIONS SECTION 854).
CONSTRUCT EXPANSION AND CONTRACTION JOINTS AS SHOWN ON SHEET 2.
SEAL EXPANSION JOINTS WITH JOINT FILLER. (SEE SECTION 1028 OF THE SPECIFICATIONS).
SUBMIT ALTERNATIVE METHODS FOR STEEL FABRICATION PLACEMENT FOR REVIEW.

DOUBLE FACED CONCRETE BARRIER
TYPES I, II, III & IV

SECTION X-X
TYPE III - NO GLARE SCREEN PERMITTED

SECTION X-X
TYPE IV - NO GLARE SCREEN PERMITTED

NOTE:
REFER TO PLAN SHEET AND/OR TYPICAL SECTIONS FOR PROPER BARRIER ORIENTATION.

*THE 2" DIMENSION FROM FINISH GRADE TO THE BASE IS A MINIMUM DIMENSION.
REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH.

GENERAL NOTES:
CONSTRUCT CONCRETE BARRIER OF CLASS ‘AA’ CONCRETE. (SEE SPECIFICATIONS SECTION 854).
CONSTRUCT EXPANSION AND CONTRACTION JOINTS AS SHOWN ON SHEET 2.
SEAL EXPANSION JOINTS WITH JOINT FILLER. (SEE SECTION 1028 OF THE SPECIFICATIONS).
SUBMIT ALTERNATIVE METHODS FOR STEEL FABRICATION PLACEMENT FOR REVIEW.
TOP PLAN VIEW

CONTRACTED JOINTS

EXPANSION JOINT

INSET "A"

SHOWING RADII AND BEVEL

INSET "B"

SHOWING RADII

NOTES:
SEE SHEET 1 FOR GENERAL NOTES.
SEE SHEETS 3 THRU 4 FOR STEEL LAYOUT OF BARRIERS.
SEE GLARE SCREEN DETAIL FOR TYPES I & II.
NO GLARE SCREEN ALLOWED WITH TYPES III & IV.

** THE 2" DIMENSION FROM FINISH GRADE TO THE BASE IS A MINIMUM DIMENSION. REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH.
** TYPE II AND III BARRIERS BASE MAY BE INCREASED BY A MAXIMUM OF 3/4" INCHES.
DOUBLE FACED CONCRETE BARRIER

ELEVATION VIEW

SECTION VIEW

TYPE IV
2'-0" BASE

TYPE I
2'-6" BASE

ELEVATION VIEW

SECTION VIEW

NOTES:
1. EVENLY SPACE HORIZONTAL REBAR 8"±1" UNLESS OTHERWISE NOTED.
2. USE #4 BAR FOR HORIZONTAL STEEL AND #4 OR #5 BAR FOR THE VERTICAL CAGE.
3. SUBMIT CHANGES IN STEEL PLACEMENT OR SIZE TO THE ENGINEER.
4. USE SPLICE LENGTHS EQUAL TO 20 TIMES THE DIAMETER OF THE BAR.
* REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH. DIMENSIONS SHOWN ARE BASED ON A 2" MIN. KEY-IN DEPTH.

STEEL PLACEMENT FOR CAST-IN-PLACE OR SLIP-FORM CONCRETE BARRIER
DOUBLE FACED CONCRETE BARRIER

TYPE III
MIN. 2'-0" BASE

TYPE II
MIN. 2'-6" BASE

NOTES:
1. EVENLY SPACE HORIZONTAL REBAR 8"±1" UNLESS OTHERWISE NOTED.
2. USE #4 BAR HORIZONTAL STEEL AND #4 OR #5 FOR VERTICAL CAGE.
3. SUBMIT CHANGES IN STEEL PLACEMENT OR SIZE TO THE ENGINEER.
4. USE SPLICE LENGTHS EQUAL TO 20 TIMES THE DIAMETER OF THE BAR.
* REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH.
DIMENSIONS SHOWN ARE BASED ON A 2" MIN. KEY-IN DEPTH.
NOTE:
REFER TO PLAN SHEET AND/OR TYPICAL SECTIONS FOR PROPER BARRIER ORIENTATION.

*THE 2" OR 5" DIMENSION FROM FINISH GRADE TO THE BASE IS A MINIMUM DIMENSION. REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH.

GENERAL NOTES:
CONSTRUCT CONCRETE BARRIER OF CLASS 'AA' CONCRETE. (SEE SECTION 854 OF SPECIFICATIONS).

CONSTRUCT EXPANSION AND CONTRACTION JOINTS AS SHOWN ON SHEET 2.

SEAL ALL EXPANSION JOINTS WITH JOINT FILLER. (SEE SECTION 1028 OF THE SPECIFICATIONS).
SUBMIT ALTERNATIVE METHODS FOR STEEL FABRICATION TO THE ENGINEER.
DOUBLE FACED CONCRETE BARRIER

INSET "A"

SHOWING RADII AND BEVEL

INSET "B"

SHOWING RADII

NOTES:

- SEE SHEET 1 FOR GENERAL NOTES.
- SEE SHEETS 3 THRU 4 FOR STEEL LAYOUT OF BARRIERS.

* THE 2" AND 5" DIMENSION FROM FINISH GRADE TO THE BASE IS A MINIMUM DIMENSION. REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH.
DOUBLE FACED CONCRETE BARRIER

ELEVATION VIEW

SECTION VIEW

TYPE T

STEEL PLACEMENT FOR CAST-IN-PLACE OR SLIP-FORM CONCRETE BARRIER

NOTES:
1. EVENLY SPACE HORIZONTAL REBAR 8"±1" UNLESS OTHERWISE NOTED.
2. USE #5 BAR FOR HORIZONTAL STEEL AND #5 BAR FOR VERTICAL CAGE.
3. SUBMIT CHANGES IN STEEL PLACEMENT OR SIZE TO THE ENGINEER.
4. USE SPLICE LENGTHS EQUAL TO 20 TIMES THE DIAMETER OF THE BAR.
* REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH. DIMENSIONS SHOWN ARE BASED ON A MIN. KEY-IN DEPTH.
**DOUBLE FACED CONCRETE BARRIER**

**TYPE-T2**

1. EVENLY SPACE HORIZONTAL REBAR 8"±1" UNLESS OTHERWISE NOTED.
2. USE #5 BAR FOR HORIZONTAL STEEL AND #5 BAR FOR THE VERTICAL CAGE.
3. SUBMIT CHANGES IN STEEL PLACEMENT OR SIZE TO THE ENGINEER.
4. USE SPLICE LENGTHS EQUAL TO 20 TIMES THE DIAMETER OF THE BAR.

* REFER TO PLAN TYPICAL SECTIONS AND PAVEMENT SCHEDULE TO DETERMINE KEY-IN DEPTH. DIMENSIONS SHOWN ARE BASED ON A MIN. KEY-IN DEPTH.

STEEL PLACEMENT FOR CAST-IN-PLACE OR SLIP-FORM CONCRETE BARRIER
PLAN OF CONNECTION

CONNECTOR PIN ASSEMBLY

PART ELEVATION OF LIFT SLOT

1-1/4" PIN

PLAIN GALVANIZED STEEL WASHER FOR 1-1/4" PIN

CONNECTOR PIN

ELEVATION OF CONNECTION

PLAN OF CONNECTION
CONCRETE MEDIAN TRANSITION BARRIER

LEFT HAND TRANSITION

CENTER TRANSITION

RIGHT HAND TRANSITION

NOTE:
SEE PLAN TYPICAL SECTIONS TO
DETERMINE SECTION VIEW DIRECTION.

INSET "A"
SHOwing RAdII AND BEVEL

1-12

DEPT. OF TRANSPORTATION

STATE OF NORTH CAROLINA

DEPT. OF TRANSPORTATION

DEPT. OF TRANSPORTATION

STATE OF NORTH CAROLINA

DEPT. OF TRANSPORTATION
DOUBLE FACE TRANSITION BARRIER
(NO GLARE SCREEN PERMITTED)

NOTES:
1. EVENLY SPACE HORIZONTAL REBAR 8”±1” UNLESS OTHERWISE NOTED.
2. USE #4 BAR FOR HORIZONTAL STEEL AND #4 OR #5 BAR FOR THE VERTICAL CAGE.
3. SUBMIT CHANGES IN STEEL PLACEMENT OR SIZE TO THE ENGINEER.
4. CONSTRUCT THE TRANSITION BARRIER IN ACCORDANCE WITH SECTION 854 OF THE SPECIFICATIONS.
CONCRETE MEDIAN TRANSITION BARRIER

LOCATION OF OVERHEAD ASSEMBLY

SECTION VIEW

FINISH GRAGE

2'-0" TO VAR.

VARIABLE

ELEVATION VIEW

TYPE III - 2'-0" BASE

DOUBLE FACE MEDIAN TRANSITION OFFSET BARRIER

(NO GLARE SCREEN PERMITTED)

STEEL VIEW

FINISH GRAGE

2'-6" TO VAR.

VARIABLE

SECTION VIEW

TYPE II - 2'-6" BASE

DOUBLE FACE MEDIAN TRANSITION OFFSET BARRIER

(GLARE SCREEN PERMITTED)

ELEVATION VIEW

STEEL VIEW

NOTES: SEE SHEET 2.
DOUBLE FACE MEDIAN TRANSITION BARRIER

SECTION VIEW

FINISH GRADE

VAR. 51" TO 63"

RADIUS

10"

10" TO VAR.

7"

SECTION VIEW

FINISH GRADE

VAR. 51" TO 63"

RADIUS

10"

10" TO VAR.

7"

ELEVATION VIEW

TYPE T-1 OR T-2

DOUBLE FACE MEDIAN TRANSITION OFFSET BARRIER

SECTION VIEW

FINISH GRADE

VAR. 51" TO 63"

RADIUS

10"

10" TO VAR.

7"

ELEVATION VIEW

TYPE T

DOUBLE FACE MEDIAN TRANSITION BARRIER

NOTES: SEE SHEET 2.
NOTE:
1) THIS DRAWING IS NOT INTENDED TO SHOW TYPICAL BARRIER AND GUARDRAIL INSTALLATION. IT DETAILS POSSIBLE BARRIER AND STRUCTURE ANCHOR COMBINATIONS FOR THIS TYPE FACILITY.
2) USE TRAILING END GUARDRAIL IF WARRANTED
NOTE:
1) THIS DRAWING IS NOT INTENDED TO SHOW TYPICAL BARRIER AND GUARDRAIL INSTALLATION. IT DETAILS POSSIBLE BARRIER AND STRUCTURE ANCHOR COMBINATIONS FOR THIS TYPE FACILITY.
2) USE TRAILING END GUARDRAIL IF WARRANTED

GUARDRAIL AND BARRIER AT DIVIDED HIGHWAY BRIDGE UNDERPASS
PART FRONT ELEVATION

NOTE:

THESE DIMENSIONS APPLY TO THIS END ONLY.

10'-0" TO 25'-0"

FINISH GRADE

NOTE:

SEE PIN & EYE CONNECTION

DETAIL - SHEET 7

#5 BAR EYE CONNECTION

PART FRONT ELEVATION

NOTE:

THESE DIMENSIONS APPLY TO THIS END ONLY.

10'-0" TO 25'-0"

FINISH GRADE

NOTE:

SEE PIN & EYE CONNECTION

DETAIL - SHEET 7

#5 BAR EYE CONNECTION

ELEVATION VIEWS
SHOWING PLACEMENT OF EYE BARS AT EACH END
PRECAST REINFORCED CONCRETE BARRIER

PART FRONT ELEVATION

DETAIL X-X

CROSS SECTIONAL VIEW

PLAN OF BONDED CONNECTION OF PRECAST UNIT

JOINT FILLER DETAIL

NOTE: FILL COMPLETELY THROUGH BARRIER SECTION
**DEPARTMENT OF TRANSPORTATION**
**PRECAST REINFORCED CONCRETE BARRIER**

**English Standard Drawing for**

**Part Section of Barrier**

**Thru End Shoe Section and 4 Bolt Insert Assembly**

**Detail A**

4 Bolt Insert Assembly

**Class 'AA' Concrete**

**Guardrail End Shoe**

See Std. Dwg. 862.02

<table>
<thead>
<tr>
<th>GUARDRAIL AND INSERT ASSEMBLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/8&quot; X 2 1/4&quot; BOLTS WITH ROUND WASHERS FOR ATTACHING END SHOE TO BARRIER.</td>
</tr>
<tr>
<td>1 3/4&quot; OFFSET</td>
</tr>
<tr>
<td>#5 &quot;S&quot; BAR</td>
</tr>
</tbody>
</table>

**Notes for 4 Bolt Hold Down Plate**

Use a 1/4" hold down plate and 4 - 7/8" dia. bolts with nuts and washers for guardrail anchor assembly.

Use hold down plate which conforms to AASHTO M270 Grade 36. After fabrication, hot dip galvanize the hold down plate in accordance with AASHTO M111.

After installation, burr the exposed thread of the bolt.

Form or drill the 1 1/4" dia. holes with a core bit. Impact tools will not be permitted. Repair any concrete damaged by this work to the satisfaction of the engineer.

**Part Section of Barrier**

**Thru End Shoe Section and 4 Bolt Hold Down Plate**

**Detail B**

4 Bolt Hold Down Plate

**Class 'AA' Concrete**

**Guardrail End Shoe**

See Std. Dwg. 862.02

<table>
<thead>
<tr>
<th>GUARDRAIL AND BOLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/8&quot; BOLTS WITH ROUND WASHERS FOR ATTACHING END SHOE TO BARRIER.</td>
</tr>
<tr>
<td>1 3/4&quot; OFFSET</td>
</tr>
<tr>
<td>#5 &quot;S&quot; BAR</td>
</tr>
</tbody>
</table>

**1/16" Dia. Holes for 7/8" Bolts (Typ.)**

**1/4" Hold Down Plate**

**1 1/4" Dia. Hole (Typ.)**
GROOVE END AND PIN & EYE CONNECTION DETAILS

CONNECTOR PIN ASSEMBLY 3'-1"

OR

#8 (1" DIA.) STEEL REINF. BAR 3'-3"

#8 REINFORCING STEEL BAR
CONNECTOR PIN

OPTION #1

GALVANIZE ALL PARTS IN ACCORDANCE WITH ASTM A-153 SPEC.

#5 REINFORCING BAR 17/8" RAD.

GALVANIZE REQUIRED

OPTION #2

GALVANIZE ALL PARTS IN ACCORDANCE WITH ASTM A-153 SPEC.
NOTE: WHEN OFFSET DISTANCE FROM FACE OF OBSTRUCTION TO FACE OF GUARDRAIL IS BETWEEN 3'-6" AND 5'-6", BEGIN 3'-1½" POST SPACING AT A POINT 25' BEFORE REACHING THE OBSTRUCTION AND CARRY THROUGHOUT ITS LENGTH. IF THE OFFSET IS LESS THAN 3'-6" USE CONCRETE BARRIER.
NOTE SPECIAL LAYER OF PAVEMENT ........

USE 3'-1½" POST SPACING ON THE 50' OF GUARDRAIL PARALLEL TO LANES AND 6'-3" POST SPACING ON 15:1 TRANSITION SECTIONS.

GRADE MEDIAN IN THE VICINITY OF THE SIGN SUPPORT AS ILLUSTRATED IN THE ROADWAY STANDARD DRAWINGS (STANDARD 862.01 SHEET 1 OF 11).
Dimensions for Length of Guardrail Approaching Dual Lane Bridges

<table>
<thead>
<tr>
<th>Median Width</th>
<th>-L***-</th>
<th>-L1-</th>
<th>-L2-</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 MPH</td>
<td>60 MPH</td>
<td>50 MPH</td>
<td>70 MPH</td>
</tr>
<tr>
<td>30'</td>
<td>300.0'</td>
<td>250.0'</td>
<td>150.0'</td>
</tr>
<tr>
<td>36'</td>
<td>300.0'</td>
<td>250.0'</td>
<td>150.0'</td>
</tr>
<tr>
<td>40' &amp; Above</td>
<td>300.0'</td>
<td>250.0'</td>
<td>150.0'</td>
</tr>
</tbody>
</table>

Notes:

* Minor variation to the 25'-0" dimension is permissible to accommodate the 12'-6" in guardrail lengths.

** No guardrail is required on the trailing end when this distance exceeds clear roadside recovery area for the appropriate design speed.

*** Based on "x" of 12"

Use flare rate as the control if the "x" distance is not obtained. ("x" is based on shoulder widths in the Highway Design Branch manual, Part 1, 1-48, FIA).

"N" distance from edge of lane to face of guardrail where guardrail is parallel to lane.

The design layout for lengths shown on this standard are minimum design lengths.

See Sheet 1 of 12 for Sections XX, YY

See Std. 862.03 for Structure Anchor Units

Detail of Guardrail Approaching Dual Lane Bridges
GUARDRAIL PLACEMENT

LENGTHS AND OFFSETS FOR PROPOSED GUARDRAIL AT TWO LANE - TWO WAY LOCATIONS

*USE FLARE RATE AS THE CONTROL IF THE "X" DISTANCE IS NOT OBTAINED. ("X" IS BASED ON SHOULDER WIDTHS IN THE HIGHWAY DESIGN BRANCH MANUAL, PART 1, 1-4B, F1).

"N"= DISTANCE FROM EDGE OF LANE TO FACE OF GUARDRAIL WHERE GUARDRAIL IS PARALLEL TO LANE.

SEE STD. 862.03 FOR STRUCTURE ANCHOR UNITS

GUARDRAIL INSTALLATION AT BRIDGE APPROACHES FOR TWO-LANE, TWO-WAY TRAFFIC

<table>
<thead>
<tr>
<th>DESIGN SPEED (MPH)</th>
<th>&quot;L&quot; APPROACH LENGTH (FT.)</th>
<th>&quot;L&quot; TRAILING LENGTH (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>362.5' 362.5' 350' 287.5'</td>
<td>287.5' 187.5' 187.5' 175'</td>
</tr>
<tr>
<td>60</td>
<td>300' 287.5' 275' 225'</td>
<td>137.5' 137.5' 100' 75'</td>
</tr>
<tr>
<td>50</td>
<td>212.5' 212.5' 200' 162.5'</td>
<td>87.5' 75' 75' 75'</td>
</tr>
<tr>
<td>40</td>
<td>175' 150' 137.5' 112.5'</td>
<td>75' 75' 75' 75'</td>
</tr>
</tbody>
</table>

X * 8' 6' 4' 4' 8' 6' 4' 4'
STANDARD GUARDRAIL PLACEMENT AT BRIDGES WITH 2'-6" CONCRETE CURB AND GUTTER

MINIMUM GUARDRAIL LENGTHS "L" REQUIRED AT BRIDGE APPROACHES ON 2'-6" CONCRETE CURB AND GUTTER ROADWAYS

<table>
<thead>
<tr>
<th>DESIGN SPEED (MPH)</th>
<th>&quot;L&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>150'</td>
</tr>
<tr>
<td>50</td>
<td>225'</td>
</tr>
</tbody>
</table>

NOTE: "L" VALUES ARE BASED ON NO HAZARDS OTHER THAN END OF BRIDGE BEING PRESENT WITHIN THE CLEAR ZONE.
SEE STD. 862.03 FOR STRUCTURE ANCHOR UNITS.
"N" = Distance from edge of lane to face of guardrail where guardrail is parallel to lane.

Detail of beginning of guardrail in cut or fill section.
GUARDRAIL BREAK INTERVALS WITH 30’ - 36’ MEDIANS

DETAIL AT UNDERPASSES

* GUARDRAIL OPENING MAY BE SPACED AS CLOSE AS 350 FT. FROM STRUCTURE IF NECESSARY TO ALLOW MOWER ACCESS TO MEDIAN

DETAIL AT OVERPASSES
GUARDRAIL TREATMENT AT INTERSECTIONS

NOTES:

SHOP CURVED GUARDRAIL IS DEFINED AS HAVING A RADIUS OF 150' OR LESS.

WHEN RADIUS IS LESS THAN 20' REFER TO SHEET 8.

WHENEVER SHOP CURVED GUARDRAIL IS USED AS AN ANCHOR AND THE RADIUS IS FROM 20' TO 75', USE A MINIMUM LENGTH OF 50' OF SHOP CURVED GUARDRAIL AND FLARE WITH AN AT-1 ANCHOR UNIT. REFER TO DETAIL 1.

WHENEVER SHOP CURVED GUARDRAIL RADIUS IS MORE THAN 75', REFER TO DETAIL 2.

MAINTAIN CLEAR SIGHT DISTANCE.

DETAIL-1

DETAIL-2
GUARDRAIL TREATMENT AT DRIVEWAYS

**GUARDRAIL PLACEMENT**

**NOTE:** USE DETAIL 3 & 4 WHENEVER 20’ OR LARGER RADIUS CANNOT BE UTILIZED.

MAINTAIN CLEAR SIGHT DISTANCE.

**DETAIL-3**
DIVIDED HIGHWAY

**DETAIL-4**
UNDIVIDED HIGHWAY

GUARDRAIL ANCHOR UNIT
TYPE 350 (50:1 TAPER)

RALEIGH, N.C.
DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION

GUARDRAIL ANCHOR UNIT
TYPE 350 (50:1 TAPER)
**NESTED W-BEAM RAIL PLAN**

**ELEVATION**

**SECTION A-A**

**RAIL SPLICE**

**SECTION B-B**

**SECTION C-C**

**FRONT**

**WEAKENED WOOD POST**

**GENERAL NOTES:**

1. LAP RAIL IN THE DIRECTION OF TRAFFIC FLOW.

2. SEE ROADWAY PLANS FOR LOCATIONS AND CONTINUATION OF RAIL OR END SECTIONS.

3. 25'-0" SPANS: POSTS MAY BE ELIMINATED SUCH THAT A MAXIMUM OF ONE RAIL SPLICE IS LOCATED WITHIN THE UNSUPPORTED LENGTH. A 25'-0" LENGTH OF NESTED W-BEAM RAIL MAY BE USED TO ELIMINATE A SPLICE WITHIN THE 25'-0" CLEAR SPAN.

4. MAXIMUM DISTANCE OF 5 FEET BEHIND THE GUARDRAIL SHOULD BE CLEAR OF ANY FIXED-OBJECT HAZARDS THAT COULD SNAG AN IMPACTING VEHICLE.
NOTE:
When wooden guardrail posts are used, drill holes through earth material and base course. The post may then be driven to the proper depth. Drill the hole of sufficient size to accommodate the particular post being used. Backfill and tamp holes using the excavated material.
GUARDRAIL PLACEMENT

SECTION D-D
FACE OF GUARDRAIL IS FLUSH WITH FACE OF CURB

SECTION C-C
GUARDRAIL AT FACE OF CURB

1'-11" BERM
1'-0" GUARDRAIL UNIT TERMINAL

12' CURB AND GUTTER
2'-6" CURB AND GUTTER

1'-11" BERM

GUARDRAIL ANCHOR UNIT TYPE 350 (50:1 TAPER)

1 FT. OFFSET FROM FACE OF GUARDRAIL @ TERMINAL

GUARDRAIL AT FACE OF CURB

FILL SLOPE
ROADWAY

GUARDRAIL ANCHOR UNIT TERMINAL
1'-11"

FILL SLOPE
ROADWAY

GUARDRAIL 12' OFFSET FROM FACE OF CURB
1'-11"

2'-6" CURB AND GUTTER
2'-6" CURB AND GUTTER

1'-11"

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR GUARDRAIL TREATMENT AT CURB AND GUTTER
A.T.-1 SYSTEM

END SECTION ASSEMBLY - ELEVATION

"W" BEAM RAIL

LEVEL GROUND

STEEL TUBE

PAY LIMITS

BUTTON HEAD BOLT (10" LONG) THRU RAIL AND POST WITH NUT AND STD. WASHER

"W" BEAM RAIL

SHORT WOOD BREAKAWAY POST (SEE SHEET 4 OF 7)

BREAKAWAY LINE POST

"W" BEAM RAIL

STEEL TUBE

BREAKAWAY LINE POST

6'-3"

LINE POST

BREAKAWAY

6'-0' POST LENGTH

2'-5"

2'-5"

2'-5"

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2'-5"
NOTES:
A - 9/16" DIA. BUTTON HEAD SPLICE BOLT 1 1/4" LONG (8 REQ. PER SPLICE JOINT).
B - 9/16" DIA. BUTTON HEAD BOLT 7 1/2"/9" LONG WITH NUT FOR BOLTING 6"/8" ROUTED OFFSET BLOCK TO STEEL POSTS.
C - FIELD PUNCHING OF HOLES INTO GUARDRAIL AS DIRECTED BY THE ENGINEER.
WOOD OFFSET BLOCK
( FOR WOOD POSTS )

STANDARD LINE POST

SHORT WOOD BREAKAWAY POST

BEARING PLATE
9/16" THICK PLATE

ROUTED OFFSET BLOCK

SOIL PLATE
1/4" THICK PLATE

STEEL TUBE
TS 6" x 8" x 0.1875"

SIDE FRONT

SIDE FRONT

"W6" STEEL POST

SYSTEM PARTS
ANCHOR PLATE ASSEMBLY

3\textquoteleft\textfrac{3}{4}'' THICK END PLATE WITH 1\textquoteleft\textfrac{1}{4}'' DIA. HOLE CENTERED IN PLATE. END PLATE TO BE WELDED TO ANCHOR PLATE.

5\textquoteleft\textfrac{3}{4}'' HEX HEAD BOLT WITH WASHER UNDER NUT (8 REQUIRED PER ASSEMBLY)

SWAGED CABLE

3\textquoteleft\textfrac{3}{4}'' THICK GALV. STEEL PLATE

34" DIA. HOLES

3\textquoteleft\textfrac{3}{4}'' THICK GALV. CABLE TO BE SWAGED CONNECTED

DETAIL OF STANDARD WASHER

STANDARD WASHER: TYPICAL USE UNDER NUT WITH WOOD POST

DETAIL OF STANDARD HEX BOLT AND NUT

DETAIL OF BUTTON HEAD BOLT AND NUT

SYSTEM PARTS
ENGLISH STANDARD DRAWING FOR
STRUCTURE ANCHOR UNIT TYPE B-77

ELEVATION

GENERAL NOTES:
1) POSTS 1 THROUGH 5 REQUIRE AN ADDITIONAL HOLE TO ATTACH LOWER BLOCKOUTS AND/OR RUBRAIL.
2) RUBRAIL BLOCKOUTS LOCATED ON POSTS 1 THROUGH 4 ARE OFFSET DRILLED AND SECURED WITH 5/16" BUTTONHEAD BOLTS (SEE CHART FOR BOLT LENGTHS). SECURE BLOCKS ONLY TO POSTS 2 AND 4. SECURE RUBRAIL AND BLOCKOUTS TO POSTS 1 AND 3. RUBRAIL IS SECURED TO POST 5 WITH A 3/8" x 1/2" BUTTONHEAD BOLT. RUBRAIL IS PLANNED TO BACK OF POST 6 AND NOT SECURED.
3) STEEL SPACER TUBE IS A SCHEDULE 40 GALVANIZED PIPE 6" INSIDE DIAMETER x 9" LONG. ATTACH TUBE TO GUARDRAIL ONLY WITH 3/8" x 1 1/4" LONG BUTTONHEAD BOLT AND RECTANGULAR PLATE WASHER.
4) SEE DETAIL D FOR SLOPED RUBRAIL BLOCKOUT. BLOCKOUT IS ATTACHED TO RAIL ELEMENT ONLY. USE 9/16" x 3" LAG BOLT WITH FLAT WASHER.
5) SHOP FABRICATE THE CS x 8.2 RUBRAIL END TO BE CONSISTENT WITH THE SLOPE OF THE JERSEY SHAPE AND ATTACH FLUSH WITH THE SLOPED TOE OF THE BARRIER OR BRIDGE RAIL.
6) ANCHORAGE:
   (a) AT EXISTING BRIDGE RAIL AND NEW OR EXISTING BARRIERS, ANCHOR RUBRAIL USING THREE 9/16" x 6" CHEMICALLY ANCHORED BOLTS WITH WASHERS. MAXIMUM PROJECTION FOR BOLTS IS 1 1/2".
   (b) AT EXISTING BRIDGE RAIL AND NEW OR EXISTING BARRIERS, ANCHOR THE W-BEAM END SHOE USING A 4 BOLT HOLD DOWN PLATE (SEE STD. DWG. 862.04).
   (c) AT NEW BRIDGE RAIL, ANCHOR THE W-BEAM END SHOE AND RUBRAIL AS DETAILED ON THE STRUCTURE PLANS.
7) POSTS 1 AND 2 ARE W6 x 13, 7'-6" LONG. ALL OTHER POSTS IN THE ANCHOR UNIT ARE W6 x 8.5.

PLAN

GUARDRAIL ANCHOR UNIT TYPE B-77

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
STRUCTURE ANCHOR UNIT TYPE B-77

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
RALEIGH, N.C.
**SECTION A-A**

**PLAN VIEW**

**ELEVATION VIEW**

**NOTE:**
- **ELIMINATE POST 3 AND SHIFT POSTS 1 & 2 ON SKW ANGLES GREATER THAN 160° OR LESS THAN 30° UNLESS OTHERWISE DIRECTED BY THE ENGINEER.**
- **MEASURE GUARDRAIL HEIGHT FROM THE TOP OF ADJACENT SURFACE (SHOULDER, BERM, OR GUTTER).**
- **USE NO WOOD POSTS WITHIN THE GUARDRAIL ANCHOR UNIT LIMITS.**
- **LAP JOINTS IN THE DIRECTION OF TRAFFIC FLOW.**
- **SHOULDER BERM GUTTER IS REQUIRED IF NO CURBING EXISTS THROUGH ANCHOR UNIT PAY LIMITS.**
- **ANCHOR THE W-BEAM END SHOE USING A 4 BOLT HOLD DOWN PLATE AS SHOWN IN STANDARD 862.04.**

**SECTION B-B**

**PLAN VIEW**

**SECTION C-C**

**ELEVATION VIEW**

**SECTION D-D**

**GUARDRAIL ANCHOR UNIT TYPE B-83**

**NOTE:**
- **THE DISTANCE FROM END OF BRIDGE RAIL TO CENTER LINE OF THE FIRST POST SHOULD BE 11'-6" IF CONCRETE BACKWALL IS NOT PRESENT.**
- **MEASURE GUARDRAIL HEIGHT FROM THE TOP OF ADJACENT SURFACE (SHOULDER, BERM, OR GUTTER).**
- **USE NO WOOD POSTS WITHIN THE GUARDRAIL ANCHOR UNIT LIMITS.**
- **LAP JOINTS IN THE DIRECTION OF TRAFFIC FLOW.**
- **SHOULDER BERM GUTTER IS REQUIRED IF NO CURBING EXISTS THROUGH ANCHOR UNIT PAY LIMITS.**
- **ANCHOR THE W-BEAM END SHOE USING A 4 BOLT HOLD DOWN PLATE AS SHOWN IN STANDARD 862.04.**

**NOTE:**
- **ELIMINATE POST 3 AND SHIFT POSTS 1 & 2 ON SKW ANGLES GREATER THAN 160° OR LESS THAN 30° UNLESS OTHERWISE DIRECTED BY THE ENGINEER.**
- **MEASURE GUARDRAIL HEIGHT FROM THE TOP OF ADJACENT SURFACE (SHOULDER, BERM, OR GUTTER).**
- **USE NO WOOD POSTS WITHIN THE GUARDRAIL ANCHOR UNIT LIMITS.**
- **LAP JOINTS IN THE DIRECTION OF TRAFFIC FLOW.**
- **SHOULDER BERM GUTTER IS REQUIRED IF NO CURBING EXISTS THROUGH ANCHOR UNIT PAY LIMITS.**
- **ANCHOR THE W-BEAM END SHOE USING A 4 BOLT HOLD DOWN PLATE AS SHOWN IN STANDARD 862.04.**
ANCHORAGE FOR GUARDRAIL POST ON BOX CULVERT

NOTES FOR:
- GUARDRAIL POST ANCHORED TO STRUCTURE:
- USE FULL LENGTH 1/4" BUTT WELDS AT ALL LOCATIONS OF CONTACT BETWEEN THE BASE PLATE, SUPPORT PLATES AND STEEL POST.
- USE POST AND POST BASE PLATES CONFORMING TO THE REQUIREMENTS OF A.S.T.M. A-36 AND GALVANIZED AFTER FABRICATION TO CONFORM TO A.S.T.M. A-123.
- USE CONCRETE ANCHORS CONSISTING OF A STUD BOLT WITH NUT AND WASHER. USE STUDS THREADED ON ONE END AND HAVING AN EXPANDED WEDGE ASSEMBLY POSITIONED AROUND A TAPERED AREA AT THE OTHER END. USE ANCHORS WHICH PROVIDE A MINIMUM SAFE HOLDING POWER OF 2875 LBS. FOR A 3/4" OR 1" DIAMETER BOLT. CALCULATE HOLDING POWER BASED ON 1/4 THE ACTUAL HOLDING POWER OF THE ANCHOR IN 3500 PSI CONCRETE AS DETERMINED BY AN APPROVED COMMERCIAL TESTING LABORATORY.
- USE ANCHORS GALVANIZED IN ACCORDANCE WITH A.S.T.M. A-153. SIZE HOLES FOR THE CONCRETE ANCHORS IN ACCORDANCE WITH THE ANCHOR MANUFACTURER'S RECOMMENDATIONS. DRILL HOLES WITH A CARBIDE OR DIAMOND TIPPED MASONRY BIT POWERED BY A ROTARY OR ROTARY IMPACT DRILL. NO OTHER IMPACT TOOLS WILL BE PERMITTED. DRILL HOLES VERTICALLY. FURNISH DOCUMENTATION OF HOLE SIZE RECOMMENDED FOR THE SPECIFIED ANCHOR TO THE ENGINEER BEFORE DRILLING HOLES. THOROUGHLY CLEAN HOLES FOR ANCHORS OF ALL CONCRETE CHIPS, DUST, DREASE, OIL, ETC. BEFORE ANCHORS ARE INSTALLED. REPAIR ALL DAMAGE CAUSED BY THIS WORK TO THE SATISFACTION OF THE ENGINEER.

NEW STRUCTURES:
- ATTACH POST TO INSERT ASSEMBLY UNITS (USING ANCHOR BOLTS SUPPLIED WITH INSERTS) WHICH HAVE BEEN CAST INTO THE STRUCTURE DURING CONSTRUCTION.

EXISTING STRUCTURES:
- USE CONCRETE ANCHORS CONSISTING OF A STUD BOLT WITH NUT AND WASHER. USE STUDS THREADED ON ONE END AND HAVING AN EXPANDED WEDGE ASSEMBLY POSITIONED AROUND A TAPERED AREA AT THE OTHER END. USE ANCHORS WHICH PROVIDE A MINIMUM SAFE HOLDING POWER OF 2875 LBS. FOR A 3/4" OR 1" DIAMETER BOLT. CALCULATE HOLDING POWER BASED ON 1/4 THE ACTUAL HOLDING POWER OF THE ANCHOR IN 3500 PSI CONCRETE AS DETERMINED BY AN APPROVED COMMERCIAL TESTING LABORATORY.
- USE ANCHORS GALVANIZED IN ACCORDANCE WITH A.S.T.M. A-153. SIZE HOLES FOR THE CONCRETE ANCHORS IN ACCORDANCE WITH THE ANCHOR MANUFACTURER'S RECOMMENDATIONS. DRILL HOLES WITH A CARBIDE OR DIAMOND TIPPED MASONRY BIT POWERED BY A ROTARY OR ROTARY IMPACT DRILL. NO OTHER IMPACT TOOLS WILL BE PERMITTED. DRILL HOLES VERTICALLY. FURNISH DOCUMENTATION OF HOLE SIZE RECOMMENDED FOR THE SPECIFIED ANCHOR TO THE ENGINEER BEFORE DRILLING HOLES. THOROUGHLY CLEAN HOLES FOR ANCHORS OF ALL CONCRETE CHIPS, DUST, DREASE, OIL, ETC. BEFORE ANCHORS ARE INSTALLED. REPAIR ALL DAMAGE CAUSED BY THIS WORK TO THE SATISFACTION OF THE ENGINEER.
ANCHORING END OF GUARDRAIL

FOR B-77 AND B-83 ANCHOR UNITS

ENGLISH STANDARD DRAWING FOR

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH, N.C.

1/4" HOLD-DOWN PLATE

4 BOLT HOLD DOWN PLATE

1 1/8" DIA. HOLES FOR 7/8" BOLTS (TYP.)

GUARDRAIL END SHOE
SEE STD. 862.02

7/8" BOLTS WITH ROUND WASHERS FOR ATTACHING GUARDRAIL END SHOE TO BARRIER.

SEE DETAIL B FOR 1 1/4" HOLD-DOWN PLATE

1 1/4" DIA. HOLE (TYP.)

NOTES FOR 4 BOLT HOLD DOWN PLATE
FOR GUARDRAIL ANCHOR ASSEMBLY USE 1 1/4" HOLD DOWN PLATE AND 4 - 7/8" DIA. BOLTS WITH NUTS AND WASHERS.
USE HOLD-DOWN PLATE THAT CONFORMS TO AASHTO M270 GRADE 36. AFTER FABRICATION, HOT-DIP GALVANIZE THE HOLD-DOWN PLATE IN ACCORDANCE WITH AASHTO M111.
AFTER INSTALLATION, BURR THE EXPOSED THREAD OF THE BOLT WITH A SHARP POINTED TOOL. FORM OR DRILL THE 1 1/4" DIA. HOLES WITH A CORE BIT. IMPACT TOOLS WILL NOT BE PERMITTED. REPAIR ANY CONCRETE DAMAGED BY THIS WORK TO THE SATISFACTION OF THE ENGINEER.
DETAIL 'A'

1-12

1. MEDIAN HAZARDS

- Use 8'-0" MIN. OFFSET FOR MEDIANS LESS THAN 60'.
- Use 4'-0" MIN. OFFSET FOR MEDIANS LESS THAN 60'.

2. SHOULDER SLOPES PER PLANS (10:1 OR FLATTER)

3. MEDIAN WIDTH

- 30' → 80.0'
- 36' → 80.0'
- 40' & ABOVE → 40.0'

4. DITCH SLOPE

- PER PLANS (10:1 OR FLATTER)

5. SHOULDER BREAKPOINT

- DIRECTED BY THE ENGINEER.

- OPENINGS AT EACH MEDIAN HAZARD UNLESS OTHERWISE NOTED:
  - POSTS WILL ONLY BE PLACED IN ONE OF THE TWO SIDES OF SUCCESSIVE POST.
  - PLACE REFLECTORS ON ALTERNATING INTERMEDIATE POSTS WITHOUT CABLE.
  - INSTALL DOUBLE FACE GUIDERAIL INTERMEDIATE POSTS WITHOUT CABLE.

6. CONCRETE ANCHOR UNIT

- INSTALL DOUBLE FACE GUIDERAIL INTERMEDIATE POSTS WITHOUT CABLE.

7. LIMITS OF -L2-

- USE 4'-0" MIN. OFFSET FOR MEDIANS LESS THAN 60'.
- USE 8'-0" MIN. OFFSET FOR MEDIANS 60' AND OVER.

- OFFSET GUIDERAIL TO EITHER SIDE OF MEDIAN.

- MEDIAN HAZARD GUIDERAIL LAYOUT

- CABLE GUIDERAIL WITH NORMAL POST SPACING

- PAVED SHOULDER

- MEDIAN WIDTH

- SHOULDER SLOPE PER PLANS (10:1 OR FLATTER)

- INLET & PIPE REQUIRED WHERE DITCH CANNOT BE GRADED TO DRAIN.

- SEE DETAIL 857D01

- SINGLE FACED PRECAST CONCRETE BARRIER SEE DETAIL 857D01

- CABLE GUIDERAIL 20' TYPICAL DIST.

- INSTALL DOUBLE FACE GUIDERAIL INTERMEDIATE POSTS WITHOUT CABLE.

- PLACE REFLECTORS ON ALTERNATING INTERMEDIATE POSTS WITHOUT CABLE.

- INSTALL DOUBLE FACE GUIDERAIL INTERMEDIATE POSTS WITHOUT CABLE.

- DIRECTED BY THE ENGINEER.

- OPENINGS AT EACH MEDIAN HAZARD UNLESS OTHERWISE NOTED:
  - POSTS WILL ONLY BE PLACED IN ONE OF THE TWO SIDES OF SUCCESSIVE POST.
  - PLACE REFLECTORS ON ALTERNATING INTERMEDIATE POSTS WITHOUT CABLE.

- INSTALL DOUBLE FACE GUIDERAIL INTERMEDIATE POSTS WITHOUT CABLE.

- PLACE REFLECTORS ON ALTERNATING INTERMEDIATE POSTS WITHOUT CABLE.

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- PLACE REFLECTORS ON ALTERNATING INTERMEDIATE POSTS WITHOUT CABLE.

- INSTALL DOUBLE FACE GUIDERAIL INTERMEDIATE POSTS WITHOUT CABLE.

- PLACE REFLECTORS ON ALTERNATING INTERMEDIATE POSTS WITHOUT CABLE.
DIMENSIONS FOR LENGTH OF GUARDRAIL APPROACHING DUAL LANE BRIDGES

<table>
<thead>
<tr>
<th>MEDIAN WIDTH</th>
<th>-L1-</th>
<th>-L2-</th>
</tr>
</thead>
<tbody>
<tr>
<td>40' &amp; ABOVE</td>
<td>300.0'</td>
<td>250.0'</td>
</tr>
<tr>
<td></td>
<td>150.0'</td>
<td>122.5'</td>
</tr>
<tr>
<td></td>
<td>212.5'</td>
<td>187.5'</td>
</tr>
<tr>
<td></td>
<td>137.5'</td>
<td>40.0'</td>
</tr>
</tbody>
</table>

NOTES:
- BASED ON "X" OF 12'
- USE FLARE RATE AS THE CONTROL IF THE "X" DISTANCE IS NOT OBTAINED. ("X" IS BASED ON SHOULDER WIDTHS IN THE HIGHWAY DESIGN BRANCH MANUAL, PART 1, 1-4B, F1A).
- "N" = DISTANCE FROM EDGE OF LANE TO FACE OF GUARDRAIL WHERE GUARDRAIL IS PARALLEL TO LANE.
- THE DESIGN LAYOUT FOR LENGTHS SHOWN ON THIS STANDARD ARE MINIMUM DESIGN LENGTHS.
- SEE STANDARD 862.01 SHEET 1 FOR SECTIONS XX, YY
- SEE STD. 862.03 FOR STRUCTURE ANCHOR UNITS

DETAIL OF CABLE GUIDERAIL AT DUAL LANE BRIDGES
GENERAL NOTES:
1. FALSE SUMP DETAIL IS APPLICABLE TO ALL MEDIAN WIDTHS.
2. DO NOT TRANSITION GUIDERAIL FOR SUPERELEVATION WHEN THE RATE IS 2 PERCENT OR LESS.
3. DO NOT INSTALL GUIDERAIL ON SLOPES STEEPER THAN 6:1.
TYPICAL SECTION
(DEFLECTION AREA ON MEDIAN SLOPES)
DOUBLE FACE GUIDERAIL APPLICATION

TYPICAL SECTION
(DEFLECTION AREA ON SHOULDER ONLY)

TYPICAL SECTION
(DEFLECTION AREA ON SHOULDER AND DITCH SLOPE)
SINGLE FACE GUIDERAIL APPLICATION

*OFFSET GUIDERAIL TO EITHER SIDE OF MEDIAN $\xi$.
USE 8'-0" MIN. OFFSET FOR MEDIANS 60' AND OVER.
USE 4'-0" MIN. OFFSET FOR MEDIANS LESS THAN 60'.
TYPICAL LAYOUT

GUIDERAIL LAYOUT

INTERMEDIATE ANCHORAGE SECTIONS, OR INTERMEDIATE ANCHORAGE SECTIONS 2000' MAXIMUM BETWEEN TERMINAL SECTIONS, TERMINAL SECTIONS AND INTERMEDIATE ANCHORAGE SECTIONS, OR INTERMEDIATE ANCHORAGE SECTIONS.

4" X 6" WOOD POST
(SEE NOTE BELOW)

ANCHOR UNIT

POSTS

TYPICAL ON TANGENT

SIDE VIEW SHOWING CABLE WIRE PLACEMENT ON POST

WHEN USED AT A DRIVEWAY OR VEHICLE OPENING ONLY PLACE A 4" X 6" X 5'-4"
WOOD POST 30" ABOVE GROUND LINE. PLACE POST 6" AHEAD OF CONCRETE ANCHOR.

*PROVIDE OPENINGS ONLY FOR AREAS AS DESIGNATED ON ROADWAY PLAN SHEETS.

SIDE VIEW SHOWING CABLE WIRE PLACEMENT ON POST

ANCHOR UNIT

POSTS

TYPICAL INTERMEDIATE ANCHORAGE SECTION

SEE SHEET 5 DETAIL "A"

SIDE VIEW SHOWING CABLE WIRE PLACEMENT ON POST

ANCHOR UNIT

POSTS

TYPICAL APPROACH & TERMINAL SECTIONS

SEE NOTES 7 & 8 ASSEMBLY CABLE END

ENGLISH STANDARD DRAWING FOR

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
RALEIGH, N.C.

SHEET 5 OF 12
865.01

DIVISION OF HIGHWAYS

DEPT. OF TRANSPORTATION
RALEIGH, N.C.

NORTH CAROLINA
STATE OF

ENGLISH STANDARD DRAWING FOR

GUIDERAIL LAYOUT

CABLE GUIDERAIL

CABLE GUIDERAIL LAYOUT

SHEET 5 OF 12
865.01

GUIDERAIL LAYOUT

TYPICAL APPROACH & TERMINAL SECTIONS

TYPICAL INTERMEDIATE ANCHORAGE SECTION

ELEVATION

ELEVATION

4'-8"

8'-4"

8'-4"

16'-8"

8'-4"

16'-8"

26'-0" LINEAR OFFSET

2000' MAX.

26'-0" LINEAR OFFSET

2000' MAX.

26'-0" LINEAR OFFSET

2000' MAX.

26'-0" LINEAR OFFSET

2000' MAX.

2000' MAX.

25'-0" LINEAR OFFSET

2000' MAX.

25'-0" LINEAR OFFSET

2000' MAX.

25'-0" LINEAR OFFSET

2000' MAX.

25'-0" LINEAR OFFSET

2000' MAX.

25'-0" LINEAR OFFSET

2000' MAX.

25'-0" LINEAR OFFSET

2000' MAX.
**Double Face Guiderail Post - Hole Placement Detail**

**Intermediate Post**

- **Delineator**

**Hook Bolts (See Detail)**

**3/4" Dia. Hole Delin. Mounting (See Reflector Mount Detail)**

**Front**

- **3/4" Dia. Holes For Hook Bolts**

**Side**

- **14" x 8" x 24"**

---

**Double Face Guiderail Intermediate Post**

**Detail "A" Center Post**

**Intermediate Anchorage Section**

- **Lap Cable Wire Over Top and Bottom Hook Bolt**

- **The Center Post in the Intermediate Anchorage Section Will Have Cable Wire on Both Sides of the Middle Strand Requiring the Use of Two 1 3/4" Hook Bolts for This Application.**

---

**Reflector Mount Detail**

**Plan View**

- **3/8" Dia. Holes**

- **Approved Tamper-Proof Lock Nut**

- **Spacer or Approved Shoulder Bolt (Galv. Steel or Aluminum)**

- **3" Diameter Button**

**Reflector Mount Detail**

**Elevation View**

- **3/8" Dia.**

- **ائ" Dia. A.S.H. Hex Backing Nut or Approved Shoulder. Approved Shoulder Must Equal Bearing Area of 3/8" Std. Nut.**

**Hook Bolt (Alternates)**

- **2 3/8" To 2 3/8"**

- **1 3/4" To 1 3/4"**

**3 3/8" To 3 3/8"**

**4 3/8" To 4 3/8"**

**1 3/4" To 1 3/4"**

**3/8" Dia.**

---

**Double Face Guiderail - Post Details**
**SINGLE FACE GUIDERAIL POST**

**HOLE PLACEMENT DETAIL**

**SINGLE FACE GUIDERAIL INTERMEDIATE POST**

**REFLECTOR MOUNT DETAIL**

**PLAN VIEW**

**ELEVATION VIEW**

**HOOK BOLT (ALTERNATES)**
SIDE VIEW OF POST TOP

FRONT VIEW OF POST TOP (ROAD SIDE)

ANCHOR POST DETAIL

KEEPER PLATE

SLIP IMPACT BASE (KEEPER PLATE NOT SHOWN)

**CABLE GUIDERAIL ANCHOR POST DETAILS**

- **Anchor Post Support:**
  - 3/4" Plate
  - 1/4" Dia. hole for 3/8" Dia. Brass Rod
  - 3/8" Dia. Brass Rod

- **Anchor Post:**
  - 3/4" Plate
  - 1/4" Dia. Typical

- **Cables on Roadside:**
  - 3/8" Dia. Brass Rod
  - 1/4" Dia. hole for 3/8" Dia. Brass Rod

- **Concrete:**
  - 6" thick
  - 1/2" Bolt 2 5/8" long
  - W/nuts and 3 washers
  - Torque to 25 ft. lbs.

- **Plumb the Anchor Post:**
  - Head, 1 between plate's
  - 1 under nut. An additional 3/8" thick washer may be placed between plate's to plumb the anchor post.

- **Torque to 25 ft. lbs. w/nuts and 3 washers.**

- **20 Ga. Galv. Steel**

- **S3 X 5.7 Post**

- **3/4" Plate (2 Req.)**

- **3/4" Rad.**

- **Dir of Traffic**

- **2.6' to 2.4' Rad.**

- **S3X5.7 Post**

- **Concrete Anchor**

- **Concrete Slip Impact Base**
BREAKAWAY ANCHOR ANGLE

NOTE: SUBMIT ALTERNATE METHODS OF FABRICATING ANCHOR ANGLES FOR APPROVAL.
ANCHOR UNIT DETAIL
TOP VIEW LEFT HAND
(TOP VIEW LEFT HAND
(ANCHOR UNIT DETAIL NOT SHOWN)
TWO PIECE

NOTE: USE ONE OR TWO PIECE ANCHOR.
DIMENSIONS OF TWO PIECE ANCHOR
ARE SHOWN ON DRAWING.
DIMENSIONS OF ONE PIECE ANCHOR
ARE 5'-0" LONG BY 3'-0" WIDE BY
3'-4" HIGH.

ANCHOR UNIT DETAIL
TOP VIEW RIGHT HAND
(TOP VIEW RIGHT HAND
(ANCHOR UNIT DETAIL NOT SHOWN)
TWO PIECE

NOTE: SET THE CONCRETE ANCHOR INTO THE EXCAVATION AS DETAILED. THE BOTTOM OF THE ANCHOR MUST HAVE A FULL AND EVEN BEARING ON THE SURFACE UNDER IT SO THAT IF THE CONTRACTOR ELECTS TO PLACE THE ANCHOR IN TWO SECTIONS, THERE WILL BE LITTLE OR NO DIFFERENTIAL SETTLEMENT. IF THE CONTRACTOR ELECTS TO PLACE THE ANCHOR IN TWO SECTIONS, PLACE THE TOPS OF BOTH SECTIONS ON THE SAME PLANE. AFTER THE ANCHOR IS IN PLACE, BACKFILL THE EXCAVATION.

ANCHOR UNIT & RE-BAR INSTALLATION DETAIL

ANCHOR POST
SLIP IMPACT BASE
LIMITS OF EXCAVATION
FOR CONCRETE ANCHOR
ANCHOR POST
ANCHOR ANGLES

BOLT PATTERN &
CONTRACTOR MAY CAST
ANCHORS AS ONE UNIT OR
TWO UNITS AS SHOWN.

ANCHOR UNIT DETAIL
LEFT HAND
(ANCHOR UNIT DETAIL
(ANCHOR UNIT DETAIL NOT SHOWN)
TWO PIECE

NOTE: USE ONE OR TWO PIECE ANCHOR.
DIMENSIONS OF TWO PIECE ANCHOR
ARE SHOWN ON DRAWING.
DIMENSIONS OF ONE PIECE ANCHOR
ARE 5'-0" LONG BY 3'-0" WIDE BY
3'-4" HIGH.

ANCHOR UNIT DETAIL
TOP VIEW LEFT HAND
(TOP VIEW LEFT HAND
(ANCHOR UNIT DETAIL NOT SHOWN)
TWO PIECE

NOTE: USE ONE OR TWO PIECE ANCHOR.
DIMENSIONS OF TWO PIECE ANCHOR
ARE SHOWN ON DRAWING.
DIMENSIONS OF ONE PIECE ANCHOR
ARE 5'-0" LONG BY 3'-0" WIDE BY
3'-4" HIGH.
GENERAL NOTES:

1. PROVIDE ALL S3x5.7 ROLLED STEEL SECTIONS IN ACCORDANCE WITH ASTM A-6. USE POSTS, PLATES AND ANCHOR ANGLES CONFORMING TO THE REQUIREMENTS OF SECTION 862 OF THE STANDARD SPECIFICATIONS. WHERE THE RAIL IS PARALLEL TO THE EDGE OF THE TRAVEL LANE, REFLECTORIZE EVERY 6th POST (96") (SEE STANDARD 1261.02 FOR DELINEATORS). FOR DOUBLE FACE GUARDRAIL, PLACE DELINEATOR VISIBLE ON EVERY 6th POST TO TRAFFIC IN EITHER DIRECTION. DO NOT REFLECTORIZE POSTS IN THE TYPICAL INTERMEDIATE ANCHORAGE SECTION, TYPICAL APPROACH OR TERMINAL SECTIONS.

2. PROVIDE ROUND ¾" DIAMETER ZINC COATED CABLE WIRE CONSTRUCTED OF THREE STRANDS (7 WIRES PER STRAND) HAVING A MINIMUM TENSILE STRENGTH OF 25000 LBS. IN ACCORDANCE WITH AASHTO M-30 TYPE I CABLE, CLASS 'A' COATING.

3. PROVIDE MATERIALS INDICATED AS 'CAST STEEL' WHICH CONFORM TO AASHTO M103.

4. PROVIDE INSTALLED HOOK BOLTS WHICH DEVELOP AN ULTIMATE PULL OPEN STRENGTH OF 500 LBS TO 1000 LBS. APPLIED IN A DIRECTION NORMAL TO THE LONGITUDINAL AXIS OF THE POST.

5. DESIGN ALL FITTINGS, INCLUDING SPLICES, TO USE THE CABLE WEDGE AND DEVELOP THE FULL STRENGTH OF THE ¾" CABLE. HOT DIP GALVANIZE ALL FITTINGS, EXCEPT THE CABLE WEDGE, ACCORDANCE WITH AASHTO M-30.

6. CRIMP ONE WIRE OF THE WIRE ROPE OVER THE BASE OF THE WEDGE TO HOLD IT FIRMLY IN PLACE AT ALL LOCATIONS WHERE THE CABLE IS CONNECTED TO A CABLE SPLICE CONNECTION.

7. DESIGNS FOR A COMBINATION OR SINGLE UNIT COMPENSATING DEVICE AND TURNBUCKLE ASSEMBLY MAY BE SUMBITTED FOR APPROVAL. COMPENSATING DEVICES MUST HAVE A SPRING RATE OF 450 LBS. PLUS OR MINUS 50 LBS. PER INCH WITH A MINIMUM TOTAL 'THROW' OF 6".

8. APPLY THE FOLLOWING CRITERIA FOR ARRANGEMENT OF SPRING CABLE END ASSEMBLIES (COMPENSATING DEVICES) AND TURNBUCKLE CABLE END ASSEMBLIES:

LENGTH OF CABLE RUNS:

TO 1000' - USE COMPENSATING DEVICE ON ONE END AND TURNBUCKLE ON THE OTHER END OF EACH INDIVIDUAL CABLE.

1000' TO 2000' - USE COMPENSATING DEVICE ON EACH END OF EACH CABLE.

OVER 2000' - START NEW STRETCH BY INTERLACING AT LAST PARALLEL POST (TYPICAL LAYOUT). PRIOR TO FINAL ACCEPTANCE BY THE STATE, USE THE FOLLOWING VALUES TO TIGHTEN THE TURNBUCKLES BASED ON THE TEMPERATURE AT THE TIME OF ADJUSTMENT.

<table>
<thead>
<tr>
<th>TEMPERATURE (FAHRENHEIT)</th>
<th>SPRING COMPRESSION FROM UNLOADED POSITION IN EACH SPRING</th>
</tr>
</thead>
<tbody>
<tr>
<td>110° - 120°</td>
<td>1&quot;</td>
</tr>
<tr>
<td>100° - 109°</td>
<td>1 ¼ &quot;</td>
</tr>
<tr>
<td>90° - 99°</td>
<td>1 ½ &quot;</td>
</tr>
<tr>
<td>80° - 89°</td>
<td>1 ¾ &quot;</td>
</tr>
<tr>
<td>70° - 79°</td>
<td>2&quot;</td>
</tr>
<tr>
<td>60° - 69°</td>
<td>2 ¼ &quot;</td>
</tr>
<tr>
<td>50° - 59°</td>
<td>2 ½ &quot;</td>
</tr>
<tr>
<td>40° - 49°</td>
<td>3&quot;</td>
</tr>
<tr>
<td>30° - 39°</td>
<td>3 ¼ &quot;</td>
</tr>
<tr>
<td>20° - 29°</td>
<td>3 ½ &quot;</td>
</tr>
<tr>
<td>10° - 19°</td>
<td>4&quot;</td>
</tr>
<tr>
<td>0° - 9°</td>
<td>4 ¼ &quot;</td>
</tr>
<tr>
<td>-10° - -1°</td>
<td>4 ½ &quot;</td>
</tr>
<tr>
<td>-20° - -11°</td>
<td>5&quot;</td>
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TABLE "A"

<table>
<thead>
<tr>
<th>PAVEMENT &amp; CURVATURE</th>
<th>POST SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>8° OR LESS</td>
<td>16'</td>
</tr>
<tr>
<td>MORE THAN 8° TO 13°</td>
<td>12'</td>
</tr>
<tr>
<td>(440 FT. RAD.)</td>
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</tr>
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</table>
A Chain Link Fence

**"H" is the height of fence. See pay item description for required height for project.**

**NOTE:** Roll formed line post may be driven to a minimum of 3'-0" in lieu of concrete anchor, unless otherwise directed by the Engineer.

---

**Method of Tying Fence to Endwall**

- Use tie wire (#6 GA. @ 24" CTRS.) to tie fabric to brace rail.
- Wire may either be fastened to the tension wire by hog rings spaced at 2" intervals, or the tension wire may be woven through the fabric.
- Use tie wire clips or ties to attach fabric to posts at 12" centers.

---

**Method of Constructing Fence on Sharp Break in Grade**

- Break in fence at this post may be omitted if fence can be taut without breaking and if omission and erection are approved by the engineer.

---

**Notes:***

- Caps are required on pipe post. Caps are not required on "H" post or roll formed post.
- Install fence fabric on the side farthest from the highway except that on horizontal curves greater than three degrees, install the fence to pull against line post.
- Consider all changes in direction of fence line of 30° or more as corners.

---

**Technical Details:**

- Tension wire - #7 GA.
- Brace rail
- Stretcher bar band
- Wire clips #6 GA. steel
- Gate or terminal post with stretcher bar attachment
SINGLE SWING GATE

**H**'' is the height of fence. See pay item description for fixed height for project.

NOTE: Roll former line post may be driven to a minimum of 3'-0" in lieu of concrete anchor, unless otherwise directed by the engineer.

MAXIMUM CLEARANCE BETWEEN LOWEST STRAND AND GROUND TO BE 6''.

**H** is the height of fence. See pay item description for fixed height for project.

NOTE: Roll former line post may be driven to a minimum of 3'-0" in lieu of concrete anchor, unless otherwise directed by the engineer.

MAXIMUM CLEARANCE BETWEEN LOWEST STRAND AND GROUND TO BE 6''.

MAXIMUM WIRE SPACING TO BE 6''.

ERECT BRACE RAILS BETWEEN TERMINAL OR GATE POSTS AT INTERVALS NOT EXCEEDING 750' ON TANGENTS OR 350' ON SHORT RADIUS CURVES.

ERECT ADDITIONAL TERMINAL POSTS IF DIRECTED BY THE ENGINEER.

TERMINAL POST

TERMINAL POST

NOTE: FENCE HARDWARE VARIES DUE TO DIFFERING MANUFACTURES SUPPLIES.

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Grade if necessary to clear wires.
**H** IS THE HEIGHT OF FENCE. SEE PAY ITEM DESCRIPTION FOR REQ'D HEIGHT FOR PROJECT.

"H" IS THE HEIGHT OF FENCE. SEE PAY ITEM DESCRIPTION FOR REQ'D HEIGHT FOR PROJECT.

**"H" IS THE HEIGHT OF FENCE. SEE PAY ITEM DESCRIPTION FOR REQ'D HEIGHT FOR PROJECT.**

**ALLOWABLE COMPONENTS FOR FENCE SYSTEMS**

**FOR 4' AND 5' FENCE SYSTEMS**

**FOR 6' FENCE SYSTEMS**

**LINE BRAKE DETAIL**

**VARIES DUE TO DIFFERING MANUFACTURING DIMENSIONS.**

**THE FABRIC MAY EITHER BE FASTENED TO THE TENSION WIRE BY HOE RINGS SPACED AT 2' INTERVALS, OR THE TENSION WIRE MAY BE WOVEN THROUGH THE FABRIC.**

**USE TIE WIRE (#8 GA.) AT 24' CTRS. TO TIE FABRIC TO BRACE RAIL.**

**WIRE CLIPS/TIES USED TO ATTACH FABRIC TO POST AT 12' CTRRS.**

**ROLL Formed LINE Post MAY BE Driven to a Minimum of 3'-0" in lieu of Concrete Anchor, unless otherwise directed by the Engineer.**

**866.01**

**STATE OF NORTH CAROLINA  DEPT. OF TRANSPORTATION  RALEIGH, N.C.**

**DEPT. OF TRANSPORTATION  DIVISION OF HIGHWAYS  RALEIGH, N.C.**

**CHAIN LINK FENCE  4', 5', AND 6' HIGH FENCE**

**ENGLISH STANDARD DRAWING FOR**

**FRAME COMPONENTS**

<table>
<thead>
<tr>
<th>Fabric</th>
<th>Galvanized Steel</th>
<th>Aluminum Alloy</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>B1</td>
<td>A1</td>
</tr>
<tr>
<td>Line Post</td>
<td>1.90&quot; O.D. Steel Pipe</td>
<td>2.375&quot; O.D. Aluminum Pipe</td>
</tr>
<tr>
<td>Terminal Post</td>
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<td>2.375&quot; O.D. Aluminum Pipe</td>
</tr>
<tr>
<td>Gate Post up</td>
<td>2.875&quot; O.D. Steel Pipe</td>
<td>2.875&quot; O.D. Aluminum Pipe</td>
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<tr>
<td>Gate Post up</td>
<td>4.000&quot; O.D. Steel Pipe</td>
<td>4.000&quot; O.D. Aluminum Pipe</td>
</tr>
<tr>
<td>Brake Rail</td>
<td>1.660&quot; O.D. Steel Pipe</td>
<td>1.660&quot; O.D. Aluminum Pipe</td>
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**FRAME COMPONENTS**

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<tr>
<th>Fabric</th>
<th>Galvanized Steel</th>
<th>Aluminum Alloy</th>
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<td>A1</td>
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<td>Brake Rail</td>
<td>1.660&quot; O.D. Steel Pipe</td>
<td>1.660&quot; O.D. Aluminum Pipe</td>
</tr>
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</table>

**ALUMINUM ALLOY OR ALUMINUM COATED STEEL (#11 GAGE)**

| System          | D1               | D2             |
| Line Post       | 1.625" X 1.875" Steel Post | 2.00" X 2.50" Aluminum Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe | 2.375" O.D. Aluminum Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe | 2.875" O.D. Aluminum Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe | 4.000" O.D. Aluminum Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe | 1.660" O.D. Aluminum Pipe |

**STEEL PIPE**

| System          | D3               |
| Line Post       | 1.625" X 1.875" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D4               |
| Line Post       | 2.00" X 2.50" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D5               |
| Line Post       | 1.625" X 1.875" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D6               |
| Line Post       | 2.00" X 2.50" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D7               |
| Line Post       | 1.625" X 1.875" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D8               |
| Line Post       | 2.00" X 2.50" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D9               |
| Line Post       | 1.625" X 1.875" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D10              |
| Line Post       | 2.00" X 2.50" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D11              |
| Line Post       | 1.625" X 1.875" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |

**STEEL PIPE**

| System          | D12              |
| Line Post       | 2.00" X 2.50" Steel Pipe |
| Terminal Post   | 2.375" O.D. Steel Pipe |
| Gate Post up    | 2.875" O.D. Steel Pipe |
| Gate Post up    | 4.000" O.D. Steel Pipe |
| Brake Rail      | 1.660" O.D. Steel Pipe |
Woven Wire Fence

End or Gate Location

Line Braces
(Maximum spacing 324"

Place the brace wire around the post. Draw wire taut by twisting between each post. This applies to all brace wires. Notch posts for braces. Place two galvanized 12d or three galvanized 10d on all braces at each end.

Erect line braces between end, corner or gate posts at intervals not exceeding 324 feet.

This maximum interval may be reduced by the engineer on curves where the degree of curvature is greater than 3 degrees. Place line braces at the end of each roll or piece of woven wire.

Fence Corner

Use when corner angle is 15° or greater

Post for Blocking Driveways
Or Other Entrances

Install in addition to fence where shown in plans or where directed by the engineer

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
RALEIGH, N.C.
**Woven Wire Fence**

**Detail of Ditch Crossing**

- 4" x 4" post
- 14'-0" spacing
- 6" minimum spacing
- 9" allowable spacing

**Detail Showing Method of Constructing Fence on Sharp Break in Grade**

- 4 pt. barbed wire
- 5 x 5" wood brace post
- 6" minimum embedment as directed by the engineer
- 5" x 5" wire
- 4" brace:
  - 9" minimum spacing
  - 12" maximum spacing

**Detail of Post Anchor**

- Use at gate posts or where required by soil conditions. May also be used in lieu of setting posts to a depth of 3'-2".
- 3'-2" minimum embedment as directed by the engineer.
- Use one #9 staple or two #16 staples at each point of attachment.
**METHOD OF TYING FENCE TO HEADWALL**

**GENERAL NOTES:**

- All posts and braces may be either round or square at the option of the contractor, provided the same type is used throughout the project for post and brace.
- Dimensions shown are the diameter of round posts or edge dimensions of square posts.
- Install the fence facing the property owner except that on horizontal curves greater than three degrees; install the fence to pull against all posts.

**METHOD OF ERECTING FENCE FOR FILL SLOPE**

- Fasten cut strands of woven wire to the lower strand of barbed wire with fabric fasteners.
- Cut and splice or tie fence wire around post.
- Wire fence need not be cut.
- All posts and braces may be either round or square at the option of the contractor, provided the same type is used throughout the project for post and brace.
- Dimensions shown are the diameter of round posts or edge dimensions of square posts.
Woven Wire Fence

End of Gate Location

Erect line braces between end, corner or gate posts at intervals not exceeding 324 feet. This maximum interval may be reduced by the engineer on curves where the degree of curvature is greater than 3 degrees. Place line braces at the end of each roll or piece of woven wire.

Line Braces

Place the brace wire around the post. Draw the wire taut by twisting between each post. This applies to all brace wires.

Post for Blocking

Use when corner angle is 15° or greater.

Gate

Use latch device approved by the engineer. Hinge assembly, as detailed, is suggested. Substitution may be made subject to the approval of the engineer.

Driveways and Other Entrances

Install in addition to fence where shown in plans or where directed by the engineer.
WOVEN WIRE FENCE

DETAIL OF DITCH CROSSING

DEPT. OF TRANSPORTATION
NORTH CAROLINA
STATE OF
RALEIGH, N.C.

4 PT. BARBED WIRE
2'-6" MINIMUM EMBEDMENT AS DIRECTED BY THE ENGINEER
1.66" O.D. BRACE

8'-0" 14'-0"
8'-0" 14'-0"
8'-0" 14'-0"
8'-0" 14'-0"

6" MINIMUM SPACING
9" ALLOWABLE SPACING

DETAILED SHOWING METHOD OF CONSTRUCTING FENCE ON SHARP BREAK IN GRADE

USE CONCRETE FOOTING ON ALL CORNER, END, GATE AND BRACE POSTS.
METHOD OF TIEING FENCE TO HEADWALL

METHOD OF ERECTING FENCE FOR
FILL SLOPE
**Barbed Wire Fence Chart**

<table>
<thead>
<tr>
<th>Number of Barbed Wire Strands</th>
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<td>Strands B</td>
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<td>12&quot;</td>
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<td>Strands C</td>
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<table>
<thead>
<tr>
<th>Brace Posts</th>
<th>Length</th>
<th>Exposed</th>
<th>Embedment</th>
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<tbody>
<tr>
<td>H1</td>
<td>8'-0&quot;</td>
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<td></td>
</tr>
<tr>
<td>H2</td>
<td>6'-0&quot;</td>
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</tr>
<tr>
<td>H3</td>
<td>2'-7&quot;</td>
<td>3'-1&quot;</td>
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<table>
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<td>H5</td>
<td>3'-5&quot;</td>
<td>3'-5&quot;</td>
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</tr>
<tr>
<td>H6</td>
<td>2'-7&quot;</td>
<td>2'-7&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Alternate Types of Staples**

Use one #9 staple or two #16 staples at each point of attachment.

**Corner Brace**

Use when corner angle is 15° or greater.

**End or Gate Braces**

Typical spacing all line posts.
ALTERNATE CATTLE GATE

DETAIL OF GATE POST ANCHOR

USE CLASS "B" CONCRETE AT GATE POSTS OR WHERE REQUIRED BY SOIL CONDITIONS. CONCRETE MAY ALSO BE USED IN LIEU OF SETTING POSTS TO THEIR MAXIMUM DEPTH.

GENERAL NOTES:

ALL POSTS AND BRACES MAY BE EITHER ROUND OR SQUARE AT THE OPTION OF THE CONTRACTOR, PROVIDED THE SAME TYPE IS USED THROUGHOUT THE PROJECT. DIMENSIONS SHOWN ARE THE DIAMETER OF ROUND OR EDGE DIMENSIONS OF SQUARE POSTS AND BRACES.

ERECT LINE BRACES BETWEEN END, CORNER OR GATE POSTS. PLACE LINE BRACES AT INTERVALS NOT EXCEEDING 330' AND AT THE END OF THE BARBED WIRE ROLL.

THE 330' INTERVAL MAY BE REDUCED BY THE ENGINEER ON CURVES WHERE THE DEGREE OF CURVATURE IS GREATER THAN 3 DEGREES.

NOTCH BRACE POSTS 1" MINIMUM FOR HORIZONTAL BRACES. PLACE TWO GALVANIZED 12D OR THREE GALVANIZED 10D NAILS AT EACH END OF ALL BRACES.

PLACE THE BRACE WIRE AROUND THE POST. DRAW ALL BRACE WIRE TAUT BY TWISTING BETWEEN EACH POST.

INSTALL THE FENCE FACING THE PROPERTY OWNER EXCEPT THAT ON HORIZONTAL CURVES GREATER THAN THREE DEGREES (3') INSTALL THE FENCE TO PULL AGAINST ALL POSTS. SEE STD. 866.02 FOR FENCING AT DITCH CROSSINGS, BREAKS IN GRADES AND R/W BREAKS.

USE LATCH DEVICE APPROVED BY THE ENGINEER. HINGE ASSEMBLY AS SHOWN IS SUGGESTED. SUBSTITUTION MAY BE SUBJECT TO APPROVAL BY THE ENGINEER. USE 1/2" DIAMETER GALVANIZED STEEL PIPE FOR GATE FRAME EXCEPT AS SHOWN HERE.

ANY COMBINATION OF GATE AND FENCE TYPE MEETING THE APPROVAL OF THE ENGINEER IS ACCEPTABLE AND IS NOT LIMITED TO THE EXAMPLES SHOWN HEREON.
ELEVATION

POST MOUNTING TO STEEL GUARDRAIL W6 POST

POST MOUNTING TO WOOD GUARDRAIL 6" X 8" POST

SECTION A-A

ALTERNATE SECTION A-A

NOTE:
- Erect brace panel between ends at intervals not exceeding 350 ft.
- Erect additional brace posts if so directed by the engineer. Brace the posts from both sides of posts.

PLAN OF BRACE PANEL

THE FABRIC MAY EITHER BE FASTENED TO THE TENSION WIRE BY HOG RINGS SPACED AT 24" INTERVALS OR THE TENSION WIRE MAY BE WOVEN THROUGH THE FABRIC.

USE WIRE CLIPS OR TIES TO ATTACH FABRIC TO POST (12" CTRS.)

TENSION WIRE #6 GA. (SEE NOTE SHEET 2)

TENSION WIRE #6 GA.

POST CAPS VARY DUE TO DIFFERING MANUFACTURERS DIMENSIONS

ATTACH FABRIC TO POST (12" CTRS.)

TENSION WIRE #6 GA.

CHAIN LINK FABRIC

CHAIN LINK FABRIC / GUARDRAIL MOUNTED

WITH TURNBUCKLE

"U" BOLT

SEE DETAIL "B"

SEE DETAIL "A"

BRACE PANEL

ELEVATION

POST MOUNTING TO STEEL GUARDRAIL W6 POST

POST MOUNTING TO WOOD GUARDRAIL 6" X 8" POST

U" BOLT

SEE DETAIL "A"

BRACE PANEL

ELEVATION

POST MOUNTING TO STEEL GUARDRAIL W6 POST

POST MOUNTING TO WOOD GUARDRAIL 6" X 8" POST

"U" BOLT

SEE DETAIL "B"

SEE DETAIL "A"
NOTES: VINYL COATED GLARE SCREEN

1. Use chain link fabric 48" wide, 1½" mesh, 11½ ga.
   Hot dipped galvanized steel wire vinyl coated Sherwood Green.
2. Use end (brace) post, line post and brace rail
   Galvanized steel pipe vinyl coated Sherwood Green.
3. Use fittings and other appurtenances aluminum alloy,
   Galvanized pressed steel, malleable or cast steel
   Vinyl coated Sherwood Green. Painted fittings are not acceptable.
4. Use tension wire galvanized steel ASTM A752 Grade 1335
   or 5140 Vinyl coated Sherwood Green.
5. Use hog rings 9 ga. and Vinyl coated Sherwood Green.
6. Use tire wire 9 ga. Galvanized steel wire vinyl coated
   Sherwood Green.

NOTES: GALVANIZED GLARE SCREEN

1. Use chain link fabric 48" wide, 1½" mesh, 11½ ga.
   Hot dipped galvanized steel wire.
2. Use end (brace) post, line post and brace rail
   Galvanized steel pipe.
3. Use fittings and other appurtenances galvanized pressed
   steel, malleable or cast steel.
4. Use tension wire galvanized steel ASTM A752 Grade 1335
   or 5140.
5. Use hog rings 9 ga.
GENERAL NOTES:
1. USE RIP-RAP IN CHANNEL BED WHERE SHOWN ON PLANS.
2. IF BEDROCK IS ENCOUNTERED WITHIN THE LIMITS OF THE TOEWALL, BEGIN TOEWALL ON THE BEDROCK OR AS DIRECTED BY THE ENGINEER.
3. WHERE ONLY ONE SIDE REQUIRES RIP-RAP I OR 'II' LIST STATION AND SIDE OF SAME.

CHANNEL WITH CLASS I RIP RAP*

CHANNEL WITH CLASS I OR CLASS II RIP RAP

18" MIN. CLASS I
24" MIN. CLASS II

18" MIN. CLASS I
24" MIN. CLASS II

LONGITUDINAL SECTION A-A, B-B OR C-C

LENGTH OF DITCH

4'-0" CLASS II
2'-0" CLASS I

CLASS I

*"W" "X"
0'-5' BED LEVEL
6'-10' 12"
11'-20' 18"

CLASS II

"W" "X"
ALL 36"

*FOR "V" DITCH "W" IS 0'
**PIPE OUTLET WITH DITCH**

H = RIP RAP TO TOP OF PIPE (MAX. H = D + T)

T = 15" CLASS I RIP RAP, UNLESS OTHERWISE SHOWN ON PLANS

T = 12" CLASS 'B' RIP RAP, UNLESS OTHERWISE SHOWN ON PLANS

**SLOPE 1½:1 OR FLATTER**

**SECTION A-A**

**PIPE OUTLET WITHOUT DITCH**

**OUTLET W/DITCH**

<table>
<thead>
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<th>CLASS 'B' RIP RAP</th>
<th>CLASS I RIP RAP</th>
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<tbody>
<tr>
<td>12&quot;</td>
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<tr>
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<tr>
<td>72&quot;</td>
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**OUTLET W/O DITCH**

<table>
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<th>CLASS I RIP RAP</th>
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</table>

**NOTE:**

FOR CALCULATION PURPOSES

CLASS 'B' RIP RAP = 100 LBS./FT³

CLASS I RIP RAP = 105 LBS./FT³

**SECTION B-B**

**PLAN**

**D**

**T**

**GEOTEXTILE**

**4 X D**

**2 X D**

**A**

**PLAN**

**D**

**T**

**GEOTEXTILE**

**4 X D**

**2 X D**

**A**
GENERAL NOTES:
- USE CLASS 'A' RIP RAP.
- CONSTRUCT WIDTH AND SHAPE OF THE DITCHES AS SHOWN OR DIRECTED BY THE ENGINEER.
- USE GEOTEXTILE UNDER CLASS 'A' RIP RAP IF SPECIFIED ON PLANS.
* AS SPECIFIED ON PLANS.

SLOPE DRAIN, BASE DITCH OR BERM DRAINAGE OUTLET DITCH

MEDIAN OR BERM DITCH

12' V.C. ROADWAY DITCH

SHOULDER POINT
NOTE: "D" VARIES WITH LENGTH AND RATE OF SIDE SLOPES.

SIDE DITCH
GENERAL NOTES:

- USE CLASS 'B' RIP RAP.
- CONSTRUCT WIDTH AND SHAPE OF THE DITCHES AS SHOWN OR DIRECTED BY THE ENGINEER.
- USE GEOTEXTILE UNDER CLASS 'B' RIP RAP IF SPECIFIED ON PLANS.
  *AS SPECIFIED ON PLANS.