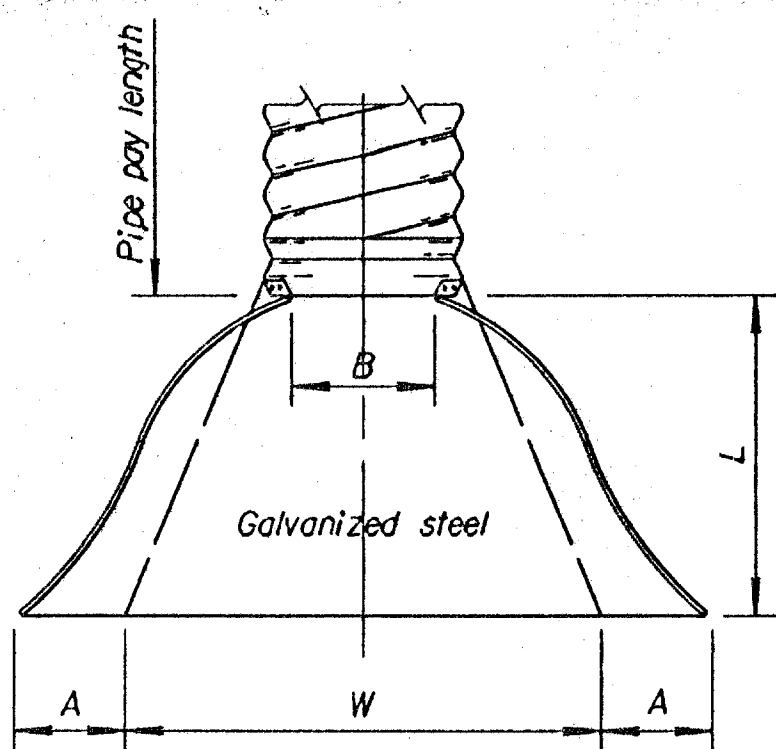
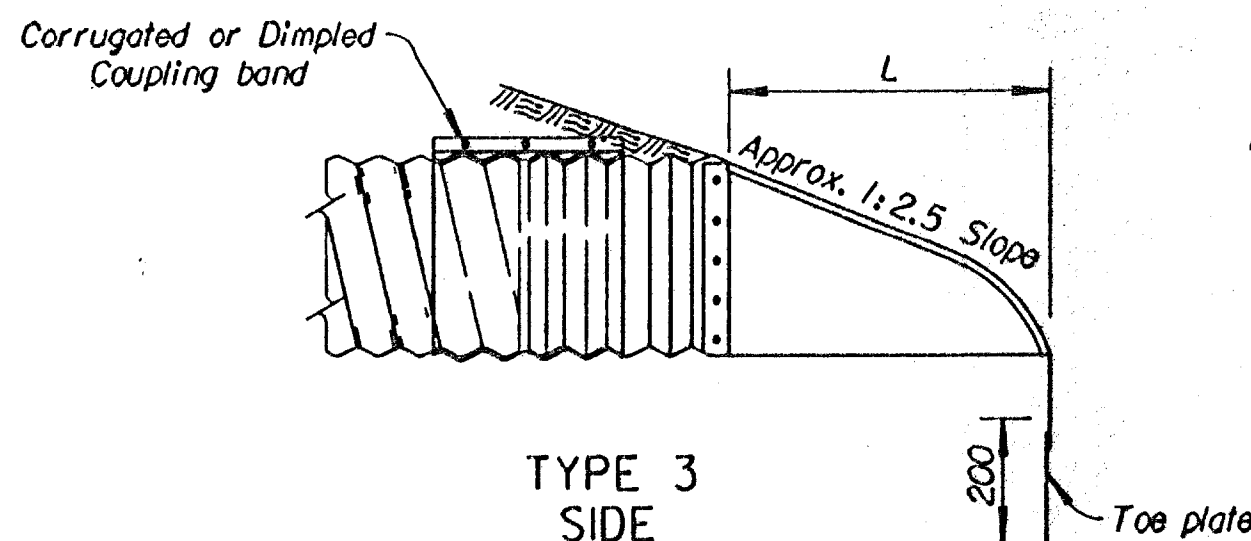
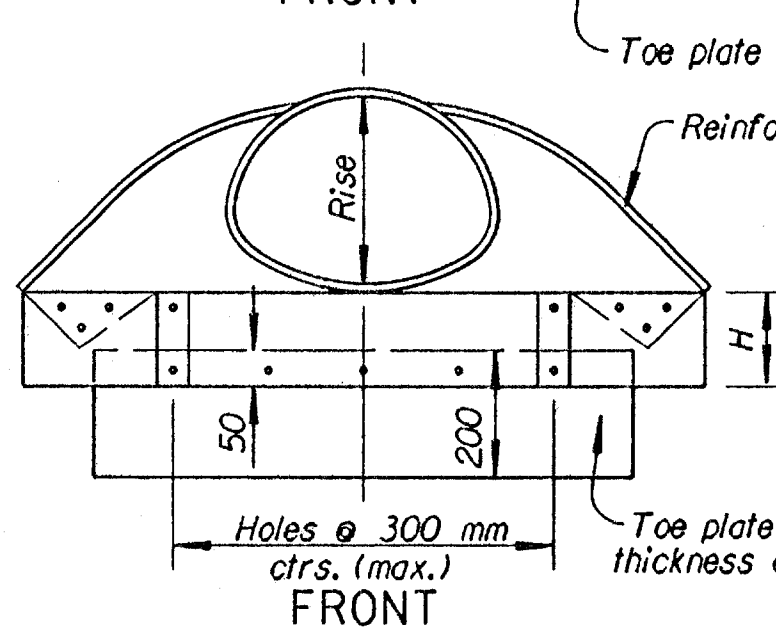
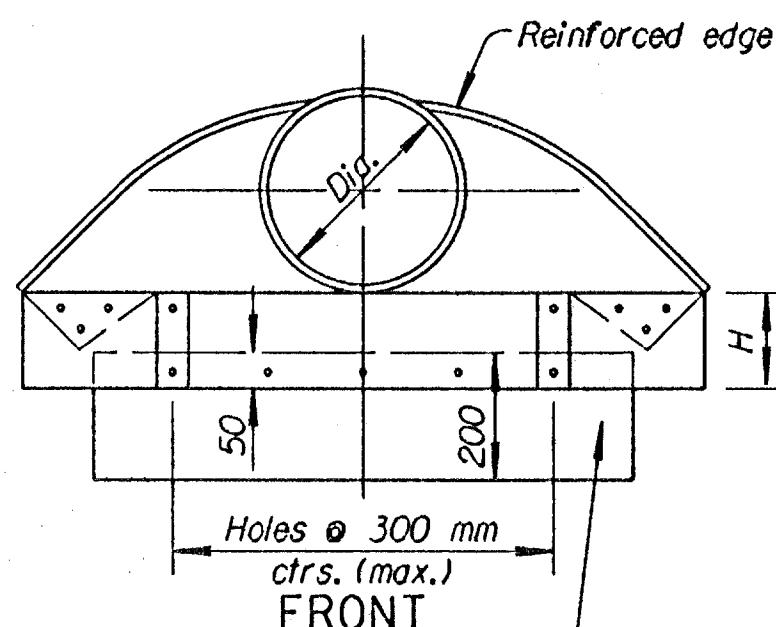


| FHWA REGION NO. | STATE  | PROJECT NO.  | YEAR | SHEET NO. | TOTAL SHEETS |
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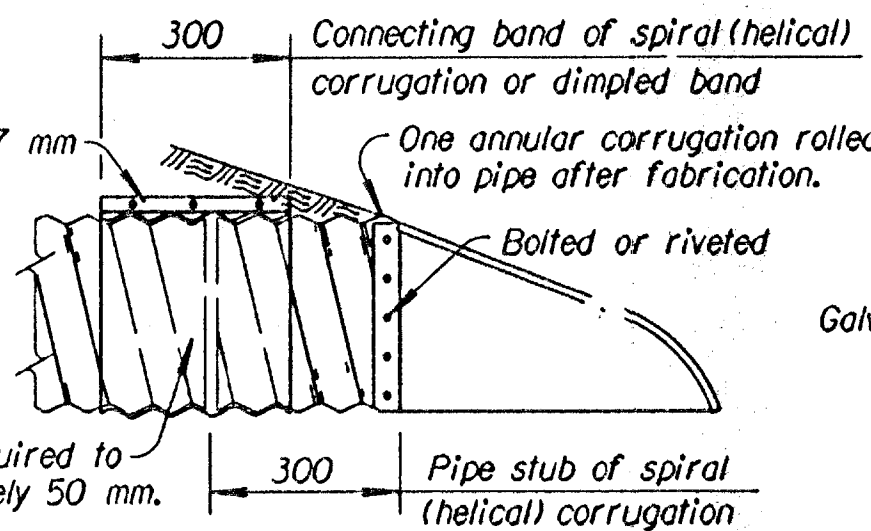


PLAN  
(Illustrated with Type #3 Connection)



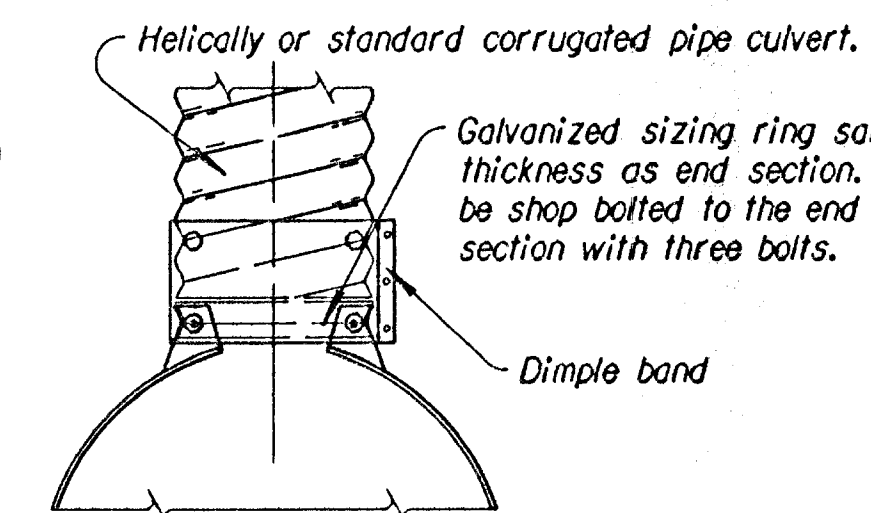
TYPE 3  
SIDE

L 51x51x4.8 or  
50 mm x 65 mm 2.77 mm  
galvanized angle.



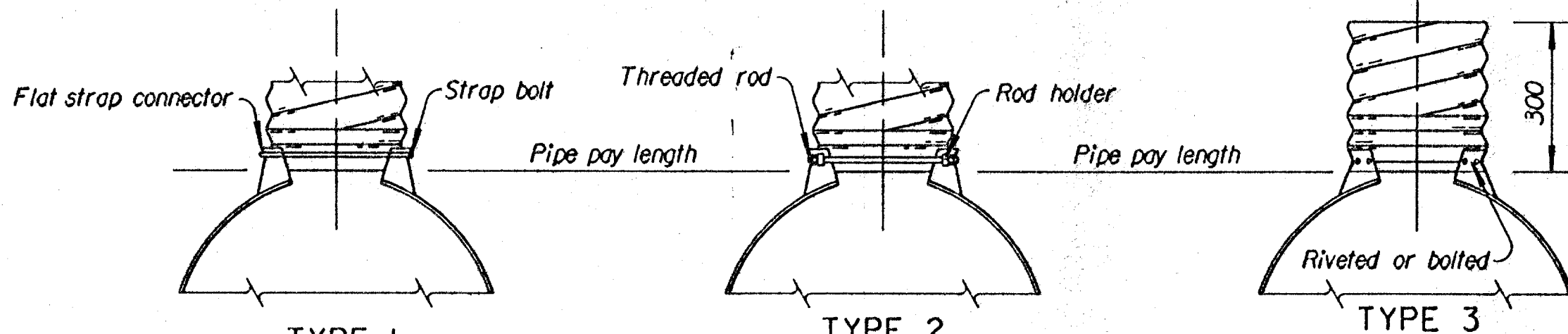
#### CONNECTION FOR SPIRAL (HELICAL) CORRUGATED PIPE

For all sizes of round and arch culvert pipes having spiral (helical) corrugations, the end sections and connecting bands shall be as shown above.



#### ALTERNATE TYPE D CONNECTION with Sizing Ring

Available in sizes 300 mm through 900 mm and  
430 mm x 330 mm through 1 440 mm x 970 mm pipe arches.



TYPE 1

Available in sizes 300 mm through  
600 mm only.

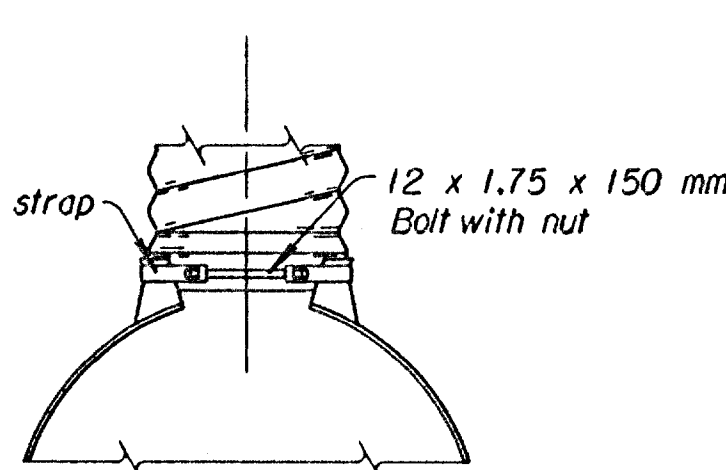
TYPE 2

Available in sizes 750 mm and 900 mm round and  
430 mm x 330 mm through 1 440 mm x 970 mm  
pipe arches.

TYPE 3

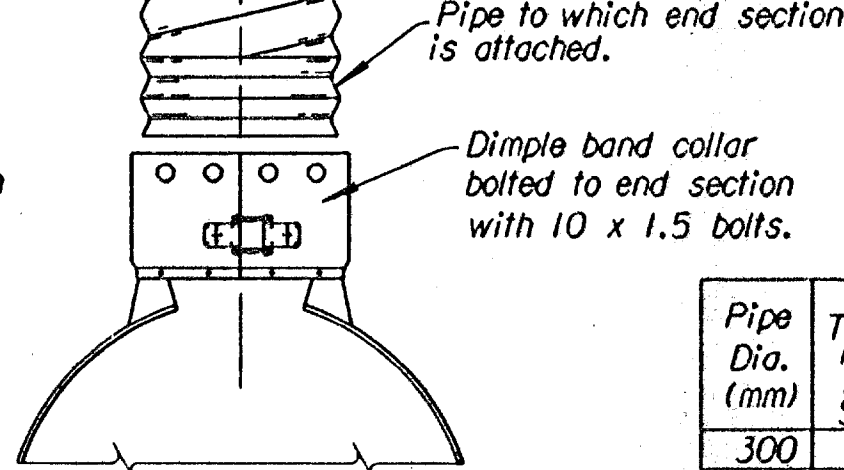
Available in sizes 1 050 mm through  
2 400 mm round and 1 520 mm x 1 170 mm  
through 2 050 mm x 1 500 mm pipe arches.

Note: Type #3 connection may be furnished instead of Types #1 & #2 for smaller sizes of pipe and pipe arches.



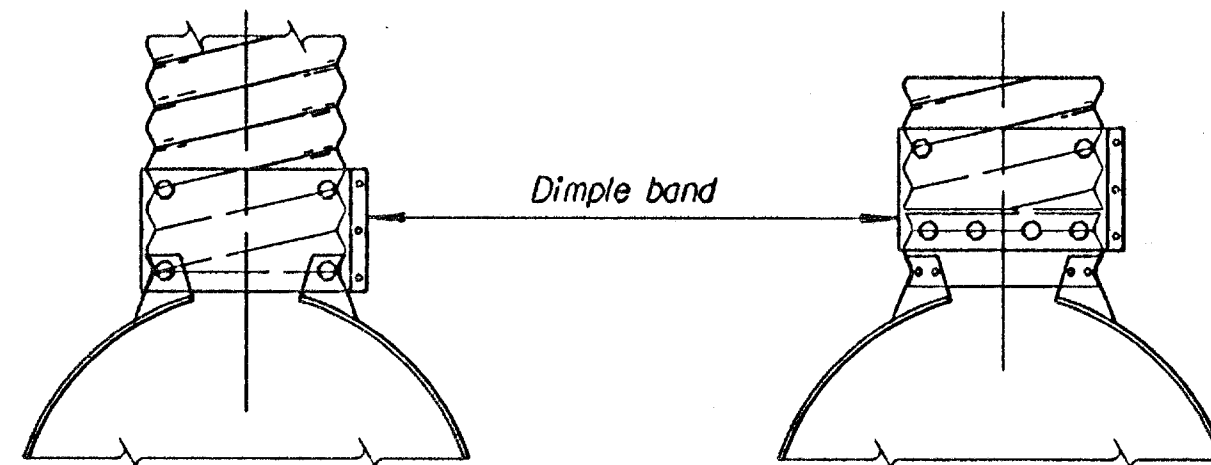
ALTERNATE TYPE 1

For 300 mm through  
600 mm only.



TYPE 5

Available for all round and equivalent pipe arch sizes,  
(Type 1 and Type 2 connections are recommended for  
the smaller sizes with annular ends).



TYPE D

ALTERNATE TYPE 3

Avail. in sizes 1 050 mm through 2 400 mm  
round and 1 520 mm x 1 170 mm through  
2 050 mm x 1 500 mm pipe arches.

| Pipe Dia.<br>(mm) | Min. Thickness<br>End Sect. | Dimensions (mm)   |              |                 |                 |                 |                 | No. Apron Panels | Slope |
|-------------------|-----------------------------|-------------------|--------------|-----------------|-----------------|-----------------|-----------------|------------------|-------|
|                   |                             | A<br>25 mm Tol.   | B<br>Max.    | H<br>25 mm Tol. | L<br>50 mm Tol. | W<br>50 mm Tol. | W<br>50 mm Tol. |                  |       |
| 300               | 1.63                        | 150               | 150          | 150             | 525             | 600             | 1               | 1:2.5            |       |
| 375               | 1.63                        | 175               | 200          | 150             | 650             | 750             | 1               | 1:2.5            |       |
| 450               | 1.63                        | 200               | 250          | 150             | 775             | 900             | 1               | 1:2.5            |       |
| 525               | 1.63                        | 225               | 300          | 150             | 900             | 1 050           | 1               | 1:2.5            |       |
| 600               | 1.63                        | 250               | 325          | 150             | 1 050           | 1 200           | 1               | 1:2.5            |       |
| 750               | 2.01                        | 300               | 400          | 200             | 1 300           | 1 500           | 1               | 1:2.5            |       |
| 900               | 2.01                        | 350               | 475          | 225             | 1 500           | 1 800           | 2               | 1:2.5            |       |
| 1 050             | 2.77                        | 400               | 550          | 275             | 1 750           | 2 100           | 2               | 1:2.5            |       |
| 1 200             | 2.77                        | 450               | 675          | 300             | 1 950           | 2 250           | 2               | 1:2.25           |       |
| 1 350             | 2.77                        | 450               | 750          | 300             | 2 100           | 2 600           | 2               | 1:2.25           |       |
| 1 500             | 2.77                        | 450               | 850          | 300             | 2 200           | 2 900           | 3               | 1:2              |       |
| 1 650             | 2.77                        | 450               | 900          | 300             | 2 200           | 3 050           | 3               | 1:2              |       |
| 1 800             | 2.77                        | 450               | 1 000        | 300             | 2 200           | 3 200           | 3               | 1:2              |       |
| 1 950             | 2.77                        | 450               | 1 050        | 300             | 2 200           | 3 350           | 3               | 1:1.5            |       |
| 2 100             | 2.77                        | 450               | 1 150        | 300             | 2 200           | 3 500           | 3               | 1:1.5            |       |
| 2 250             | 2.77                        | 450 or 600 or 625 | 950 or 1 150 | 275 or 300      | 2 200           | 3 500 or 3 800  | 3               | 1:1.5            |       |
| 2 400             | 2.77                        | 450 or 625        | 900 or 1 150 | 300             | 2 200           | 3 500 or 3 800  | 3               | 1:1.5            |       |
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| Bid Designation<br>m <sup>2</sup> | Nom. W.W. Area<br>m <sup>2</sup> | Pipe Arch |           | Min. Thick-<br>ness End Sect. | Dimensions (mm) |        |              |              |              | No. Apron Panels | Slope |
|-----------------------------------|----------------------------------|-----------|-----------|-------------------------------|-----------------|--------|--------------|--------------|--------------|------------------|-------|
|                                   |                                  | Span (mm) | Rise (mm) |                               | A 25 mm Tol.    | B Max. | H 25 mm Tol. | L 50 mm Tol. | W 50 mm Tol. |                  |       |
| 0.10                              | 0.10                             | 430       | 330       | 1.63                          | 175             | 225    | 150          | 475          | 750          | 1                | 1:2.5 |
| 0.15                              | 0.15                             | 530       | 380       | 1.63                          | 175             | 250    | 150          | 575          | 900          | 1                | 1:2.5 |
| 0.20                              | 0.20                             | 610       | 460       | 1.63                          | 200             | 300    | 150          | 700          | 1 050        | 1                | 1:2.5 |
| 0.25                              | 0.26                             | 710       | 510       | 1.63                          | 225             | 350    | 150          | 800          | 1 200        | 1                | 1:2.5 |
| 0.30 or 0.35                      | 0.41                             | 885       | 610       | 2.01                          | 250             | 400    | 150          | 1 000        | 1 525        | 1                | 1:2.5 |
| 0.45 or 0.55                      | 0.59                             | 1 060     | 740       | 2.01                          | 300             | 450    | 200          | 1 175        | 1 900        | 2                | 1:2.5 |
| 0.65 or 0.80                      | 0.81                             | 1 240     | 840       | 2.77                          | 325             | 525    | 225          | 1 350        | 2 175        | 2                | 1:2.5 |
| 0.90 or 1.00                      | 1.06                             | 1 440     | 970       | 2.77                          | 450             | 650    | 300          | 1 600        | 2 250        | 2                | 1:2.5 |
| 1.15 or 1.30                      | 1.45                             | 1 520     | 1 170     | 2.77                          | 450             | 875    | 300          | 1 775        | 2 600        | 2                | 1:2   |
| 1.55                              | 1.79                             | 1 670     | 1 300     | 2.77                          | 450             | 850    | 300          | 1 950        | 2 900        | 3                | 1:1.5 |
| 2.00                              | 2.16                             | 1 850     | 1 400     | 2.77                          | 450             | 900    | 300          | 1 950        | 3 200        | 3                | 1:1.5 |
| 2.30                              | 2.55                             | 2 050     | 1 500     | 2.77                          | 450             | 1 000  | 300          | 1 950        | 3 500        | 3                | 1:1.5 |
| 3.00                              | 2.99                             | 2 200     | 1 620     | 2.77                          | 550             | 975    | 300          | 1 950        | 3 750        | 3                | 1:1.5 |
| 3.40                              | 3.44                             | 2 400     | 1 720     | 2.77                          | 550             | 875    | 300          | 1 950        | 4 125        | 3                | 1:1.5 |
| 3.90                              | 3.94                             | 2 600     | 1 820     | 2.77                          | 550             | 975    | 300          | 1 950        | 4 425        | 3                | 1:1.5 |
| 4.40                              | 4.46                             | 2 840     | 1 920     | 2.77                          | 600             | 1 025  | 300          | 1 950        | 4 425        | 3                | 1:1.5 |
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#### GENERAL NOTES

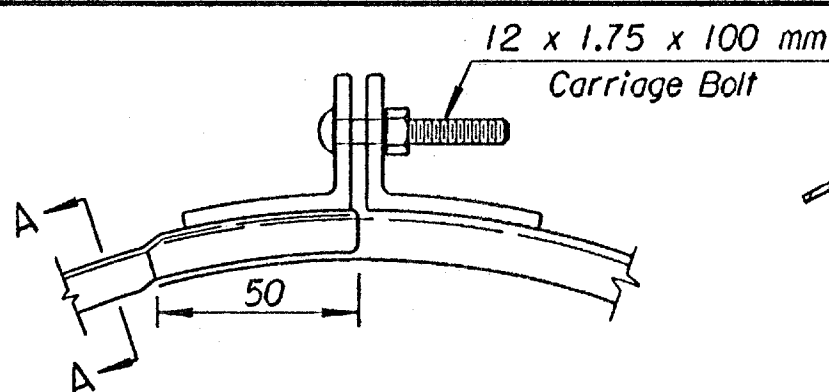
Toe plate, where specified, shall be punched to match holes in apron lip. 10 mm dia. galvanized bolts shall be

W + 255 mm for 300 mm through 750 mm diameter pipes.  
W + 510 mm for 900 mm through 2 100 mm diameter pipes.  
W + 255 mm for pipe arches with a rise of 330 mm through 740 mm.  
W + 510 mm for pipe arches with a rise of 840 mm through 1 500 mm.

Apron section for 300 mm through 600 mm diameter pipe and pipe arches with rise of 330 mm through 610 mm shall be made from one sheet. Apron sections for 750 mm through 1 050 mm diameter pipe and pipe arches with rise of 740 mm through 840 mm may be made from up to two sheets joined by riveting or bolting on the centerline apron section. Apron section for 1 200 mm through 1 800 mm diameter pipe and pipe arches with rise of 970 mm through 1 620 mm may be made from up to three sheets joined by riveting or bolting at equal distances from centerline. Apron sections for 1 950 mm diameter pipe and above and pipe arches with rise 1 720 mm and above may be made from up to four sheets joined by riveting or bolting.

Corner sections, corner plate and toe plate shall be same thickness as apron and each shall be galvanized in accordance with the specifications.

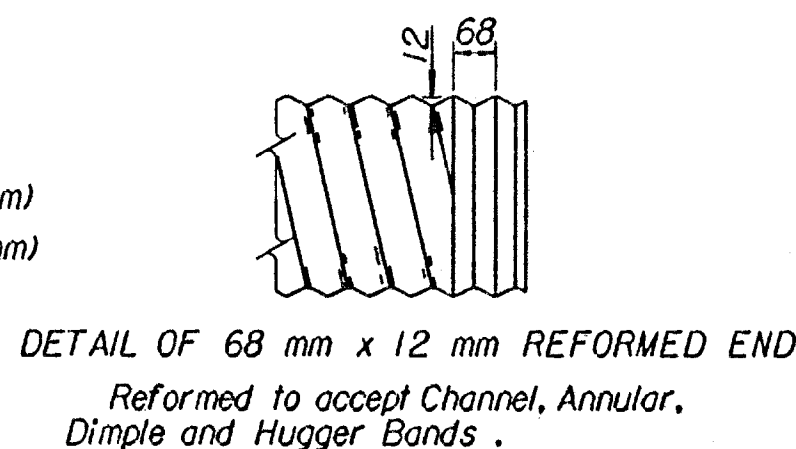
Other approved designs may be used in lieu of type shown.



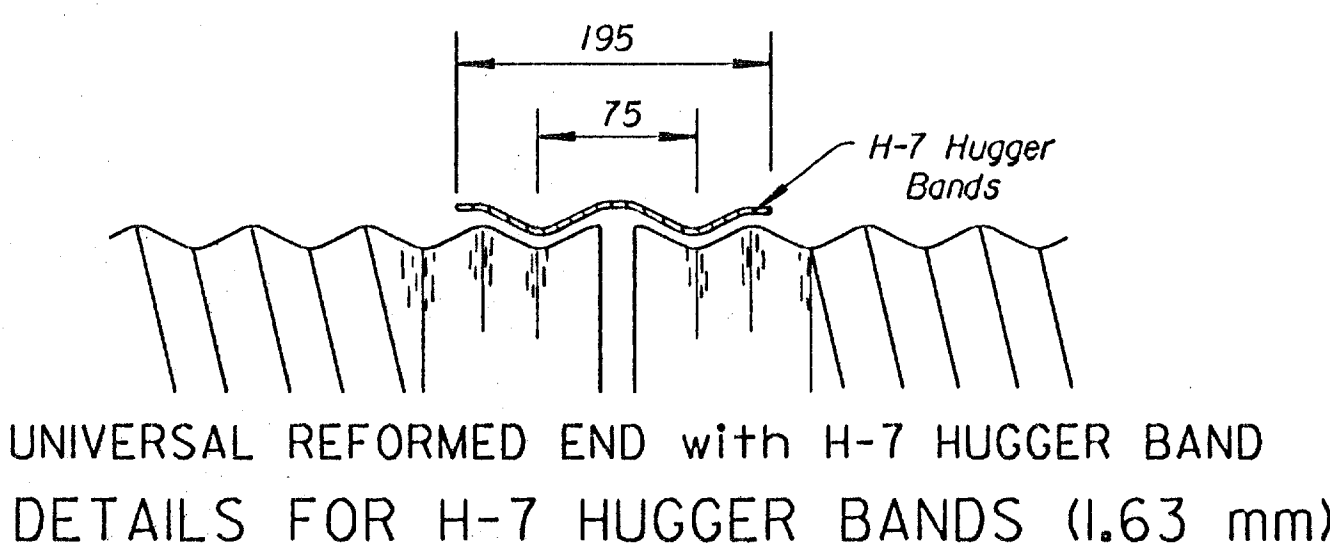
#### CHANNEL BAND DETAILS

#### Channel band couplers shall:

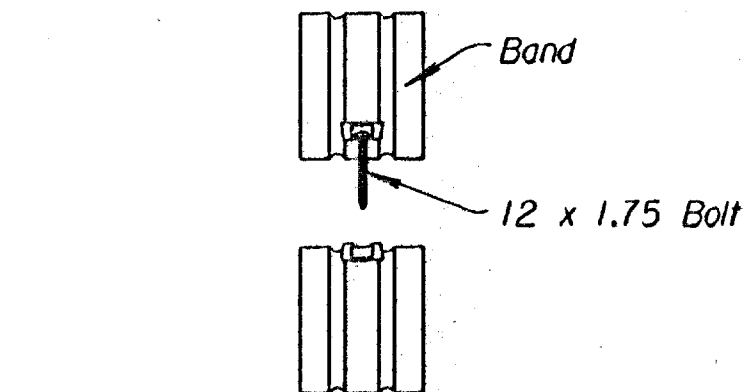
1. Be of two piece design.
2. Be fabricated f . m galvanized steel.
3. Be 2.01 mm thickness for pipe 2.77 mm or thinner. (A= 19 mm)
4. Be 2.77 mm thickness for pipe 3.51 mm or thicker. (A= 25 mm)
5. Have L 51 mm x 51 mm x 4.8 mm securely fastened to each band end to allow for proper tightening.



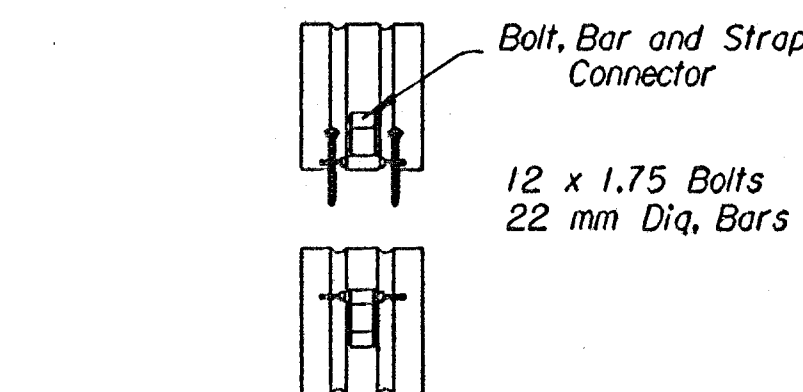
Reformed to accept Channel, Annular, Dimple and Hugger Bands .



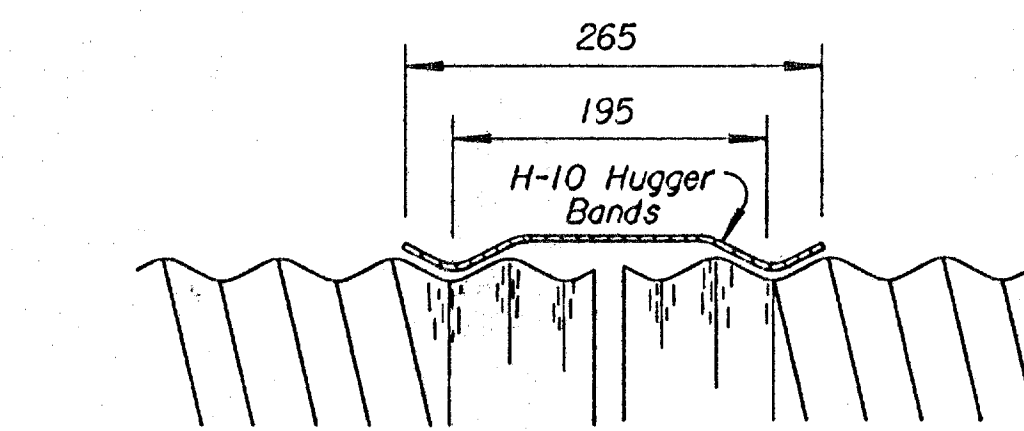
#### UNIVERSAL REFORMED END with H-7 HUGGER BAND DETAILS FOR H-7 HUGGER BANDS (1.63 mm)



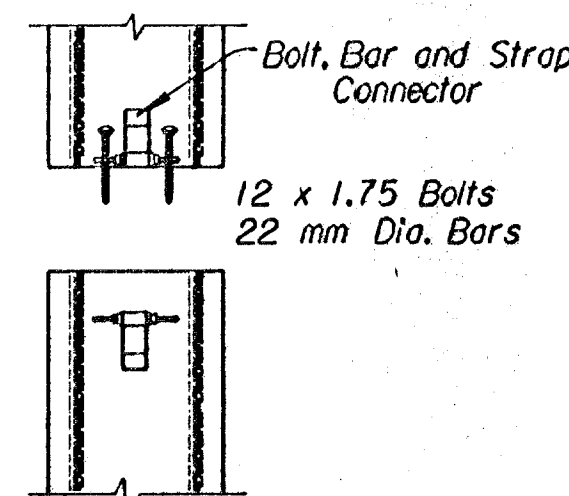
#### STANDARD CONNECTION DETAIL



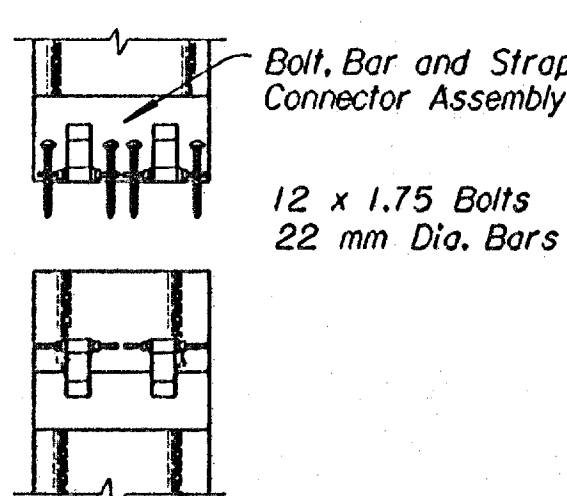
#### ALTERNATE CONNECTION DETAIL



#### UNIVERSAL REFORMED END with H-10 HUGGER BAND DETAILS FOR H-10 HUGGER BANDS (1.63 mm)



#### CONNECTION DETAIL SINGLE HARNESS



#### CONNECTION DETAIL DOUBLE HARNESS

▲ Note: At the Contractor's option, 125 mm x 25 mm corrugated steel pipe of equal thickness may be substituted for the 75 mm x 25 mm corrugated steel pipe listed in the table with the following restrictions:

1. Fill height over top of pipe shall be less than 7.6 m.
2. Pipe shall be fabricated with helical corrugations and lock seams or continuous welded seams.

| PIPE CULVERT SUMMARY |          |      |                         |                   |           |     |                    |     |                    |                    |     |                  |              |          |         |     |     |     |
|----------------------|----------|------|-------------------------|-------------------|-----------|-----|--------------------|-----|--------------------|--------------------|-----|------------------|--------------|----------|---------|-----|-----|-----|
| Station              | Location | Type | Dia. or Bid Designation | Crown Grade Elev. | Flow Line |     | Horizontal Roadway |     | Degree of Rotation | Length of Pipe (m) |     | Total Length (m) | End Sections |          |         |     |     |     |
|                      |          |      |                         |                   | Lt.       | Rt. | Lt.                | Rt. |                    | Lt.                | Rt. |                  | Type I       | Type III | Type IV | Lt. | Rt. | Lt. |
| 1+775                | Lt.      | E.P. | 375 mm                  | ---               | ---       | --- | ---                | --- | ---                | ---                | --- | 12.2             | 1            | 1        |         |     |     |     |
| 1+965                | Lt.      | E.P. | 375 mm                  | ---               | ---       | --- | ---                | --- | ---                | ---                | --- | 9.1              |              |          |         |     |     |     |
|                      |          |      |                         |                   |           |     |                    |     |                    |                    |     |                  |              |          |         |     |     |     |
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#### GENERAL NOTES

The culverts listed on this sheet may not indicate that the culvert installed will be steel, aluminum or reinforced concrete. \*For thickness above minimum requirements see summary of culverts.

Connection of end sections by welding will not be permitted. All 3 piece apron sections shall have 2.77 mm sides and 3.51 mm center panels. Multiple panel apron sections shall have lap seams which are to be tightly joined by galvanized rivets or bolts at equal distances from centerline.

For 1 500 mm through 3 000 mm diameter pipe apron sections, reinforced edges shall be supplemented by hot dipped galvanized stiffener angles. The angles shall be attached by galvanized nuts and bolts.

For 1 850 mm x 1 400 mm and larger pipe arch sections, reinforced edges shall be supplemented by hot dipped galvanized stiffener angles. The angles shall be attached by galvanized bolts and nuts.

Angle reinforcement shall be placed under the center panel seams on 1 850 mm x 1 400 mm and larger pipe arch apron sections. All references to galvanized metal refer to steel only.

Gain in pipe length due to fit of pipe at connecting band shall not be paid for.

When Hugger Bands are used the H-7 Hugger Band may be used on circular pipes 900 mm diameter and smaller and pipe arches 1 060 mm x 740 mm and smaller. The H-10 Hugger Band is required for larger size pipes.

| NO. | DATE     | REVISIONS                            | BY     | APP'D  |
|-----|----------|--------------------------------------|--------|--------|
| 4   | 10-03-00 | Revised bolt callouts                | R.J.S. | J.O.B. |
| 3   | 4-27-98  | Added pipe corrugation option note   | R.J.S. | J.O.B. |
| 2   | 1-12-96  | Rev. Arch Dimensions                 | R.J.S. | J.O.B. |
| 1   | 7-24-95  | Rev. General Notes, tables & details | R.J.S. | J.O.B. |

#### KANSAS DEPARTMENT OF TRANSPORTATION

#### METAL END SECTION FOR ROUND & ARCH METAL CULVERTS (TYPE I) & PIPE GAUGE TABLES

|               |            |                        |            |               |
|---------------|------------|------------------------|------------|---------------|
| RD710 SI      |            |                        |            |               |
| FHWA APPROVAL | 10-13-00   | APP'D, James O. Brewer | QUANTITIES | TRACED Bowser |
| DESIGNED      | DETAIL CK. | QUAN. CK.              | TRACE CK.  | Saltz         |