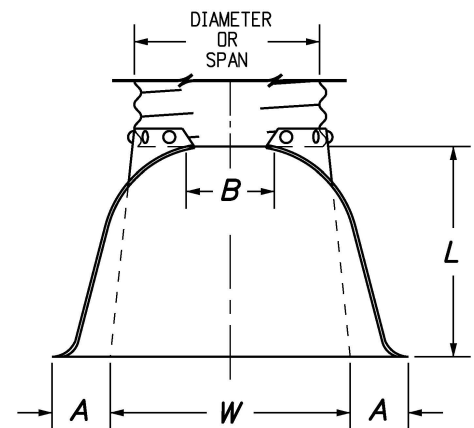


| PIPE DIA. | THICKNESS | DIMENSIONS |    |    |    |     |     |
|-----------|-----------|------------|----|----|----|-----|-----|
|           |           | A          | B  | H  | L  | W   | T   |
| IN.       |           |            |    |    |    |     |     |
| 12        | 0.064     | 6          | 6  | 6  | 21 | 24  | 34  |
| 18        | 0.064     | 8          | 10 | 6  | 31 | 36  | 46  |
| 21        | 0.064     | 9          | 12 | 6  | 36 | 42  | 52  |
| 24        | 0.064     | 10         | 13 | 6  | 41 | 48  | 58  |
| 30        | 0.079     | 12         | 16 | 8  | 51 | 60  | 70  |
| 36        | 0.079     | 14         | 19 | 9  | 60 | 72  | 94  |
| 42        | 0.109     | 16         | 22 | 11 | 69 | 84  | 106 |
| 48        | 0.109     | 18         | 27 | 12 | 78 | 90  | 112 |
| 54        | 0.109     | 18         | 30 | 12 | 84 | 102 | 124 |
| 60        | 0.109     | 18         | 33 | 12 | 87 | 114 | 136 |
| 66        | 0.109     | 18         | 36 | 12 | 87 | 120 | 142 |
| 72        | 0.109     | 18         | 39 | 12 | 87 | 126 | 148 |
| 78        | 0.109     | 18         | 42 | 12 | 87 | 132 | 154 |
| 84        | 0.109     | 18         | 45 | 12 | 87 | 138 | 160 |



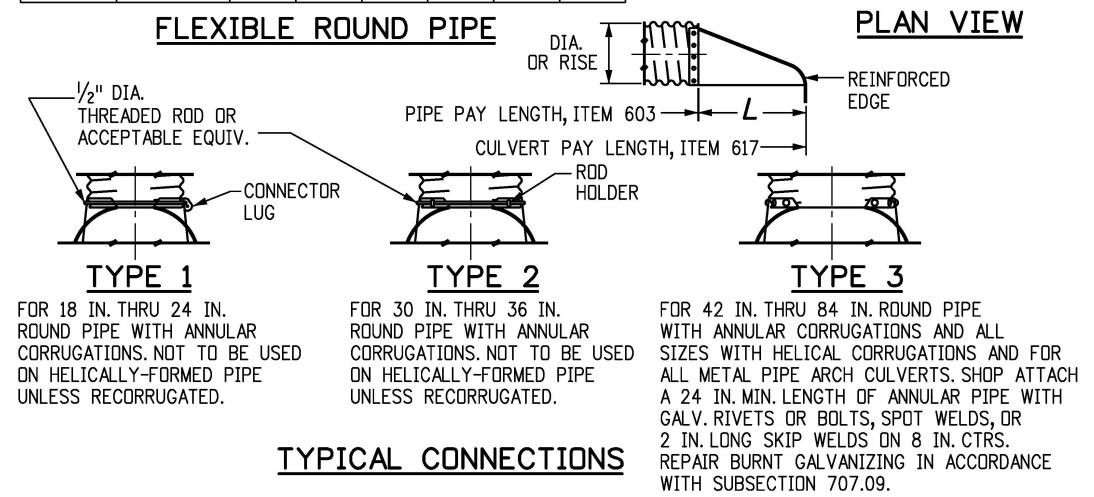
| PIPE ARCH   | THICKNESS | DIMENSIONS |        |       |         |       |     |
|-------------|-----------|------------|--------|-------|---------|-------|-----|
|             |           | A          | B      | H     | L       | W     | T   |
| IN.         |           |            |        |       |         |       |     |
| SPAN x RISE |           | (±1")      | (MAX.) | (±1") | (±1.5") | (±2") |     |
| 21 x 15     | 0.064     | 7          | 10     | 6     | 23      | 36    | 46  |
| 24 x 18     | 0.064     | 8          | 12     | 6     | 28      | 42    | 52  |
| 28 x 20     | 0.064     | 9          | 14     | 6     | 32      | 48    | 58  |
| 35 x 24     | 0.079     | 10         | 16     | 6     | 39      | 60    | 70  |
| 42 x 29     | 0.079     | 12         | 18     | 8     | 46      | 75    | 85  |
| 49 x 33     | 0.109     | 13         | 21     | 9     | 53      | 85    | 103 |
| 57 x 38     | 0.109     | 18         | 26     | 12    | 63      | 90    | 108 |
| 64 x 43     | 0.109     | 18         | 30     | 12    | 70      | 102   | 120 |
| 71 x 47     | 0.109     | 18         | 33     | 12    | 77      | 114   | 132 |

**FLEXIBLE PIPE ARCH**

**GENERAL NOTES**

- DIMENSIONS OF END SECTIONS MAY VARY SLIGHTLY FROM THOSE SHOWN ON THE TABLES DUE TO DIFFERENT MANUFACTURERS' CONFIGURATIONS.
- CONCRETE END SECTIONS SHALL BE FURNISHED WITH TONGUE OR GROOVE AS REQUIRED.
- DESIGN LENGTH OF PIPE OR SIDE DRAIN IS BASED ON LENGTH OF END SECTION SHOWN IN TABLE. ANY ADDITIONAL PIPE REQUIRED TO PROVIDE THE DESIGN LENGTH SHALL BE FURNISHED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE PROJECT.
- THE INSIDE CONFIGURATION AND THE JOINT OF CONCRETE END SECTION AND PIPE SHALL MATCH.
- END SECTIONS FOR CMP ARCH PIPE SHALL MATCH THE DIMENSIONS OF THE PIPE SHOWN ON THE PLANS.
- GALVANIZED TOE PLATE AS SHOWN IS REQUIRED ON END SECTIONS FOR CORRUGATED STEEL PIPE AND SHALL BE THE SAME THICKNESS AS END SECTIONS. TOE PLATE SHALL BE FIELD-BOLTED TO END SECTION WITH 3/8 IN. GALVANIZED BOLTS, NUTS AND WASHERS.
- GALVANIZED STEEL SHALL CONFORM TO AASHTO M 111, M 218 OR M 232.
- CONCRETE PIPE JOINT FASTENERS, WHERE SHOWN ON PLANS, SHALL BE INSTALLED SO THAT A MINIMUM OF 15 LINEAR FEET OF THE OUTLET END OF THE PIPE ARE MECHANICALLY LOCKED TOGETHER. END SECTION LENGTHS WHEN USED, SHALL BE INCLUDED IN THE 15 LF REQUIREMENT.
- CONNECTIONS OF METAL END SECTIONS TO PLASTIC PIPE SHALL BE APPROVED BY THE ENGINEER. PLASTIC END SECTIONS SHALL NOT BE USED.
- THE END SECTION STYLE, EITHER REGULAR OR SAFETY, SHALL BE AS SHOWN ON THE PLANS.
- AT THE OPTION OF THE CONTRACTOR AND APPROVAL OF THE CDDT PROJECT ENGINEER, REINFORCED CONCRETE END SECTIONS MAY BE MADE WITH SYNTHETIC FIBERS INSTEAD OF STEEL FOR PIPES 36 INCHES IN DIAMETER AND SMALLER, AND CONFORM TO AASHTO M 86 AND SUBSECTION 601.03.

**FLEXIBLE ROUND PIPE**

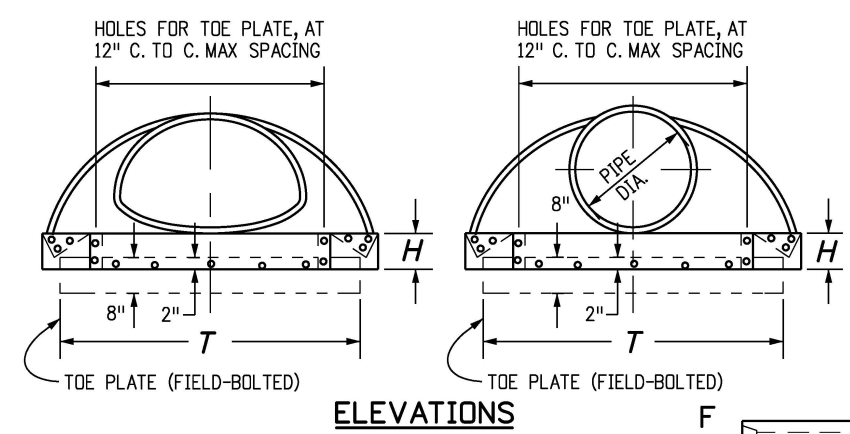


**TYPE 1**  
FOR 18 IN. THRU 24 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS. NOT TO BE USED ON HELICALLY-FORMED PIPE UNLESS RECORRUGATED.

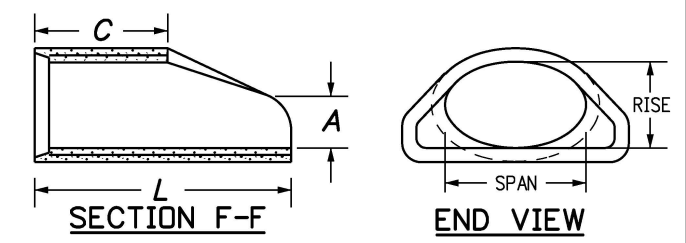
**TYPE 2**  
FOR 30 IN. THRU 36 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS. NOT TO BE USED ON HELICALLY-FORMED PIPE UNLESS RECORRUGATED.

**TYPE 3**  
FOR 42 IN. THRU 84 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS AND ALL SIZES WITH HELICAL CORRUGATIONS AND FOR ALL METAL PIPE ARCH CULVERTS. SHOP ATTACH A 24 IN. MIN. LENGTH OF ANNULAR PIPE WITH GALV. RIVETS OR BOLTS, SPOT WELDS, OR 2 IN. LONG SKIP WELDS ON 8 IN. CTRS. REPAIR BURNT GALVANIZING IN ACCORDANCE WITH SUBSECTION 707.09.

**TYPICAL CONNECTIONS**



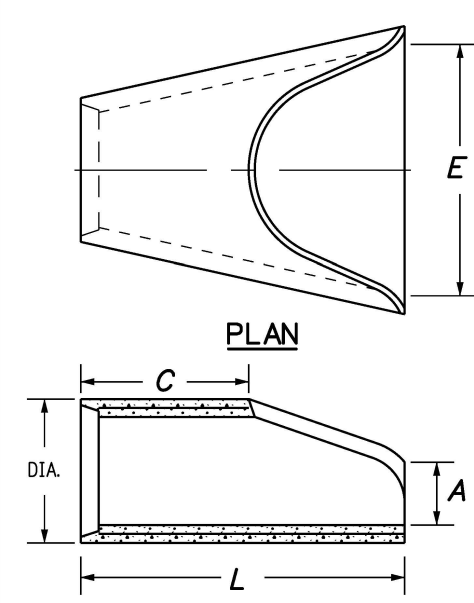
**ELEVATIONS**



| EQUIVALENT CIRCULAR DIA. | DIMENSIONS          |    |    |    |    |    |
|--------------------------|---------------------|----|----|----|----|----|
|                          | NOMINAL SPAN x RISE | A  | C  | L  | E  |    |
| IN.                      |                     |    |    |    |    |    |
| 24                       | 30                  | 19 | 9  | 33 | 72 | 48 |
| 30                       | 38                  | 24 | 10 | 18 | 72 | 60 |
| 36                       | 45                  | 29 | 12 | 24 | 84 | 72 |
| 42                       | 53                  | 34 | 16 | 36 | 96 | 78 |
| 48                       | 60                  | 38 | 21 | 36 | 96 | 84 |
| 54                       | 68                  | 43 | 26 | 36 | 96 | 90 |
| 60                       | 76                  | 48 | 30 | 36 | 96 | 96 |

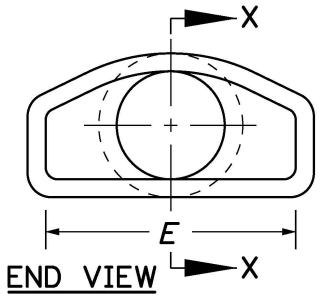
**END SECTION FOR REINFORCED CONCRETE ELLIPTICAL PIPE**

**END SECTION AND CONNECTION DETAILS FOR ROUND AND ARCH METAL PIPES**

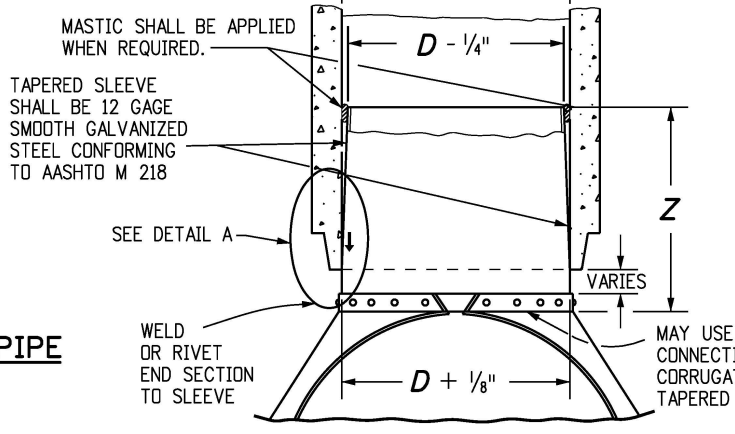


| PIPE I.D. | DIMENSIONS |    |    |     |
|-----------|------------|----|----|-----|
|           | A          | C  | L  | E   |
| IN.       |            |    |    |     |
| 18        | 10         | 48 | 78 | 36  |
| 24        | 10         | 48 | 78 | 48  |
| 30        | 14         | 36 | 96 | 60  |
| 36        | 18         | 36 | 96 | 72  |
| 42        | 24         | 36 | 96 | 78  |
| 48        | 28         | 24 | 96 | 84  |
| 54        | 30         | 36 | 96 | 90  |
| 60        | 36         | 36 | 96 | 96  |
| 72        | 34         | 20 | 96 | 108 |

**REINFORCED CONCRETE CIRCULAR PIPE**

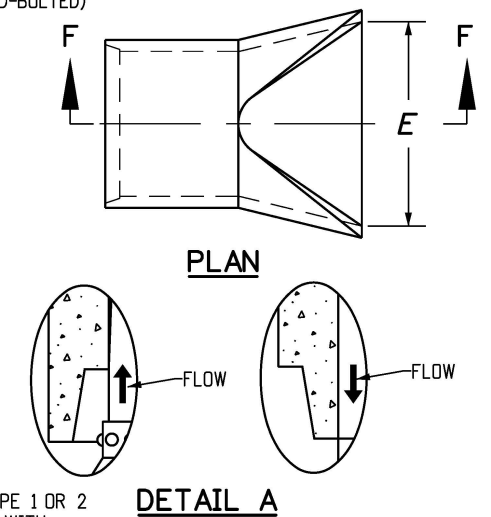


**END VIEW**



| D             | Z (MIN.) |
|---------------|----------|
| IN.           |          |
| 18 - 24       | 12       |
| 30 AND 36     | 16       |
| 42 AND LARGER | 24       |

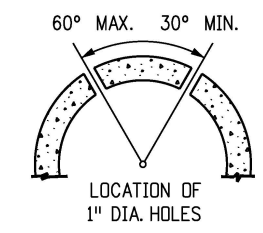
**STEEL END SECTION FOR CONCRETE CIRCULAR PIPE**  
(ALTERNATIVE FOR CONCRETE END SECTION)



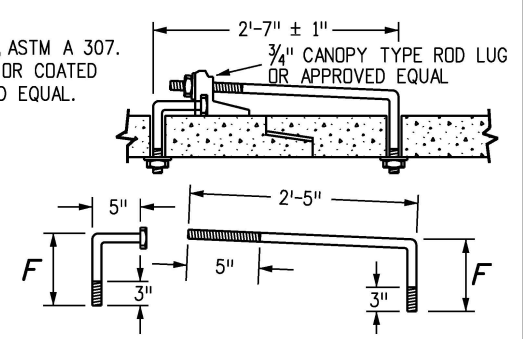
**PLAN**

**DETAIL A**

3/4" GALVANIZED ANCHOR BOLTS, NUTS AND WASHERS, MILD STEEL, ASTM A 307. ROD LUG SHALL BE GALVANIZED OR COATED WITH EPOXY PAINT OR APPROVED EQUAL.



**LOCATION OF 1" DIA. HOLES**



**CONCRETE JOINT FASTENER (TWO PER JOINT)**

| Computer File Information |                 |
|---------------------------|-----------------|
| Creation Date:            | 07/31/19        |
| Designer Initials:        | JBK             |
| Last Modification Date:   | 07/31/19        |
| Detailer Initials:        | LTA             |
| CAD Ver.:                 | MicroStation V8 |
| Scale:                    | Not to Scale    |
| Units:                    | English         |

| Sheet Revisions |          |
|-----------------|----------|
| Date:           | Comments |
| (R-X)           |          |
| (R-X)           |          |
| (R-X)           |          |
| (R-X)           |          |

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**Project Development Branch**      **JBK**

**CONCRETE AND METAL END SECTIONS**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**  
M-603-10  
**Standard Sheet No. 1 of 1**  
Project Sheet Number: