

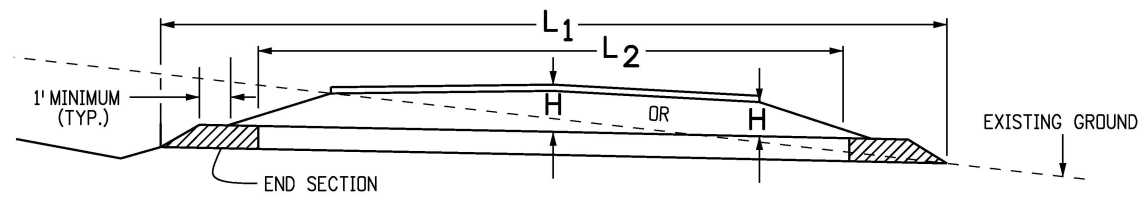
NOTE: Bc IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.

PIPE INSTALLATION
(WITH 0.7 PROJECTION RATIO)

| CIRCULAR (CIR) | | | VERTICAL ELLIPTICAL (VE) | | | | HORIZONTAL ELLIPTICAL (HE) | | | |
|-------------------------------|----------------|-------------------------|--------------------------|------|----------------|------------------|----------------------------|------|----------------|------------------|
| PIPE SIZE= Ba (INSIDE DIA) | WALL THICKNESS | 0.3 Bc (OUTSIDE DIA) | SPAN | RISE | WALL THICKNESS | 0.3 OUTSIDE RISE | SPAN | RISE | WALL THICKNESS | 0.3 OUTSIDE RISE |
| IN. | | FT. | IN. | | | | IN. | | | |
| | | | FT. | | | | FT. | | | |
| 12 | 2 | 0.40 | | | | | 23 | 14 | 2-3/4 | 0.49 |
| 15 | 2-1/4 | 0.49 | | | | | | | | |
| 18 | 2-1/2 | 0.58 | | | | | | | | |
| 21 | 2-3/4 | 0.66 | | | | | 30 | 19 | 3-1/4 | 0.66 |
| 24 | 3 | 0.75 | | | | | 34 | 22 | 3-1/2 | 0.73 |
| 27 | 3-1/4 | 0.84 | | | | | | | | |
| 30 | 3-1/2 | 0.92 | | | | | 38 | 24 | 3-3/4 | 0.79 |
| 33 | 3-3/4 | 1.01 | | | | | | | | |
| 36 | 4 | 1.10 | 29 | 45 | 4-1/2 | 1.35 | 45 | 29 | 4-1/2 | 0.95 |
| 42 | 4-1/2 | 1.28 | 34 | 53 | 5 | 1.58 | 53 | 34 | 5 | 1.10 |
| 48 | 5 | 1.45 | 38 | 60 | 5-1/2 | 1.78 | 60 | 38 | 5-1/2 | 1.23 |
| 54 | 5-1/2 | 1.62 | 43 | 68 | 6 | 2.00 | 68 | 43 | 6 | 1.38 |
| 60 | 6 | 1.80 | 48 | 76 | 6-1/2 | 2.23 | 76 | 48 | 6-1/2 | 1.53 |
| 66 | 6-1/2 | 1.97 | 53 | 83 | 7 | 2.43 | 83 | 53 | 7 | 1.68 |
| 72 | 7 | 2.15 | 58 | 91 | 7-1/2 | 2.65 | 91 | 58 | 7-1/2 | 1.83 |
| 78 | 7-1/2 | 2.32 | 63 | 98 | 8 | 2.85 | 98 | 63 | 8 | 1.98 |
| 84 | 8 | 2.50 | 68 | 106 | 8-1/2 | 3.08 | 106 | 68 | 8-1/2 | 2.13 |
| 90 | 8-1/2 | 2.68 | 72 | 113 | 9 | 3.28 | 113 | 72 | 9 | 2.25 |
| 96 | 9 | 2.85 | 77 | 121 | 9-1/2 | 3.50 | 121 | 77 | 9-1/2 | 2.40 |
| 102 | 9-1/2 | 3.02 | 82 | 128 | 9-3/4 | 3.69 | 128 | 82 | 9-3/4 | 2.54 |
| 108 | 10 | 3.20 | 87 | 136 | 10 | 3.90 | 136 | 87 | 10 | 2.68 |

△ ALSO EQUIVALENT ROUND DIMENSION FOR ELLIPTICAL PIPE.

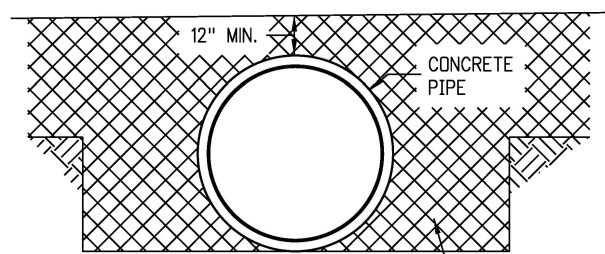
DIMENSIONS FOR REINFORCED CONCRETE PIPE
(FOR INFORMATION ONLY)



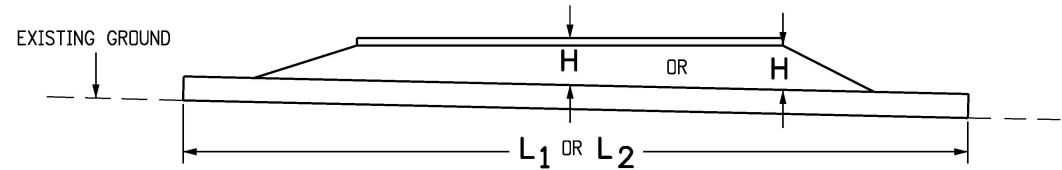
CONCRETE PIPE WITH END SECTIONS

NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

- H = HEIGHT OF FILL OVER TOP OF PIPE, INCLUDING PAVEMENT THICKNESS.
- L1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.
- L2 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.



CONSTRUCTION MINIMUM COVER FOR RIGID PIPE



CONCRETE PIPE WITHOUT END SECTIONS

NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

| TYPE OF PIPE | HEIGHT OF FILL OVER TOP OF PIPE, H (FEET) | | | | |
|----------------------------|--|---|--|---|-----------------------|
| | CLASS OF PIPE (0.01 IN. CRACK D-LOAD) | | | | |
| | CLASS CIR II CLASS VE II CLASS HE II 1000 D | CLASS CIR III CLASS VE III CLASS HE III 1350 D | CLASS CIR IV CLASS VE IV CLASS HE IV 2000 D | CLASS CIR V CLASS VE V CLASS HE V 3000 D | CLASS VE VI 4000 D |
| CIRCULAR (CIR) | 1 TO 18 | 1 TO 25 | ± 25 TO 37 | ± 37 TO 45 | |
| VERTICAL ELLIPTICAL (VE) | 1 TO 18 | 1 TO 25 | ± 25 TO 37 | ± 37 TO 45 | ± 45 TO 62 |
| HORIZONTAL ELLIPTICAL (HE) | 1 TO 18 | 1 TO 25 | ± 25 TO 37 | | |

ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE

(ALL SIZES)

GENERAL NOTES
REINFORCED CONCRETE PIPE

- FILL HEIGHTS GREATER THAN MAXIMUM ALLOWED IN THE HEIGHTS OF FILL TABLE ON THIS SHEET REQUIRE SPECIAL DESIGN OF STRUCTURE.
- PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.
- THE HEIGHTS OF FILL OVER TOP OF PIPE ARE BASED ON UNIT WEIGHT OF SOIL AT 135 LBS. PER CUBIC FT.
- PIPE CLASS IS DETERMINED FROM 0.01 IN. CRACK D-LOAD.
- BEDDING IS CLASS B (MODIFIED) (FROM CONCRETE PIPE DESIGN MANUAL-AMERICAN CONCRETE PIPE ASSOCIATION) WITH SETTLEMENT RATIO R = 0.0_{sd} (YIELDING BED). BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. LOOSE THICKNESS STRUCTURE BACKFILL CLASS 2. BEDDING MATERIAL FOR RIGID PIPE IN ROCK SHALL BE 12 IN. LOOSE THICKNESS STRUCTURE BACKFILL CLASS 1.
- CHANGES IN DESIGN FACTORS REQUIRE COMPENSATING CHANGES IN PIPE DESIGN.
- MINIMUM WALL THICKNESS DIMENSIONS ARE BASED ON AASHTO M 170 (WALL B) FOR CIRCULAR PIPE, AND AASHTO M 207 FOR ELLIPTICAL PIPE.
- SPACING FOR MULTIPLE PIPE INSTALLATIONS SHALL CONFORM TO THE DETAILS SHOWN ON STANDARD PLAN M-206-1.
- WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL PIPE INSTALLATION SHALL BE USED.

NONREINFORCED CONCRETE PIPE

- AT THE OPTION OF THE CONTRACTOR, NONREINFORCED CONCRETE PIPE CONFORMING TO AASHTO M 86 MAY BE USED IN LIEU OF REINFORCED CONCRETE PIPE FOR ALL SIZES 36 INCHES IN DIAMETER AND SMALLER. THE NONREINFORCED CONCRETE PIPE SHALL MEET THE SAME D-LOAD TO PRODUCE THE ULTIMATE LOAD UNDER THE THREE-EDGE BEARING METHOD AS SPECIFIED FOR REINFORCED CONCRETE PIPE IN CONFORMANCE WITH AASHTO M 170. THE CONTRACTOR SHALL PROVIDE WRITTEN CERTIFICATION OF CONFORMANCE. THE WALL THICKNESS OF THE NONREINFORCED PIPE MAY BE INCREASED AS REQUIRED TO MEET D-LOAD REQUIREMENT.
- ALL REQUIREMENTS FOR REINFORCED CONCRETE PIPE, EXCEPT THOSE REFERRING TO REINFORCEMENT, SHALL APPLY TO NONREINFORCED CONCRETE PIPE.

| | | | | | | | |
|--|-------|------------------------|-----------|---|-----------------------------------|---------------------------|--|
| Computer File Information | | Sheet Revisions | | Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 Project Development Branch | <h1>REINFORCED CONCRETE PIPE</h1> | STANDARD PLAN NO. | |
| Creation Date: 07/31/19 | | Date: | Comments: | | | M-603-2 | |
| Designer Initials: JBK | (R-X) | | | | | Standard Sheet No. 1 of 1 | |
| Last Modification Date: 07/31/19 | (R-X) | | | | | Project Sheet Number: | |
| Detailer Initials: LTA | (R-X) | | | | | | |
| CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English | | (R-X) | | Issued by the Project Development Branch: July 31, 2019 | | | |