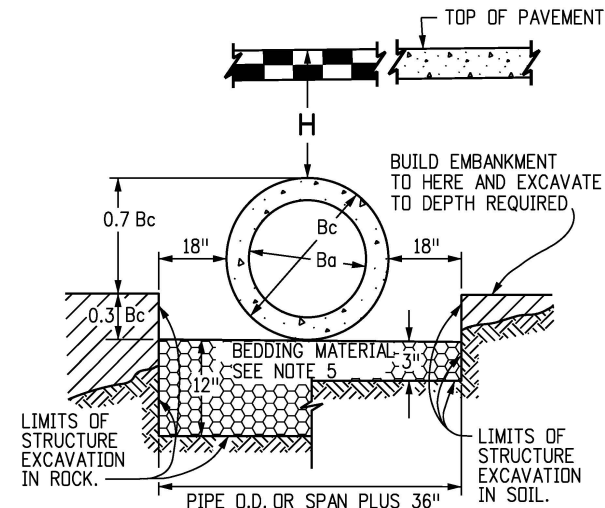




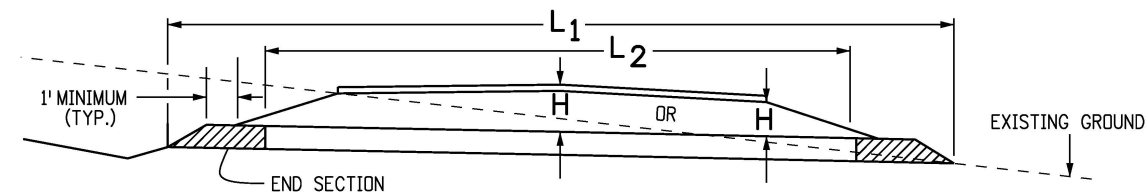
NOTE: Bc IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.

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.			
12	2	0.40					23	14	2- $\frac{3}{4}$	0.49
15	2- $\frac{1}{4}$	0.49								
18	2- $\frac{1}{2}$	0.58								
21	2- $\frac{3}{4}$	0.66					30	19	3- $\frac{1}{4}$	0.66
24	3	0.75					34	22	3- $\frac{1}{2}$	0.73
27	3- $\frac{1}{4}$	0.84								
30	3- $\frac{1}{2}$	0.92					38	24	3- $\frac{3}{4}$	0.79
33	3- $\frac{3}{4}$	1.01								
36	4	1.10	29	45	4- $\frac{1}{2}$	1.35	45	29	4- $\frac{1}{2}$	0.95
42	4- $\frac{1}{2}$	1.28	34	53	5	1.58	53	34	5	1.10
48	5	1.45	38	60	5- $\frac{1}{2}$	1.78	60	38	5- $\frac{1}{2}$	1.23
54	5- $\frac{1}{2}$	1.62	43	68	6	2.00	68	43	6	1.38
60	6	1.80	48	76	6- $\frac{1}{2}$	2.23	76	48	6- $\frac{1}{2}$	1.53
66	6- $\frac{1}{2}$	1.97	53	83	7	2.43	83	53	7	1.68
72	7	2.15	58	91	7- $\frac{1}{2}$	2.65	91	58	7- $\frac{1}{2}$	1.83
78	7- $\frac{1}{2}$	2.32	63	98	8	2.85	98	63	8	1.98
84	8	2.50	68	106	8- $\frac{1}{2}$	3.08	106	68	8- $\frac{1}{2}$	2.13
90	8- $\frac{1}{2}$	2.68	72	113	9	3.28	113	72	9	2.25
96	9	2.85	77	121	9- $\frac{1}{2}$	3.50	121	77	9- $\frac{1}{2}$	2.40
102	9- $\frac{1}{2}$	3.02	82	128	9- $\frac{3}{4}$	3.69	128	82	9- $\frac{3}{4}$	2.54
108	10	3.20	87	136	10	3.90	136	87	10	2.68

△ ALSO EQUIVALENT ROUND DIMENSION FOR ELLIPTICAL PIPE.

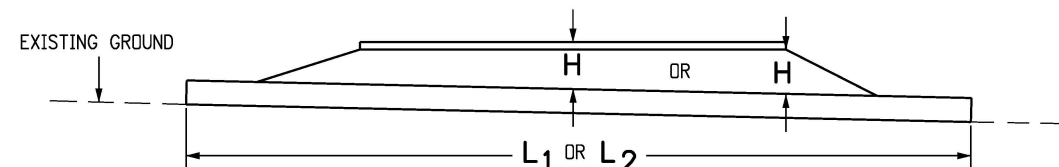
DIMENSIONS FOR REINFORCED CONCRETE PIPE (FOR INFORMATION ONLY)



CONCRETE PIPE WITH END SECTIONS

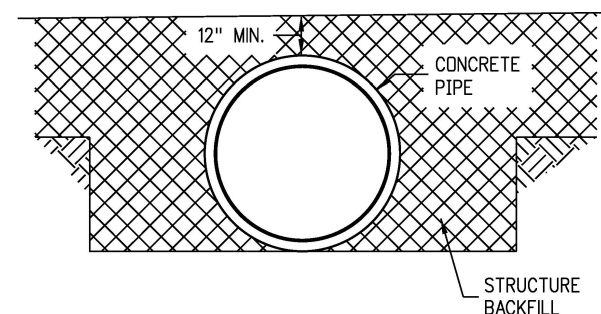
NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

- 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.



CONCRETE PIPE WITHOUT END SECTIONS

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



CONSTRUCTION MINIMUM COVER FOR RIGID PIPE

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	CLASS CIR III CLASS VE III CLASS HE III	CLASS CIR IV CLASS VE IV CLASS HE IV	CLASS CIR V CLASS VE V	CLASS VE VI
	1000 D	1350 D	2000 D	3000 D	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

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)	

Colorado Department of Transportation
2829 West Howard Place
CDOT HQ, 3rd Floor
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868
Project Development Branch JBK

REINFORCED CONCRETE PIPE

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.

M-603-2

Standard Sheet No. 1 of 1

Project Sheet Number: