


Technical Memorandum

To: Electronic Distribution Recipients
From: Mark Gieseke, P.E. 
Assistant Commissioner (Acting), Engineering Services

Subject: Reinforced Concrete Pipe Load Tables

Expiration

This is a new Technical Memorandum and will remain in effect until February 25, 2025 unless superseded or placed in the MnDOT Drainage Manual prior to that date.

Implementation

The design guidance in this Technical Memorandum is effective immediately. Use the new reinforced concrete pipe load tables on all projects with lettings after July 1, 2020. However, it is recommended that these changes be incorporated on projects let prior to July 1, 2020 to the extent practical.

Apply guidance contained herein on all new and ongoing Trunk Highway projects and State Aid projects. Local road authorities are encouraged to adopt similar guidelines.

Introduction

The concrete pipe load tables consist of minimum cover and maximum fill height tables. These tables are used to determine the class of concrete pipe for storm sewer and culverts. The existing pipe load tables have been updated using LRFD methodology. The intent of this Technical Memorandum is to inform the designer of these modifications.

Purpose

The attached minimum cover and maximum fill height tables supersede the concrete pipe load tables of Section 2.5.2 of the Drainage Manual and fill heights on Standard Plate 3014. The tables coincide with a pending update to the concrete pipe Standard Plates 3000 and 3014. While there are plans to update Chapter 2 of the Drainage Manual, the pipe load tables are needed immediately to ensure the correct pipe class is specified.

The current pipe bedding recommendations described in Section 360 of the Pavement Design Manual and Standard Plan 5-297.441 & 5-297.442 supersede pipe bedding requirements shown in Section 2.5.1 of the Drainage Manual. The load tables provided in this Technical Memorandum are based on the current pipe bedding recommendations.

Guidelines

For concrete pipe, use the attached tables to select the pipe class that meets the requirements of both minimum cover and maximum fill height. Continue to use load tables located in Technical Memorandum 17-05-B-02 for plastic pipe, and load tables in Chapter 2 of the Drainage Manual for metal pipe.

Minimum Cover

Reinforced concrete round pipes (Standard Plate 3000) allow two designs, B Wall and C Wall which have different wall thicknesses. For checking minimum cover use C Wall dimensions.

The minimum cover tables for precast reinforced concrete pipe are based on the following assumptions:

- Minimum cover is measured from top of pipe to top of pavement or ground surface.
- Pipe diameters are nominal inside diameter.

See Attachment A: Minimum Cover Requirements.

Maximum Fill

Reinforced concrete round pipes (Standard Plate 3000) allow two types of round pipe, B Wall and C Wall which have different wall thicknesses. For computing fill height use B Wall dimensions.

The fill height tables for precast reinforced concrete pipe are based on the following assumptions:

- Fill height is measured from the top of pipe to the top of pavement or ground surface.
- Pipes are installed per MnDOT bedding requirements which correspond to AASHTO Standard Installation Type 3.
- Soil Density $\gamma_s = 120$ pcf
- AASHTO HL-93 live load
- Positive Projecting Embankment Condition

See Attachment B: Maximum Fill Height Requirements

Questions

Any questions regarding the technical provisions of this Technical Memorandum can be addressed to either of the following:

Andrea Hendrickson, State Hydraulic Engineer, Bridge Office, at **(651) 366-4466**

Erik Brenna, Assistant State Hydraulic Engineer, Bridge Office, at **(651) 366-4536**

Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, DesignStandards.DOT@state.mn.us. A link to all active and historical Technical Memoranda can be found at <http://techmemos.dot.state.mn.us/techmemo.aspx>.

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Attachment A: Minimum Cover Requirements

Table A1: Minimum Cover Requirements in Feet for Round Reinforced Concrete Pipe

Internal Diameter (inches)	Flexible Paved Roads			Rigid Paved Roads			Unpaved Roads			Non-Roadway
	Class II	Class III	Class IV and V	Class II	Class III	Class IV and V	Class II	Class III	Class IV and V	All Classes
12	3	3	1.75	3	3	1.5	3.5	3.5	1.5	1
15	3	2	1.75	3	2	1.5	3.5	2.5	1.5	1
18	3	2	1.75	3	2	1.5	3.5	2.5	1.5	1
21	3	1.75	1.75	3	1.5	1.5	3.5	1.5	1.5	1
24	3	1.75	1.75	3	1.5	1.5	3.5	1.5	1.5	1
27	3	2	1.75	3	2	1.5	3.5	2.5	1.5	1
30	3	2	1.75	3	2	1.5	3.5	2.5	1.5	1
33	3	2	1.75	3	2	1.5	3.5	2.5	1.5	1
36	3	1.75	1.75	3	1.5	1.5	3.5	1.5	1.5	1
42	3	1.75	1.75	3	1.5	1.5	3.5	1.5	1.5	1
48	2	1.75	1.75	2	1.5	1.5	2.5	1.5	1.5	1
54	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
60	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
66	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
72	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
78	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
84	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
90	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
96	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
108	1.75	1.75	1.75	1.5	1.5	1.5	1.75	1.75	1.75	1

NOTES:

1. For sizes or minimum cover not provided in Table A1, contact the Bridge Office Hydraulics Unit.
2. 102" diameter pipe is not available.
3. Unpaved road minimum cover is adjusted by 0.5 feet to account for rutting, frost heave and grading tolerances.
4. Unpaved road minimum cover may be reduced by 0.5 feet for private residential and farm entrances.

Table A2: Minimum Cover Requirements in Feet for Arch Reinforced Concrete Pipe

Nominal Span (inches)	Flexible Paved Roads			Rigid Paved Roads			Unpaved Roads			Non-Roadway
	Class IIA	Class IIIA	Class IVA	Class IIA	Class IIIA	Class IVA	Class IIA	Class IIIA	Class IVA	All Available Classes
22	3	1.75	1.75	3	1.5	1.5	3.5	1.5	1.5	1
28	3	1.75	1.75	3	1.5	1.5	3.5	2	1.5	1
36	2.5	1.75	1.75	2.5	1.5	1.5	3	1.5	1.5	1
44	2.5	1.75	1.75	2.5	1.5	1.5	3	1.5	1.5	1
51	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
58	1.75	1.75	①	1.5	1.5	①	1.5	1.5	①	1 ①
65	1.75	1.75	①	1.5	1.5	①	1.5	1.5	①	1 ①
73	1.75	1.75	①	1.5	1.5	①	1.5	1.5	①	1 ①
88	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
102	1.75	1.75	1.75	1.5	1.5	1.5	1.5	1.5	1.5	1
115	1.75	1.75	1.75	1.5	1.5	1.5	1.75	1.75	1.75	1
122	1.75	1.75	1.75	1.5	1.5	1.5	1.75	1.75	1.75	1
138	1.75	1.75	①	1.5	1.5	①	2	2	①	1 ①
154	1.75	1.75	①	1.5	1.5	①	2.25	2.25	①	1 ①
169	1.75	1.75	①	1.5	1.5	①	2.25	2.25	①	1 ①

NOTES:

- ① Class IVA not available for this pipe span.
- For sizes or minimum cover not provided in Table A2, contact the Bridge Office Hydraulics Unit.
- Unpaved road minimum cover is adjusted by 0.5 feet to account for rutting, frost heave and grading tolerances.
- Unpaved road minimum cover may be reduced by 0.5 feet for private residential and farm entrances.

Attachment B: Maximum Fill Height Requirements

Table B1: Maximum Fill Height in Feet for Round Reinforced Concrete Pipe

Internal Diameter (inches)	Pipe Class for Round Pipe			
	Class II	Class III	Class IV	Class V
12	10	13	20	30
15	9	13	20	31
18	9	14	21	31
21	9	14	21	32
24	9	14	21	32
27	9	14	21	32
30	9	14	21	32
33	9	14	21	31
36	9	13	20	31
42	9	13	20	31
48	9	13	20	31
54	9	13	20	31
60	9	13	20	31
66	9	13	20	31
72	9	13	20	30
78	9	13	20	30
84	9	12	19	30
90	8	12	19	30
96	7	12	19	30
108	7	12	19	30

NOTES:

1. For sizes or fill heights not provided in Table B1, contact the Bridge Office Hydraulics Unit.
2. Source: American Concrete Pipe Association (ACPA) LRFD Fill Height Tables (Revised 03/17)
3. 102" diameter pipe is not available.

Table B2: Maximum Fill Height in Feet for Arch Reinforced Concrete Pipe

Nominal Span (inches)	Approximate Equivalent Round Diameter (inches)	Pipe Class for Arch Pipe		
		Class IIA	Class IIIA	Class IVA
22	18	7	11	17
28	24	7	11	17
36	30	7	11	17
44	36	7	11	17
51	42	7	11	17
58	48	7	11	①
65	54	7	11	①
73	60	7	11	①
88	72	7	11	17
102	84	6	11	17
115	90	7	10	17
122	96	6	10	17
138	108	6	10	①
154	120	6	10	①
169	132	6	10	①

NOTES:

- ① Class IVA not available for this pipe span.
- For sizes or fill heights not provided in Table B2, contact the Bridge Office Hydraulics Unit.
- Based on a projection ratio of 0.9
- Source: American Concrete Pipe Association (ACPA) LRFD Fill Height Tables (Revised 03/16)