



# Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

November 12, 2008

## **CIRCULAR LETTER 2008-14**

### **PIPE CULVERTS AND STORM SEWERS**

COUNTY ENGINEERS/SUPERINTENDENTS OF HIGHWAYS  
MUNICIPAL ENGINEERS/DIRECTORS OF PUBLIC WORKS/MAYORS  
CONSULTING ENGINEERS

The department working with industry has made changes to the allowable use of various pipe types and diameters. The revised allowable pipe diameters are detailed in the Bureau of Design & Environment's (BDE) Procedure Memorandum (PM) Number 65-08 and the Bureau of Bridges & Structures (BBS) All Bridge Designer (ABD) Memorandum 08.4.

BDE PM 65-08 modifies Section 40-3.07 of the BDE Manual by revising the limitations that govern allowable pipe types for culverts and storm sewers. BDE Special Provisions for Pipe Culvert and for Storm Sewers will also be issued for the April 24, 2009 letting.

BBS ABD 08.4 modifies Chapter 6 Culvert Hydraulics and Chapter 8 Storm Sewers of the department's Drainage Manual by revising the type and size of pipe culvert and storm sewers that may be used on a given roadway.

BDE PM 65-08 and BBS ABD 08.4 are attached for your information. Please contact Matt O'Connor in the BBS Hydraulics Unit at (217) 785-2917 or [matthew.oconnor@illinois.gov](mailto:matthew.oconnor@illinois.gov) with any questions.

Sincerely,

A handwritten signature in cursive script that reads "Charles J. Ingersoll".

Charles J. Ingersoll, P. E.  
Engineer of Local Roads and Streets

Attachments



# Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

## BDE PROCEDURE MEMORANDUM

NUMBER: 65-08

SUBJECT: Pipe Culverts and Storm Sewers

DATE: November 1, 2008

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This memorandum modifies portions of Section 40-3.07 of the BDE Manual and will be incorporated in the manual in a future update.

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### Background

This memorandum reflects changes to the allowable use of various pipe types and diameters. The revised allowable pipe diameters for the different pipe types are noted as well as changes to the conditions for both Pipe Culvert Class and Storm Sewer Class.

### Applicability

The following procedures are applicable to all state highway projects beginning with the April 24, 2009 letting.

### Procedures

#### 40-3.07(a) Diameter Limitations

The following limitations shall apply:

1. Reinforced Concrete Pipe may be used for diameters up to 108 inches (2700 mm) and equivalent round sizes up to 72 inches (1800 mm).
2. Corrugated Steel Pipe may be used for diameters up to 144 inches (3600 mm) and equivalent round sizes up to 120 inches (3000 mm).
3. Corrugated Aluminum Alloy Pipe may be used for diameters up to 120 inches (3000 mm) and equivalent round sizes up to 120 inches (3000 mm).
4. Polyvinyl Chloride (PVC) Pipe and Corrugated PVC Pipe with a Smooth Interior may be used for diameters up to 36 inches (900 mm). PVC Profile Wall Pipe may be used for diameters up to 48 inches (1200 mm).

**BDE PROCEDURE MEMORANDUM**

**November 1, 2008**

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- 5. Polyethylene (PE) Pipe may be used for diameters up to 48 inches (1200 mm).

**40-3.07(d) Classes of Pipe Culverts and Storm Sewers**

The classes of pipe culverts and storm sewers are defined in the following figures. In the plans, the designer should specify the appropriate pipe class and allow the contractor to bid the most cost effective material type. To specify, any one particular material type must be examined as a design exception and supported by proper justification.

Figure 40-3A presents the class of pipe culvert to be specified for specific conditions. See Section 542 of the *Standard Specifications for Road and Bridge Construction* for a listing of pipe materials allowed in each class.

Conditions	Pipe Culvert Class
Entrances, regardless of ADT; and Roadways with ADT < 4,000	D
Roadways with $4,000 \leq \text{ADT} < 10,000$	C
Roadways with ADT $\geq 10,000$	A

**PIPE CULVERT CLASSES**

**Figure 40-3A**

Figure 40-3B presents the class of storm sewer to be specified for specific conditions. See Section 550 of the *Standard Specifications for Road and Bridge Construction* for a listing of pipe materials allowed in each class.

Conditions	Storm Sewer Class
Roadways with ADT < 1,500; or pipe location is > 12 ft. (3.6 m) from the edge of the traveled way	B
Roadways with ADT $\geq 1,500$ and pipe location is $\leq 12$ ft. (3.6 m) from the edge of the traveled way	A

**STORM SEWER CLASSES**

**Figure 40-3B**

Interim Engineer of Design and Environment

Attachments



# Illinois Department of Transportation

## Memorandum

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To: ALL BRIDGE DESIGNERS 08.4  
 From: Ralph E. Anderson *Ralph E. Anderson*  
 Subject: Drainage Manual Modification \ Pipe Culverts & Storm Sewers  
 Date: November 7, 2008

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This memorandum complements BDE Procedure Memorandum Number 65-08 Pipe Culverts and Storm Sewers. BDE PM 65-08 modifies Section 40-3.07 of the BDE Manual by revising the limitations that govern allowable pipe types for culverts and storm sewers. Per PM 65-08, the new procedures are applicable to all roadways beginning with the April 24, 2009 letting.

The revisions impact two chapters within the IDOT Drainage Manual; Chapter 6 Culvert Hydraulics and Chapter 8 Storm Sewers. Modify the chapters according to the information and direction included here:

**Chapter 6, Section 6-002 Kind and Size of Culvert**

Within the 3<sup>rd</sup> sentence of 6-002, **Delete:** "6 inches of cover measured from the top of the pipe to the bottom of the subbase". **Replace with:** "12 inches of cover from the top of the pipe to the top of the subgrade".

Replace Figure 6-002 with this table:

**PIPE CULVERT CLASSES**

Conditions	Pipe Culvert Class	Minimum Diameter
Entrances, regardless of ADT; and Roadways with ADT < 4,000	D	15"
Roadways with 4000 ≤ ADT < 10,000	C	18"
Roadways with ADT ≥ 10,000	A	24"

The Class and Material listings that immediately follow Figure 6-002 were compiled before 2004 and are consequently incomplete. Refer to Article 542.03 of the Standard Specifications for Road and Bridge Construction for the current listing.

**Chapter 6, Section 6-003 Types of Culverts**

**Delete:** Additional types of culverts will be discussed in this chapter, though not in great detail. More comprehensive information on the use of these products may be obtained from the manufacturer.

**Insert:** This chapter focuses on concrete and metal pipe materials. However, the list of allowable pipe types shown in Section 542 of the Standard Specifications for Road and Bridge Construction has expanded over recent years, allowing flexible pipe to be utilized in a wider range of conditions. For a given culvert installation, the calculations of headwater and outlet velocity follow the same procedures provided in 6-100 Hydraulic Analysis, regardless of pipe or material type. The procedures are taken directly from the FHWA publication entitled HDS5, Hydraulic Design of Highway Culverts. For the concrete and metal pipe types listed here, the nomographs, tables and charts required for headwater calculations are included at the end of this chapter. For allowable pipe types not listed here- such as plastic pipe- please refer to HDS5 for the analogous information. To automate culvert hydraulic analysis for any allowable pipe material or shape, refer to the software titles recommended in this manual's Chapter 14 Computer Programs.

#### **Chapter 6, Section 6-100 Hydraulic Analyses**

**Insert at the end of the 1<sup>st</sup> paragraph:** The culvert designer should recognize that Section 40-3.07 of the BDE Manual allows the contractor to bid the most cost effective material type for pipe culverts, choosing among the allowable types for the pipe class and diameter specified in the contract plans. To accommodate the contractor's selection, the designer has to anticipate the contractor may choose ANY of the allowable material types for the specified class of culvert. It follows that in order to ensure the as-built installation satisfies design constraints on headwater and outlet velocity, design calculations should utilize an appropriately conservative Manning roughness n- value from the list of allowable materials within the given class of pipes. The correct approach is dependent on the controlling design flow condition. To satisfy headwater constraints in outlet control flow conditions, design calculations should employ the highest Manning roughness (n-value) for the pipe types within the specified class. Utilize a range of 0.010 to 0.013 (concrete) for Class A and 0.027 to 0.028 (corrugated metal) for Class C and Class D, noting that n-value varies by pipe diameter for corrugated metal. (See Figure 6-805b.) Analogously, to ensure outlet velocity limits or constraints are satisfied for pipe culverts operating under inlet control flow conditions, design calculations should employ the lowest available Manning roughness among the material types within the specified class. Utilize 0.010 to 0.013 (concrete) for Class A and 0.009 to 0.011 (PVC) for Class C and Class D. Given this direction, the designer should also anticipate the potential impact of material selection when the estimated design headwaters are on the cusp of inlet and outlet control.

#### **Chapter 8, Section 8-009.06 Type of Materials**

**Insert after the 1<sup>st</sup> sentence:** The storm sewer designer should recognize that Section 40-3.07 of the BDE Manual allows the contractor to bid the most cost effective material type for pipe storm drains, choosing among the allowable types for the pipe class and diameter specified in the contract plans. To accommodate the contractor's selection, the designer has to anticipate the

contractor may choose ANY of the allowable material types for the specified n-value from the list of allowable materials within the given class of pipes. For both Class A and B, utilize concrete with roughness ranging from 0.013 to 0.016. In addition to accounting for rougher pipe in this manner, the designer also needs to consider any adverse affects on design features due to the implementation of a smoother, thinner pipe than the concrete pipe assumed in hydraulic design calculations.

**Delete:** The three criteria currently listed as the basis for selecting an acceptable storm sewer material type. Replace with this table:

**STORM SEWER CLASSES**

Conditions	Storm Sewer Class
Roadways with ADT < 1,500 or pipe location is > 12 ft (3.6 m) from the edge of the traveled way	B
Roadways with ADT ≥ 1,500 and pipe location is ≤ 12 ft. (3.6 m) from the edge of the traveled way	A

**Chapter 8, Section 8-009.07 Cover**

**Delete:** The 6<sup>th</sup> sentence of this section: "However, in no case should a cover depth less than 0.5 ft below the subbase be used."

**Insert:** "For all cases, the minimum cover depth from top of the pipe to top of the subgrade is 12 inches".

Chapter 8 does not provide a list of the available material types within the two respective classes of storm sewer materials. See Article 550.03 of the Standard Specifications for Road and Bridge Construction for the Class A and Class B listings.

These modifications will be incorporated into the Drainage Manual in a future update. The Drainage Manual is posted with other Bureau of Bridges and Structures technical manuals at: <http://www.dot.il.gov/bridges/brmanuals.html>. Questions can be directed to Matt O'Connor of our Hydraulics Unit at 217-785-2917 or [matthew.oconnor@illinois.gov](mailto:matthew.oconnor@illinois.gov).

MO'C/kktABDdrainagemanualmodification08.4-20081107  
cc: Bureau of Design and Environment / Attn: Tara Elston