Illinois Department of Transportation

Memorandum

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	

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 3rd 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 1st 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 1st 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 6th 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.

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