INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

Design Memorandum No. 13-05
Policy Advisory

March 4, 2013

TO: **All Design, Operations, and District Personnel, and Consultants**

FROM: ***/s/Crystal M. Weaver***
Crystal M. Weaver
Manager, Hydraulics Office
Division of Bridges

SUBJECT: **In-Kind Culvert Replacement Policy**

REVISES: ***Indiana Design Manual*** **Section 203-2.02(02)**

EFFECTIVE: **Immediately**

The Office of Hydraulics has implemented the following In-Kind Culvert Replacement Policy.

Due to site and cost considerations, small structures and culverts may be replaced in kind. Replacement in kind means that the existing structure can be replaced with a new structure having the same span and the same rise from flowline to low structure elevation. The proposed structure may not be smaller than the existing structure. Current policy requirements including sumping depth, cutoff walls, and wingwalls, continue to apply to the proposed structure.

Site Criteria. A candidate for an in-kind structure replacement will meet the following site criteria:

a. The structure is in a rural area, as defined by the Indiana Department of Natural Resources (IDNR).
b. The existing culvert size meets or exceeds the minimum pipe size for the facility.
c. No record of flooding complaints at the structure.
d. No history of road overtopping at the required roadway serviceability, per INDOT Maintenance Division.
e. No evidence of scour at the outlet, including scour holes, structure undermining, or channel degradation.
f. No known debris problems.

Hydraulic Parameters. Hydraulic modeling will be required to consider a replacement in kind structure. The following hydraulic parameters need to be met before a structure can be replaced in kind.

a. The existing backwater depth is less than 3 ft. See *Indiana Design Manual* Section 201-2.0 for definitions.
b. The headwater elevation does not affect the finished floor elevation of any structures, houses, or buildings upstream of the structure.
c. The proposed backwater depth matches or improves the existing backwater depth.
d. If the existing outlet velocity of the structure is greater than 6.5 ft/s, the outlet velocity may not be more than 150% of the natural (tailwater) velocity of the stream.

If the existing structure meets the site criteria above, but does not meet the hydraulic parameters, the proposed structure may be upsized to meet the in-kind replacement hydraulic parameters.

If the in-kind culvert replacement policy conflicts with the existing-structure replacement policy, the least restrictive policy should be followed. If a backwater depth of 1 ft is reached before the outlet velocity meets the natural velocity comparison, the existing-structure replacement policy should be followed.

All structures should be designed for the appropriate design storm frequency. See *Indiana Design Manual* Figure 203-2C.

Revisions to Section 203-2.02(02) are attached to this memo.

CMW:ewp

203-2.02(02) Allowable Headwater (AHW) [Rev. Mar. 2013]

Allowable headwater is the depth of water that can be ponded at the upstream end of a culvert during the design flood. AHW will be limited by one or more of the following.

1. New Alignment. The maximum backwater, or increase in headwater elevation over the sum of TW depth plus inlet flowline elevation, should not exceed 0.14 ft. The maximum backwater may be modified if the backwater dissipates to 0.14 ft or less at the right-of-way-line or the channel is sufficiently deep to contain the increased elevation without overtopping the banks. If backwater remains within the channel banks or right of way, it is limited to a maximum of 1 ft.

   An exception to the 0.14 ft backwater allowance is subject to approval by the Office of Hydraulics.

2. Existing-Structure Replacement. The IDNR limits surcharge to 0.14 ft over existing conditions in an urban or rural location. Existing conditions are defined as the water-surface profile that results from those encroachments that were constructed prior to December 31, 1973. Although IDNR policy will allow for a slight increase over existing conditions, INDOT will not. This will allow future widening of the structure. If the backwater created by an existing structure is greater than 1 ft, the proposed backwater for the culvert replacement or extension should not be greater than 1 ft above the natural-channel flood profile. If the backwater created by an existing structure is less than 1 ft, the proposed backwater for the culvert replacement or extension should be less than or equal to that of the existing backwater.

3. In-Kind Culvert Replacement.

   Due to site and cost considerations, small structures and culverts may be replaced in kind. Replacement in kind means that the existing structure can be replaced with a new structure having the same span and the same rise from flowline to low structure elevation. The proposed structure may not be smaller than the existing structure. Current policy requirements including sumping depth, cutoff walls, and wingwalls, continue to apply to the proposed structure.

   Site Criteria. A candidate for an in-kind structure replacement will meet the following site criteria:

   a. The structure is in a rural area, as defined by IDNR.

   b. The existing culvert size meets or exceeds the minimum pipe size for the facility.

c. No record of flooding complaints at the structure.

d. No history of road overtopping at the required roadway serviceability, per INDOT Maintenance Division.

e. No evidence of scour at the outlet, including scour holes, structure undermining, or channel degradation.

f. No known debris problems.

Hydraulic Parameters. Hydraulic modeling will be required to consider a replacement in kind structure. The following hydraulic parameters need to be met before a structure can be replaced in kind.

a. The existing backwater depth is less than 3 ft. See Section 201-2.0 for definitions.

b. The headwater elevation does not affect the finished floor elevation of any structures, houses, or buildings upstream of the structure.

c. The proposed backwater depth matches or improves the existing backwater depth.

d. If the existing outlet velocity of the structure is greater than 6.5 ft/s, the outlet velocity may not be more than 150% of the natural (tailwater) velocity of the stream.

If the existing structure meets the site criteria above, but does not meet the hydraulic parameters, the proposed structure may be upsized to meet the in-kind replacement hydraulic parameters.

If the in-kind culvert replacement policy conflicts with the existing-structure replacement policy, the least restrictive policy should be followed. If a backwater depth of 1 ft is reached before the outlet velocity meets the natural velocity comparison, the existing-structure replacement policy should be followed.

All structures should be designed for the appropriate design storm frequency. See Figure 203-2C.

4. Other. Other constraints on AHW include the following:

a. grades of adjacent drives;
b. finished floor elevation of adjacent buildings or other improvements; or
c. elevation of existing cropland or other property.

5. Inlet Depression. An inlet depression should be limited to a depth of not more than half of the rise of the structure. If the structure is required to be sumped, an inlet depression should not be used without prior approval of the appropriate resource agencies.