



# INDIANA DEPARTMENT OF TRANSPORTATION

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## Design Memorandum No. 16-19 Policy Change

May 13, 2016

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

**FROM:** /s/Mark Bailey  
Mark Bailey  
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Bridges Division

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

**SUPERSEDES:** Design Memo 13-05

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

**EFFECTIVE:** Immediately

The Bridges Division Office of Hydraulics has revised the In-Kind Culvert Replacement Policy to allow for application in an urban area and revised the design criteria for allowable velocity.

Notable changes include

- General. Removed the requirement for wingwalls when utilizing the policy.
- Site Criteria. Removed item a. "The structure is in a rural area, as defined by the Indiana Department of Natural Resources."
- Hydraulic Parameters. Revised item d. to allow the existing design velocity to be utilized where there is no evidence of scour. Where scour exists, the design velocity should be less than or equal to the existing condition, but not more than 150% of the natural (tailwater) velocity.

Questions regarding this policy should be directed to the Office of Hydraulics Manager, Mark Bailey, at [mbailey1@indot.in.gov](mailto:mbailey1@indot.in.gov).

- b. A large culvert perpetuating drainage in a defined channel should be skewed as necessary to minimize channel relocation and erosion.
  - c. All utilities should be located before determining the final location of a culvert to minimize conflicts.
4. Location in Profile. The culvert profile should approximate the natural stream profile. Exceptions which require approval by the Office of Hydraulics can be considered as follows:
- a. Arrest stream degradation by utilizing a drop-end treatment or broken-back culvert.
  - b. Improve hydraulic performance by utilizing a slope-tapered end treatment.
  - c. Avoid conflicts with other utilities that are difficult to relocate such as sanitary sewers.
5. Debris Control. Debris control should be designed using HEC-9 *Debris-Control Structures*, and can be considered as follows:
- a. where experience or physical evidence indicates that the watercourse will transport a heavy volume of controllable debris;
  - b. for a culvert under a high fill; or
  - c. where clean-out access is limited. However, access must be available to clean out the debris-control device.

**203-2.02(02) Allowable Headwater (AHW) [Rev. May. 2016]**

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, the same rise, and the same shape as the existing structure. Current policy requirements including but not limited to, sumping depth, cutoff walls, and roadway serviceability, 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 existing culvert size meets or exceeds the minimum pipe size for the facility.
- b. No record of flooding complaints at the structure.
- c. No history of road overtopping at the required roadway serviceability, per INDOT Maintenance Division.
- d. No evidence of scour issues at the outlet, including but not limited to scour holes, or structure undermining.
- e. 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 there is no evidence of existing scour issues, the design velocity should be less than or equal to the existing condition. If existing scour issues exist, the design velocity should be less than or equal to the existing condition and not be more than 150% of natural (tailwater) velocity.

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.

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.

### **203-2.02(03) Roadway-Serviceability Freeboard**

See Figure [203-2C](#), Design-Storm Frequency for Bridge or Culvert, for guidance regarding roadway-serviceability freeboard and design-storm frequency.