

INSTRUCTIONAL MEMORANDUMS

To Local Public Agencies



To: Counties and Cities	Date: May 7, 2015
From: Office of Local Systems	I.M. No. 3.410
Subject: Preliminary Bridge or Culvert Plans	

Contents: This Instructional Memorandum (I.M.) includes guidelines and procedures for preparation, review, and submittal of Local Public Agency (LPA) preliminary bridge or culvert plans for projects that will be let by the Iowa Department of Transportation (Iowa DOT). This I.M. also includes the following attachments:

[Attachment A](#) – Hydraulic Review Criteria

[Attachment B](#) – Iowa DNR Floodplain Regulations

[Attachment C](#) – Instructions for Completing the Request for Approval: Local Road System Form (referred to as Form 1-E) ([Form 621003E](#))

[Attachment D](#) – Instructions for Completing the Risk Assessment Form

Note: This I.M. provides guidance specific to preliminary bridge or culvert plans. The guidance provided in [I.M. 3.405](#), Preliminary Plans also applies. However, because of the differences between bridge or culvert plans and roadway plans, the guidance provided by this I.M. shall govern in case of a conflict.

Design Guidelines

The following guidelines are presented as an aid to preliminary bridge design. This I.M. does not contain all of the information needed to prepare a satisfactory preliminary bridge or culvert design. Therefore, it is essential for LPAs to use a licensed professional engineer, competent in hydrologic and hydraulic analysis, to design preliminary bridge or culvert plans.

Iowa DOT Guidelines for Preliminary Design of Bridges and Culverts

The Iowa DOT Office of Bridge and Structures (OBS) provides a document titled, [Guidelines for Preliminary Design of Bridges and Culverts](#), referred to hereinafter simply as the “Iowa DOT Guidelines”. This document provides extensive guidance on nearly all aspects of preliminary design for bridge or culvert projects. LPA designers shall use the Iowa DOT Guidelines. In general, this I.M. will not duplicate guidance already contained in the Iowa DOT Guidelines, but instead will reference the Iowa DOT Guidelines where appropriate.

Selection of Design Flood and Clearances for Stream Crossings

A stream crossing consists of both the bridge and the roadway approaches. Stream crossings on high traffic volume or emergency access roads should generally be designed to a higher criteria such as a 50-year design flood. Where practical, clearance below the low superstructure should be three feet above design high water or one foot clearance above extreme high water, whichever is greater. The approach roadways should generally be one foot above design high water. Some "extreme high water" elevations can be disregarded in setting the grade if they are so high as to be impractical to design for.

Table 1 below is provided for guidance primarily for rural county roads. The further you reduce your design flood frequency (e.g. from a 50-year to a 10-year flood), the lower the quality of service. The table lists minimums. Use the highest discharge that you feel you can justify.

Table 1 – Design Flood Guidelines for Rural County Roads

Project ADT	Frequency of Design Flood	Clearance ^(a)			
		Bridge ^(b)		Approach Roadway ^(c)	
		Large Streams (> 100 mi ²)	Other Streams	Large Streams (> 100 mi ²)	Other Streams
Land Access Roads	2 ± year	3' above Q ₅₀	2' above Q ₂	1' above Q ₂	1' above Q ₂
49	5 year	3' above Q ₅₀	2' above Q ₅	1' above Q ₅	1' above Q ₅
50 -99	10 ± year	3' above Q ₅₀	2' above Q ₁₀	1' above Q ₁₀	1' above Q ₁₀
100 - 399	25 ± year	3' above Q ₅₀	3' above Q ₂₅	1' above Q ₂₅	1' above Q ₂₅
≥ 400	50 ± year	3' above Q ₅₀	3' above Q ₅₀	1' above Q ₅₀	1' above Q ₅₀

Notes:

- a) Clearances (freeboard) may be adjusted in some cases. See discussion below.
- b) Bridge clearance is determined by natural flood elevation, not backwater elevation.
- c) Approach roadway clearance will be determined using the bridge backwater elevation.

Clearance guidelines may be relaxed in those instances where it is impractical to provide recommended clearance because of unreasonably high cost. For example, costs may be high if a grade raise would result in the replacement of a large amount of present pavement. Also, costs may be high if the bridge is in a developed area with commercial or residential property. These examples should be handled individually as special cases. Clearance guidelines may also be relaxed where the stream is not expected to carry significant amounts of ice or debris, such as on most smaller streams.

Low Water Stream Crossings

Low water stream crossings (fords, vented fords, and low bridges) will be reviewed on an individual basis. Iowa DOT does not have a policy on these types of crossings and therefore only reviews the hydraulic characteristics and does not approve or disapprove the plan.

If a low water stream crossing is proposed, the designer should refer to the guidance provided in the following Iowa Highway Research Board reports:

- [Liability and Traffic Control Considerations for Low Water Stream Crossings](#), HR-218, April 1981.
- [Design Manual for Low Water Stream Crossings](#), HR-247, October 1983.
- [Low Water Stream Crossings: Design and Construction Recommendations](#), TR-453, December 2001.

In addition, for guidance concerning signing of low water stream crossings, refer to [I.M. 2.230](#), Signing for Low Water Stream Crossings.

Plan Content and Format

The Iowa DOT recommends that LPA bridge or culvert projects follow the same format used by Iowa DOT bridge or culvert plans. For more information, refer to the checklists and sample plans for bridges and culverts included in the Iowa DOT Guidelines.

Hydraulic Review

For projects that meet any of the criteria listed in [Attachment A](#), Hydraulic Review Criteria, submit the hydraulic review information to the Administering Office with the preliminary plans, as outlined in the "Submittal" section below.

The LPA may also request a hydraulic review, even if not required by the criteria shown in [Attachment A](#). However, such reviews will be conducted at the discretion of the Office of Bridges and Structures, and only as time permits.

The Office of Bridges and Structures will perform a general review the plans and hydraulic information. Hydraulic calculations will not be checked in detail, but given a cursory review to determine if the results and proposed structure appear to be reasonable. The Office of Bridges and Structures will return written comments to the LPA via e-mail or fax, and provide copies to the Administering Office and the consultant. Copies of hydraulic review documents will not be returned.

Reviews by Other Agencies

Bridge or culvert projects often involve impacts to waterways or water resources. As a result, there are several environmental reviews or permits by other State or Federal agencies that should be considered early in the project development process. Some of the more common reviews or permits are outlined below.

Floodplain Development Permits

The Iowa Department of Natural Resources (Iowa DNR) administers the Flood Plain Development Program. Under certain conditions, construction, operation, and maintenance of bridges, culverts, temporary stream crossings, road embankments, and channels changes may require a Flood Plain Development Permit. Projects requiring a permit must also meet certain design criteria, including design discharge, maximum backwater, and minimum freeboard clearances. For additional information, including a summary of the permit criteria and requirements, refer to [Attachment B](#), Iowa DNR Floodplain Regulations.

Sovereign Lands Construction Permits

In accordance with [571 Iowa Administrative Code, Chapter 13](#), the Iowa DNR regulates the use of sovereign lands and waters. These are State-owned lands and waters under the jurisdiction of the Iowa Natural Resource Commission, including Meandered Sovereign Lakes, Meandered Sovereign Rivers, State Forests, Wildlife Management Areas, State Parks, and State Preserves.

Bridge or culvert projects involving construction on or over sovereign lands or waters must be sent to the Iowa DNR Sovereign Lands Section for approval. For more information, including permit application forms, instructions, and listings and maps of sovereign lands and waters, refer to the [Iowa DNR Sovereign Lands Construction Permits](#) web page.

Flood Insurance Study (FIS) Requirements

The Iowa DNR works with the Federal Emergency Management Agency (FEMA) to administer the National Flood Insurance Program in Iowa. If a detailed Flood Insurance Study (FIS) has been approved for the community in which the project is located, any proposed projects in that community must meet the requirements of the FIS. If the FIS requirements cannot be met, a variance may be requested; or, if the LPA's designer believes the FIS is in error, the LPA can request to have the FIS corrected.

Section 404 Permits

Section 404 of the Clean Water Act requires the U.S. Army Corps of Engineers (Corps) to review and approve any projects that involve placement of fill or dredged material in or around streams, wetlands or other aquatic resources. All bridge and culvert projects should be submitted to the Corps for review. The Clean Water Act and its implementing regulations place special emphasis on eliminating or reducing impacts to wetlands and streams, so designers should strive to limit these types of impacts when possible. For more information, refer to [I.M. 3.130](#), Section 404 Permit Process.

Submittal

All preliminary bridge or culvert plan submittals should be made to the Administering Office in accordance with [I.M. 3.005](#), Project Development Submittal Dates and Information. Projects that require a hydraulic review should follow the Major Project schedule; however, early submittals are strongly encouraged. This will enable the Iowa DOT to provide comments in a timely manner. The preliminary plan submittal shall include the following as a minimum:

1. A cover letter or e-mail that includes:
 - a. Iowa DOT project number
 - b. project location and description
 - c. proposed letting date
 - d. type of review requested
 - e. list of the submittal contents
2. One copy of the preliminary plans, including:
 - a. a bridge or culvert situation plan showing the type, size and location (TS&L) of the proposed structure(s)
 - b. roadway plans for the approaches showing horizontal and vertical geometrics

If a hydraulic review is required or requested, the submittal shall include the following additional information:

3. Hydraulic calculations.

Include stage-discharge and backwater calculations. Computer output from hydraulic analysis software is preferred; however, hand calculations are also acceptable. For acceptable types of hydraulic analysis software, refer to the Iowa DOT Guidelines or contact the County and City Preliminary Hydraulic Review Engineer in the [Office of Bridges and Structures](#) for assistance.

4. A completed Request for Approval: Local Road System Form (referred to as Form 1-E) ([Form 621003E](#)).

The Request for Approval: Local Road System (referred to as Form 1-E) ([Form 621003E](#)) summarizes and documents data for the existing and proposed bridge or culvert. This form is required only for structures with a total clear span of 20 feet or more, but is recommended for all structures that require a hydraulic review in order to speed up the review process. For instructions and a sample form, refer to [Attachment C](#), Instructions for Completing the Request for Approval: Local Road System Form (referred to as Form 1-E) ([Form 621003E](#)).

5. A completed Risk Assessment Form.

The Risk Assessment for Bridges (Culverts) ([Form 517002](#)) is used to evaluate the risk and economics of proposed structures. It also provides the LPA with a good checklist of design items such as detours, flood data, upstream buildings, flood plain regulations, etc. This form is required only for structures with a total clear span of 20 feet or more, but is recommended for all structures that require a hydraulic review in order to speed up the review process. For instructions and a sample form, refer to [Attachment D](#), Instructions for Completing the Risk Assessment Form.

6. Site photos, including the following views as a minimum:
 - a. looking upstream
 - b. looking downstream
 - c. looking across the downstream valley
 - d. looking at the existing bridge opening (include enough detail to identify the bridge type)
 - e. looking at the existing bridge from the roadway surface