Iowa Department of Natural Resources
Flood Plain Management Program
# Bridge and Road Embankments

Use this guidance to ensure that your flood plain application is complete. To view a complete version of the state's flood plain management and dam safety criteria, visit http://floodplain.iowadnr.gov.

**Technical Assistance Help Line: 515-725-8415 or Floodplain-help@dnr.iowa.gov**

The criteria that a bridge needs to meet are dependent on the damage potential of the structures in the area where the bridge is located. Criteria are set for either 1) Low Damage Potential Areas or 2) High Damage Potential Areas:

1. **Low Damage Potential Areas**: Criteria for bridges located near low damage potential structures such as detached residential garages, sheds, park shelters, buildings used for storage of equipment or crops that can be easily removed and buildings used as temporary shelter for livestock.

   - ✓ Backwater for Q100 is less than or equal to 1.5 feet
   - ✓ Freeboard shall be 3 feet or more between Q50 and the low superstructure horizontal bridge member unless a licensed engineer provides certification that the bridge is designed to withstand the applicable effects of ice and the horizontal stream loads and uplift forces associated with the Q100.

2. **High Damage Potential Areas**: Criteria for bridges located near high damage potential structures such as residential, industrial, commercial, agricultural, recreational and public buildings.

   - ✓ In no case shall the Q100 backwater effects of a bridge or road embankment reduce the existing level of protection provided by certain flood control works, unless equivalent remedial measures are provided.

   **For bridges and road embankments:**
   - ✓ Backwater for Q100 is less than or equal to 1.0 foot
   - ✓ Freeboard shall be 3 feet or more between Q50 and the low superstructure horizontal bridge member unless a licensed engineer provides certification that the bridge is designed to withstand the applicable effects of ice and the horizontal stream loads and uplift forces associated with the Q100.

   **For bridges located within a stream reach for which FEMA has published a detailed study FIS which includes a floodway:**
   - ✓ Backwater for Q100 shall not exceed the surcharge associated with the delineation for the floodway at that location
   - ✓ Freeboard shall be 3 feet or more between Q50 and the low superstructure horizontal bridge member unless a licensed engineer provides certification that the bridge is designed to withstand the applicable effects of ice and the horizontal stream loads and uplift forces associated with the Q100.

**Bridge and Road Embankment Application Checklist**

☐ Completion of the Joint Application form through the online PERMT system.

☐ Certified Engineering Plans in pdf format, signed, sealed and dated by professional engineer licensed in the state of Iowa {IAC 567—70.4(3)}

- ☐ Plans showing the proposed structures, obstructions or deposits, the stream, property/easement lines and ownership, borrow sites (if on the flood plain), roads, buildings, grading, location map and any other pertinent physical features

☐ Certified Supporting Engineering Documents {IAC 567—70.4(3)}

- ☐ Construction specifications
- ☐ Hydraulic models input and output files (upload to PERMT as a zipped file) - typically in HEC-RAS or Iowa Bridge Hydraulics; including input and output tables labeled appropriately. Include at least one stream valley cross section taken perpendicular to the direction of flow through the project area representing typical conditions. Extend the cross section(s) beyond the project boundaries to where natural ground will be undisturbed. Additional cross sections may be required depending on the lineal extent of the project and whether there are natural or artificial control sections of the flood plain. The hydraulic modeling cross section location must be included on the plans or separate plan exhibit.
- ☐ Brief hydrology and hydraulics summary report explaining and justifying each of the steps taken to modify the respective models; include justification for all “n” values; stream slope based on a minimum of 2 survey shots taken at least 500 feet apart to represent the stream slope within the reach and/or downstream end of modeling for boundary conditions; summary table with relevant water surface elevations at each model cross section for each modeling run; and any other pertinent data showing how the project is meeting, or model is demonstrating complying with, state criteria in IAC 567—72.1(455B).
- ☐ Certification of “No-Rise” - Certified by engineer, and only required if the proposed project is located on a river or stream with a detailed FEMA Flood Insurance Study

**Detailed FEMA Flood Insurance Study at Project Location**

If the proposed project is located within the floodway as delineated in a FEMA Flood Insurance Study, it will be necessary to provide hydraulic modeling showing that the project will result in no increase (0.00 feet) in the 100 year flood elevation.

☐ Confirm with the Iowa DNR about model to be used for No-Rise Analysis. Confirmation of flowrates and model to be used can be done using Iowa DNR form 542-1030.

☐ Obtain copy of hydraulic model (for instructions on how to order study data from the FEMA Library, see https://www.fema.gov/media-library/assets/documents/7320

Please convert any previous hydraulic analyses to the current version of HEC-RAS. Many of these studies were completed using HEC-2. There is a guidance document from FEMA that is available for converting projects that were previous completed in HEC-2 into HEC-RAS. This document is, *HEC-RAS Procedures for HEC-2 Modelers*, which can be found at https://www.fema.gov/media-library/assets/documents/7677.

☐ Perform model runs in the order listed:

- ☐ 1. Original hydraulic model as received from FEMA (Convert to HEC-RAS as required)
- ☐ 2. Original hydraulic model with corrections made
- ☐ 3. Existing Conditions - Corrected model with additional cross sections located at the project site
- ☐ 4. Proposed Conditions - Corrected model from #3 with the project included

| Cross Section Label | WSEL as published in FIS | WSEL Effective FIS Base Model Step 1 | Change in WSEL FIS - (1) | WSEL Effective Base with Corrections Step 2 | Change in WSEL (2) - (1) | WSEL Effective Base with Corrections and Additional Cross Sections Step 3 | Change in WSEL (3) - (2) | Proposed Conditions Model Step 4 | Change in WSEL (4) - (3) |
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**No Detailed FEMA Flood Insurance Study at Project Location**

☐ Confirmation of flowrates to be used can be done using Iowa DNR form 542-1030, http://www.iowadnr.gov/Portals/idnr/uploads/forms/5421030.pdf. Iowa DNR may also be able to provide approximate HEC-RAS modeling for your location to be converted to a detailed model by the certifying engineer.

☐ Determination and documentation that the project meets all flood plain criteria. This includes backwater as determined using the rating curve for the natural, downstream cross section.

# Summary of Engineering Data – Bridges and Road Embankments

Stream: _____

Roadway: _____

**If a Detailed Flood Insurance Study exists for the stream, provide the following information:**

- ☐ Original hydraulic model as received from FEMA
- ☐ Original hydraulic model with corrections made
- ☐ Corrected model with additional cross sections located at the project site
- ☐ Model with cross-sections at the site with the project included

**Stream Slopes**

Reach: _____ ft/ft _____ ft/mi Source: _____

Main Channel Slope: _____ ft/mi Source: _____

**Bridge Details**

Existing Bridge Length: _____ ft Proposed Bridge Length: _____ ft

Proposed Bridge Angle: _____ degrees Proposed Pier Skew Angle: _____ degrees

**Elevation Data**

Datum: NAVD '88

Channel Bottom: _____ ft

Top of Bank: _____ ft

Record High Water: _____ ft Source: _____

Low Superstructure: _____ ft

Low Point in Approach Grade: _____ ft

**Flood Frequency Data**

| Design Frequencies: | 50 year | | 100 year | | |
|---|---|---|---|---|---|
| Discharges: | _____ | cfs | _____ | cfs | Source: _____ |
| Waterway Opening Areas: | _____ | sq ft | _____ | sq ft | |
| Average Bridge Velocities: | _____ | ft/sec | _____ | ft/sec | |
| Natural Stages: | _____ | ft | _____ | ft | Datum: NAVD '88 |
| Encroachment Stages: | _____ | ft | _____ | ft | Datum: NAVD '88 |
| Maximum Backwater Due to Project: | _____ | ft | _____ | ft | |
| Freeboard (if applicable): | _____ | ft | _____ | ft | |

**Roadgrade Overflow Data**

Amounts of Overflow _____ cfs _____ cfs