DEC 22 1986

Washington, D.C. 20590

Guidance for Implementing the One-foot Standard
for Encroachments on NFIP Floodplains

Chief, Bridge Division
Office of Engineering

HNG-31

Regional Federal Highway Administrators
Regions 1-10
Mr. Thomas Edick
Direct Federal Program Administrator (HDF-1)

The attached guidance was prepared by Region 5 in cooperation with this office for implementing in Region 5 the policy set forth in Mr. Leather's memorandum of April 2, 1986, regarding highways in National Flood Insurance Program (NFIP) floodplains. We encourage you to develop similar guidance for the Divisions in your Region, particularly if one or more States are using hydraulic design criteria that results in structures that are not cost effective.

Stanley Gordon

Stanley Gordon

Attachment

Federal Highway Administration
HNG-31:PThompson:kat:64611:10/15/86
Revised:SDavis:10/16/86
CC: Rdr. File, 3212
Rdr. File, 3109, 3113
Chron File, 3109

# Guidance for Implementing the One-Foot Standard for Encroachments on NFIP Floodplains

**December, 1986**

The following guidance is to be used to evaluate encroachment designs for floodplains that are identified in the National Flood Insurance Program (NFIP). This guidance, which is effective immediately and supersedes all previous guidance issued on this subject, is based on FHWA floodplain encroachment policy (FHPM 6-7-3-2) and Headquarters' April 2,1986 memorandum (copy attached). It is applicable to new location, as well as to replacement type projects.

## 1. Longitudinal Encroachments

FHWA's floodplain encroachment policy requires longitudinal encroachments to be avoided where practicable. If a longitudinal encroachment cannot be avoided, the degree of encroachment should be minimized to the extent practicable. Generally, any increase in the 100-year water-surface elevation produced by a longitudinal encroachment on an NFIP floodplain should not exceed the one foot allowed by the Federal NFIP standards.

## 2. Transverse Encroachments

FHWA floodplain encroachment policy requires that all transverse encroachments be supported by analyses of design alternatives with consideration given to capital costs, risk and other site specific factors. "Supported" means that the design is either shown to be cost-effective or justified on some other engineering basis. The analysis process used to develop this support is referred to as a design risk assessment. This assessment is to be documented in a hydraulic design study report and retained in the design file.

For transverse encroachments on NFIP floodplains, the analyses of design alternatives should include consideration of a design that is consistent with the Federal NFIP standard which allows a one-foot rise in the 100-year water-surface elevation. Where State standards preclude such a design and the proposed design is not cost-effective (i.e., cannot be supported by the design risk assessment),Federal participation in the hydraulic structure will be limited to the cost of providing an opening which will produce one foot of backwater for the 100-year flood without roadway overtopping. Where State standards allow such a design yet the proposed design is not cost-effective (i.e., cannot be supported by the design risk assessment),Federal participation will be likewise limited. (Backwater as used here is defined as the difference between the maximum water surface elevation upstream of the encroachment and the water surface elevation at the same location without the encroachment.)

**A. Design support**

Support thru the design risk assessment process can be achieved two different ways. One is by conducting an economic analysis. The other is by describing in detail the physical constraint(s) which justifies the design.

An economic analysis is a dollars and cents exercise which proves that a proposed hydraulic structure is cost-effective by demonstrating that an appropriate balance exists between the capital costs and the risk costs attributable to the encroachment. This method of support should be used to the extent that existing risk is quantifiable. Risk is defined as the consequences associated with the probability of flooding attributable to an encroachment. It includes the potential for property loss and hazard to life during the service life of the highway.

A physical constraint can be related to hydraulic factors, non-hydraulic factors or a combination of the two. Examples of possible hydraulic constraints include, but are not limited to, reservoir crossings,channel stability problems and supercritical flow. Examples of possible non-hydraulic constraints include, but are not limited to, environmental commitments (those specifically described in an approved environmental document),topography (e.g., deep ravine) and geometrics (e.g., navigation clearance). Examples of possible combination constraints include, but are not limited to, roadway overtopping, foundation problems and active channel encroachment.

Designing to meet a state standard does not justify a design or support it as being cost-effective.

**B. Participation limit**

The recommended method of determining the participation limit is to divide the structure length or area of opening required to produce one foot of backwater for the 100-year flood without roadway overtopping by the proposed structure length or area. When less than 1.0, this ratio should be applied to all bid items associated with the hydraulic structure to reflect the reduction in participation. This method is appropriate regardless of whether or not roadway overtopping exists. (More precise methods of determining this ratio are acceptable.) This method has been selected for establishing participation limits because it is simple to apply and it allows the State a greater percentage of Federal participation than other methods considered. The fact that the participation limit is computed assuming no roadway overtopping is not intended to discourage designs which incorporate roadway overtopping. On the contrary, such designs are encouraged where appropriate.

If a portion of the proposed structure is non-participating, a record of that fact along with the method of determining the percentage is to be kept in the design file as part of the hydraulic design study report.

## C. Project monitoring

The following procedure should be used to monitor transverse encroachment designs for NFIP floodplains.

### i. 100-year Backwater less than 0.9 feet

If the 100-year backwater produced by an encroachment is less than 0.9 feet, the risk assessment portion of the hydraulic design study report should be reviewed in depth to determine if adequate support has been developed to justify the design. This assessment has been given specific titles such as Flood Hazard Evaluation and Discussion of Structure Sizing by some states.

If the risk assessment provides solid support and leaves no questions as to the appropriateness of the proposed encroachment type,size and location, FHWA will participate fully in the cost of the hydraulic structure.

If the support is weak or inadequate, the state highway agency should be requested to provide answers to any questions regarding the appropriateness of the encroachment type, size and location and to reinforce the risk assessment accordingly. If the state highway agency will not or cannot strengthen the support and satisfactorily address all concerns, FHWA participation shall be limited as described above.

Obviously, if no design risk assessment exists and the state highway agency will not or cannot provide one then FHWA participation shall be limited as described above.

### ii. 100-year backwater 0.9 feet or greater

If the 100-year backwater produced by the encroachment is 0.9 feet or greater, a design risk assessment has been conducted and the design is satisfactory, FHWA will normally participate fully in the structure cost. Further review will not be required. However, this does not preclude a more in-depth investigation of the risk assessment if deemed necessary. As mentioned in Headquarters' April 2 memorandum, FHWA will participate in mitigation costs associated with a design which produces more than a one-foot rise in the 100-year water-surface elevation if it is cost- effective to do so.

A 100-year backwater reference of 0.9 feet is used rather than one foot because it allows for backwater deviations due to standard bridge plans, water-surface profile inaccuracies, and other imprecisions.

Since these reviews are based on backwater, it would be an obvious advantage to have the 100-year backwater value recorded on the project plans. However, this is not a requirement.

When making these reviews you are encouraged to consult with the Regional Hydraulic Engineer about the adequacy of the design risk assessments.