OFFICE OF STRUCTURES
MANUAL FOR HYDROLOGIC AND HYDRAULIC DESIGN

CHAPTER 19
CONSTRUCTION GUIDELINES

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CHAPTER 19 - CONSTRUCTION GUIDELINES

1. Introduction

The Maryland State Highway Administration, in cooperation with the Maryland Department of the Environment has developed detailed procedures for use in the construction of bridges and highways to (1) protect the public and (2) minimize the impacts to the area in which the highway is located

Chapter 19 addresses procedures to be followed by the Office of Structures during the plan preparation and construction phases of the project in order to minimize impacts to adjacent areas, and in particular, sensitive areas such as streams and wetlands.

2. Responsibility of the Office of Structures

The Office of Structures (OOS) is responsible for considering the following issues in preparing bridge plans:

- Safety of the public
- Permits
- Temporary Structures and Flow Diversions
- Establishing boundaries for the limits of disturbance (LOD)
- Erosion control features
- Rights-of-way Considerations
- Relocation of Utilities

These issues are discussed in the following sections.

3. Safety of the Public

The particular safety issue discussed in Chapter 19 is the accommodation of stream flow during construction. Public safety may be involved when temporary structures or flow diversions are inadequate to handle the stream flow and flooding results on adjacent developed properties. A second example is the potential for overtopping of temporary structures and roads carrying highway traffic, and the ensuing risks to vehicles using the road.

If a Contractor proposes a plan different from the contract plans for temporary structures and diversions, OOS should check these plans for adequate safety provisions.

4. Permits

OOS responsibility for permits is addressed in Chapter 5 of this manual. Permits are usually required for the types of work discussed in this chapter.

5. Temporary Structures and Flow Diversions

A. Maryland's Waterway Construction Guidelines prepared by the Maryland Department of the Environment (MDE)

MDE guidelines (1) advise that "temporary measures for dewatering and diverting flows should have sufficient capacity to convey the 2-year flow, based on existing conditions." "Lower flows can be considered for temporary structures which will be in place less than two weeks." This value of the 2-year flood or of any other flood recurrence interval should be obtained from (GIS Hydro 2000) for the appropriate hydrologic area. Where hydrologic data are not available, the bankfull flow can be used instead. Attention should be paid to any time limits that may apply to work in a stream or to seasons of the year when such work is not permitted. If conveying the 2-year storm at a particular site is considered to be unreasonable, OOS may select a lesser flow (subject to acceptance by MDE), based on site conditions and engineering judgment.

B. Assessing Risk

Selecting a design flow value for a temporary structure is an exercise in evaluating risk. Risks include flooding of adjacent properties, overtopping of temporary roads and overtopping or failure of temporary structures. There are two aspects to this risk assessment: (1) selection of an adequate waterway area and foundation design for inclusion in contract documents and (2) evaluation of the Contractor's proposal if different from the SHA design. Risk depends, among other things, on the chance of occurrence of a flood of a given frequency during the time a structure remains in use (See Table 1). Decisions and designs involving risks to the public should always be submitted to the OOS for review and approval prior to initiation of design or construction . The selection of the design year flood should be based on a consideration of the length of time the structure will be in use and the risks of damage to the bridge and of the safety to the travelling public in the event of a flood event. Table 1 and Figure 7-67, excerpted from the AASHTO Highway Drainage Guidelines Volume VII, provides insight into the risk of exceedance. If the potential for risk to the public and damage to the structure is great, a higher design discharge and sturdier foundation should be considered. On the other hand, if the construction period is only about 10 weeks, typical for small bridge structures, it may be appropriate to use a design discharge less than the 2-year flood.

TABLE 1
RISK OF EXCEEDANCE OF A FLOOD OF A SPECIFIED RECURRENCE INTERVAL FOR A GIVEN CONSTRUCTION TIME PERIOD (IN PERCENT)

FLOOD RECURRENCE INTERVAL	CONSTRUCTION PERIOD = 1 YEAR	CONSTRUCTION PERIOD = 2 YEARS	CONSTRUCTION PERIOD = 3 YEARS
1	67	86	95
2	50	67	85
3	33	50	67
5	20	34	48
10	10	19	27

Temporary structures for major highways carrying large volumes of traffic represent a higher order of concern, and should be designed to be safe for a major flood event. Figure 7-67 below provides insight into the relationship between flood recurrence interval, risk of exceedance and service life of the temporary structure for floods with higher recurrence intervals.

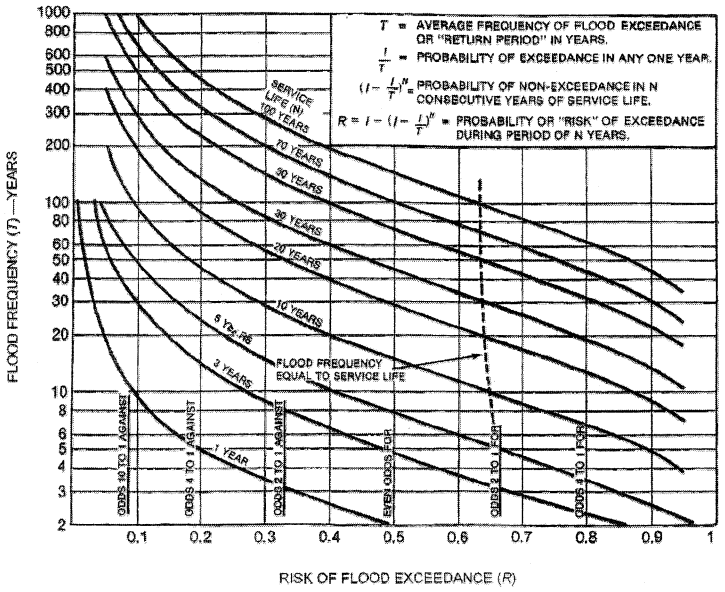

Figure 7-67. Risk of Flood Exceedance

B1. Flooding of adjacent properties.

During the preparation of bridge plans, H&H studies have been prepared which includes the evaluation of developed properties in flood plains on lands adjacent to the highway. Where such properties exist, the flows to be considered should range between the 2-year flood and the design flood for the existing bridge. Where adjacent properties are undeveloped, a flow less than the 2-year flood may be appropriate.

B2. Overtopping of temporary roads and structures carrying highway traffic.

On large streams, where the structure will be in service several years, the flows to be considered for temporary highway structures and roads may range between the 2-year flood and the design flood for the existing bridge. For small streams, or for locations where construction activities will be limited to 10 weeks or less, a flow smaller than the 2-year flood may be appropriate. Selection of the overtopping flood should always be coordinated with OOS. Scour assessments or evaluations may be required, particularly for high volume roads.

Contract documents should spell out the Contractor's responsibility for roadway and structure maintenance during construction, including the closing of the road prior to flood events likely to overtop the road.

B3. Design of Contractor's structures for construction operations.

The contractor is responsible for all aspects of temporary structures built for construction operations, including obtaining all necessary permits and maintaining the structure in accordance with the contract provisions. The Contractor's plans should be checked by OOS personnel. In particular, OOS needs to evaluate the risk of flooding of adjacent developed properties and/or the highway.

C. Types of Flow Diversions

Flow diversions are often necessary in order to construct foundation elements in streams. Diversions typically are of two types and are discussed below:

C1. Maintenance of flow in the existing stream bed under the bridge.

Flow diversion structures such as traffic barriers, sandbags or temporary dikes are often used to block the stream flow from the construction area. Attention needs to be paid to any time limits that may apply to the stream. For small one-span bridges, a portion of the stream may be blocked in sequence for construction of each abutment and installation of riprap protection. The limited area under the bridge often creates a problem for the installation of the abutment riprap protection. Typical riprap designs for installation in such limited areas are included in the standard plans for riprap installations. In some cases, the stream may be blocked entirely and the flow piped or pumped through or around the bridge site.

C2. Relocation of a stream beyond the bridge limits

This approach permits construction of bridge foundations in the dry. Such stream relocations are designed to convey the design discharge within the channel banks of the relocated channel. Stream bed and bank protection should be provided to minimize the potential for scour and erosion.

Regardless of the maintenance of flow plan selected, the plan should meet the criteria in Sections 4A and B above regarding the design discharge for designs affecting public safety. Flows less that the 2-year flood may be appropriate where concerns for public safety are not significant, and/or where the construction time period is 10 weeks or less.

6. LOD (Limit of Disturbance) Lines

The drawing of *the limit of disturbance lines (LOD)* for bridge construction needs to be coordinated with the Office of Highway Development (OHD).

Only one set of the LOD lines will be shown on the plans, and this set will be drawn on the *Erosion and Sediment Control Plans (E&SC).*

7. Sequence of Construction/ Maintenance of Traffic

A separate E&SC plan is necessary for each phase of the sequence of construction for maintaining traffic or for other work. The LOD table and lines need to be depicted on each E&SC plan. OOS is to coordinate sequence of construction plans with the *Office of Highway Development (OHD*) or the consultant obtained to prepare the E&SC plans.

8. Erosion Control

OOS personnel should be familiar with the requirements for erosion control and should check that they have been included in the appropriate bridge plans.

9. Rights-of-way Considerations

The need for ROW to construct the bridge and any stream stabilization measures should be considered very early in the project development phase. A notice to the Office of Right of Way with a minimum of a one-year lead time is necessary to enable them to obtain the necessary project ROW.

10. Relocation of Utilities

The need to consider relocation of any utilities, which may be affected by the bridge project, should also be evaluated very early in the project development phase. Preliminary plans should be developed a least one year in advance and sent to the appropriate District Utility Engineer. The District will send the plans to the affected utility companies and coordinate any relocation work with them

11. References

1. Marylands Waterway Construction Guidelines, Maryland Department of the Environment, Water Management Administration, Revised November 2000