Chapter 2 - Policy

TABLE OF CONTENTS

List of Appendices

Chapter 2 - Policy

2.1 Overview

2.1.1 Introduction

Drainage concerns are one of the most important aspects of highway design and construction. The purpose of this chapter and manual is to outline policies which, when carried out, will provide an appropriate level of consideration for the multitude of variables which influence drainage design.

The drainage policies of the Department have been established to provide continuity in the design and operation of the state highway system, to enhance traffic safety, to ensure the use of technically accepted materials and procedures, to provide the most cost-effective highway facilities, and to ensure the fulfillment of all legal obligations.

Compliance with all policies is essential to ensure the uniformity of the highway system and the timely preparation of plans; however, it is recognized that site specific circumstances may not always be best served by the written policy. In those situations where a waiver from policy is desired, a request for waiver along with proper justification must be submitted to the VDOT Location and Design Division.

Generally, the Department does not waive the basic policies that require hydraulic studies for all projects involving drainage facilities or floodplain encroachments. Typically, it is VDOT's criteria, such as freeboard, that are considered for a waiver, and then only on rehabilitation or replacement projects, not on new construction.

2.1.2 Policy vs. Criteria

Policy and criteria statements are frequently closely related - criteria being the numerical or specific guidance, which is founded in broad policy statements. For this manual, the following definitions of policy and criteria will be used.

- ***Policy*** - a definite course of action or method of action, selected to guide and determine present and future decisions.
- ***Design Criteria*** – the standards by which a policy is carried out or placed in action. Therefore, design criteria are needed for design while policy statements are not.

Following is an example of a policy statement:

"The designer will size the drainage structure to accommodate a flood compatible with the projected traffic volumes."

The design criteria for designing the structure might be:

"For projected traffic volumes less than or equal to 750 vehicles per day, drainage structures shall be designed for a 10-year flood (exceedance probability: 10%). For projected traffic volumes greater than 750 vehicles per day, a drainage structure shall be designed for a 25-year flood (exceedance probability: 4%)."

2.1.3 Location of Policy and Criteria

This chapter presents VDOT general policy. The policy and criteria for specific types of drainage facilities are located in the appropriate chapter for each type of facility (i.e.: culverts, storm sewers, etc.).

2.2 General Hydraulic Design Policies

2.2.1 Introduction

An adequate drainage structure may be defined as one which meets the following policies:

- The design of the structure meets or exceeds standard engineering practice
- The design is consistent with what a reasonably competent and prudent designer would do under similar circumstances

The studies listed below are commonly conducted as a part of the design of most highway drainage structures and serve as a means of achieving an adequate drainage design:

- Hydrologic analysis
- Hydraulic analysis
- Engineering evaluation of alternatives

These studies are discussed further in the following sections.

2.2.2 Hydrologic Analysis

Present state-of-practice formulas and models for estimating flood flows are based on statistical analyses of rainfall and runoff records and therefore provide statistical estimates of flood flows with varying degrees of error. The recommended practice is for the designer to select appropriate hydrologic estimating procedures, and obtain runoff data where available for purposes of evaluation, calibration, and determination of the predicted value of the desired flood frequencies. Since the predicted value of the flood flows represents the designer's best estimate, there is a chance that the true value of the flow for any flood event will be greater or smaller than the predicted value. The expected magnitude of this variation can be determined for some formulas or models as a part of the hydrologic design procedure.

2.2.3 Hydraulic Analysis

The next step in the design process involves development of preliminary alternative designs that are judged to meet the site conditions and to accommodate the flood flows selected for analysis. The hydraulic analysis is made utilizing appropriate formulas, physical models or computer programs for purposes of defining, calibrating, and checking the performance of the preliminary designs over a range of flows.

2.2.4 Engineering Evaluation

The final step in the design process is the engineering evaluation of the trial designs and approval of the selected final design. This process involves consideration and balancing of a number of factors including:

- Legal considerations
- Flood hazards to highway users and neighboring property owners
- Costs
- Environmental and social concerns
- Operations and maintenance
- Other site concerns

2.2.5 General Policies

The hydrologic and hydraulic analyses described above set forth the design process that represents the present "standard engineering practice." Engineering evaluation outlines the approach to be followed by a "reasonably competent and prudent designer" in evaluating, selecting, and approving a final design. The following policies are made in regard to this process:

- It is the designer's responsibility to provide an adequate drainage structure. The designer is not required to provide a structure that will handle all conceivable flood flows under all possible site conditions.
- The detail of design studies should be commensurate with the risk associated with the encroachment and with other economic, engineering, social, or environmental concerns.
- The overtopping and/or design flood may serve as criteria for evaluating the adequacy of a proposed design. The "overtopping flood" is the smallest recurrence interval flood, which will result in flow over the highway or other watershed boundary. The "overtopping flood" flow is the flow that overtops the highway or other watershed boundary limit. The "design flood" is the recurrence interval of the flood for which the drainage structure is sized to assure that no traffic interruption or significant damage will result. The overtopping flood and the design flood may vary widely depending on the grade, alignment, and classification of the road and the characteristics of the watercourse and floodplain.
- The predicted value of the 100-year or base flood serves as the present engineering standard for evaluating flood hazards and as the basis for regulating flood plains

under the National Flood Insurance Program. The designer must make a professional judgment as to the degree of risk that is tolerable for the base flood on a case-by-case basis.

- The developed hydraulic performance curve of a drainage structure depicts the relationship between floodwater stage (or elevation) and flood flow magnitudes and frequencies. The performance curve should include the 100-year flood. With the performance curve, the designer can evaluate the adequacy of the design for a range of flows and take into consideration errors of estimate in the hydrologic estimating procedure. It is standard engineering practice to use the predicated value of the 100-year flood as the basis for evaluating flood hazards; however, flows larger than this value may be considered for complex, high risk, or unusual cases that require special studies or risk analyses.

- See DDM6 for state participation in the cost of storm sewers in counties, towns and cities.*

* Rev 9/09

2.3 References

American Association of State Highway and Transportation Officials. 2005[*]. *AASHTO Model Drainage Manual*.

[*] Rev 9/09

Appendix 1A-1 Definitions and Abbreviations

Abbreviations:

AASHTO	American Association of State Highway and Transportation Officials
BMP	Best Management Practice*
DCR	(Virginia) Department of Conservation and Recreation
DDM	Drainage Design Memorandum
DEQ	(Virginia) Department of Environmental Quality
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
I&IM	Instructional and Informational Memorandum
NFIP	National Flood Insurance Program
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service (formally known as the Soil Conservation Service or SCS)
RDM	Road Design Manual
SCS	Soil Conservation Service (former name of the National Resource Conservation Service)
USCOE/USACE	United States Corps of Engineers
USGS	United States Geological Survey
VDOT	Virginia Department of Transportation or the Department
VSMR	Virginia Stormwater Management Regulations

* Rev 9/09

Appendix 2A-1 Definitions and Abbreviations

Abbreviations:

CFR	Code of Federal Regulations
DCR	Virginia Department of Conservation and Recreation*
DOT	Department of Transportation
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHPM	Federal-Aid Highway Program Manual
FHWA	Federal Highway Administration
FWPCA	Federal Water Pollution Control Act
FWS	Fish and Wildlife Service
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration*
NPS	National Park Service
NRCS	National Resource Conservation Service; formerly Soil Conservation Service (SCS)
OCZM	Office of Coastal Zone Management
RCRA	Resource Conservation and Recovery Act
SIP	State Implementation Plan
TVA	Tennessee Valley Authority
USCOE/USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USGS	United States Geological Survey*
USFS	United States Forest Service

* Rev 9/09