

HIGHWAY DRAINAGE guidelines



fourth edition **2006**



American Association of State Highway and Transportation Officials
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HIGHWAY DRAINAGE GUIDELINES



2007

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AASHTO Highway Drainage Guidelines

Foreword

The Highway Subcommittee on Design, as part of its charge, prepares and keeps current publications pertaining to principles, methods, and procedures of roadway design, including practices to protect and to enhance the quality of the environment. As the subject of highway drainage is important to many disciplines and many phases of highway engineering, the Subcommittee requested and received approval from the Standing Committee on Highways to establish a task force to prepare needed publications on the subject of highway drainage. Consequently, the Task Force on Hydrology and Hydraulics was established and first met in February 1970, developed a statement of purpose, and outlined a program of activity. The purpose of the Task Force is to assist the Subcommittee in developing guidelines and in formulating policy for highway disciplines, giving due consideration to safety and the environment.

Pursuant to this purpose, the Task Force on Hydrology and Hydraulics began the preparation of guidelines covering topics on major areas of highway hydraulic design. To the extent practicable, each Guideline is a stand-alone volume, but reference to other guidelines in the series is utilized to avoid unnecessary repetition. Since these Guidelines are intended to provide an overview, discussion, and design philosophy for each of the covered topics, technical information is kept to a minimum by making reference to appropriate publications and to the AASHTO *Model Drainage Manual* which contains recommended design policy, criteria, procedures, aids and example problems.

The following Guidelines were originally published as separate volumes: I, II and III in 1973, IV in 1975, V in 1977, and VII in 1982. Consolidated editions were published in 1973 of I–III, in 1975 of I–IV, in 1979 of I–VI, in 1982 of I–VII, and in 1987 of I–VIII which was also printed in the current loose-leaf format. The 1992 edition of the Guidelines contains rewritten Volumes I–III, updated volumes IV–VIII, and new volumes IX, X, and a Glossary. A new, separate Volume XI was published in 1994. The 1999 edition of the Guidelines is a metric conversion of the 1992 edition and also contains new Guidelines, Volumes XI, XII, XIII, and XIV, which are in metric format. This 2007 Edition contains both metric (SI) and U.S. Customary units, replaces the Volume designations with Chapter designations, and contains a new Guideline, Chapter 15.

The Highway Subcommittee on Design gratefully acknowledges the efforts of members of the Task Force on Hydrology and Hydraulics in preparing the Guidelines and the cooperation of the States participating in this endeavor.

AASHTO Highway Drainage Guidelines

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Preface

As early as 1866, Congress first authorized the use of the metric system, devised in France about the time of the French Revolution, for measuring weights in the United States. International standardization began in Paris in 1875 when the International Bureau of Weights and Measures (IBWM) was established under the jurisdiction of the General Conference on Weights and Measures (CGPM). In 1960, the CGPM adopted an extensive revision and simplification called “System International d’Unites”, which is universally known by its abbreviation of SI.

In 1968, Congress adopted an act requiring a United States metric study. The report to Congress in 1971 recommended that the nation change to the SI system deliberately and carefully. Two factors mandated this change—the adoption of the metric system by the remainder of the world and the changing global economy.

The resultant Metric Conversion Act of 1975 (15 U.S.C. 2056) declared a national policy of coordinating and encouraging the increased use of the metric system and provided for a U.S. Metric Board to coordinate the **voluntary** conversion to the metric system. As the trend of U.S. industries losing their share of world markets continued, Congress attempted to keep the United States competitive in the international trade arena by adopting the Omnibus Trade and Competitiveness Act of 1988. Section 5164(b) of the Trade and Competitiveness Act amended the Metric Conversion Act of 1975 to declare that the metric system is the **preferred** system of weights and measures for U.S. trade and commerce. It also **required** each Federal agency to convert to the metric system by the end of fiscal year 1992.

On May 3, 1990, the U.S. Department of Transportation issued Order 1020.1C which established policy and administrative procedures for the transition to metric. As a result, the Federal Highway Administration (FHWA) formed a Metric Work Group which developed a conversion plan and a timetable. The Metric Work Group found the implementation deadline of 1992 to be impracticable and proposed a five-year schedule. On this basis, an NCHRP Project 20-40 was established by the American Association of State Highway and Transportation Officials (AASHTO) in order to convert documents published by the association to the International System of Units (SI) of measurement by October 1, 1996, to comply with the FHWA mandates.

Since the federal conversion date for these mandates has been left optional for States, this guideline is being provided in dual units. The SI number and unit are shown first followed by the U.S. Customary number and unit in parentheses, e.g., 1 m (3.3 ft). If the U.S. Customary number is not a direct conversion and is a comparable value to the SI measurement, a bracket is used, e.g., 1 mm [1 inch].

CHAPTER 1

HYDRAULIC CONSIDERATIONS IN HIGHWAY PLANNING AND LOCATION

CHAPTER 1

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Chapter 1

Hydraulic Considerations in Highway Planning and Location

1.1 INTRODUCTION

The planning and locating of highway facilities are the first steps in a challenging process of providing a safe and efficient transportation system. Hydrologic and hydraulic requirements are among the facets that must be considered during the early phases of the design process.

Water and its related resources are important considerations in the planning and locating of highways and their appurtenant facilities. Although historically only major drainage features (e.g., large rivers, environmentally sensitive areas) have been considered during these early stages, the overall drainage solution must be visualized and studied so that substantial design and construction changes are not required later. The possible effects that highway construction may have on existing drainage patterns, river characteristics, potential flood hazards, and the environment in general, and the effects the river and other water features may have on the highway, should be considered at this time.

Hydrologic and hydraulic specialists must be actively involved during the initial project phases to ensure that proper consideration is being given to drainage aspects. This involvement should include participation during the highway location selection phase. Early input from these specialists will result in a better design, both hydraulically and economically.

It must be emphasized that early studies are not comprehensive, detailed, technical designs. Rather, most are cursory studies to consider obvious drainage-related problems that may be encountered or created and what type of data needs to be collected for evaluation of possible impacts. The degree and extent of preliminary hydraulic studies should be proportionate with the cost and scope of the project and the perceived flood hazards that may be encountered. This chapter presents a comprehensive overview of possible considerations in the planning and locating of a highway.

1.2 GENERAL CONSIDERATIONS

There are many tasks and requirements that must be considered during the early phases of project development. Coordination between the various divisions of the transportation agency that may be involved with the project must be established. Notification of proposed projects must be made to other agencies and the public. The permits and regulations applicable to the project should be identified as soon as possible. Often, project delays are due to the legal process. Problems that may arise during design, construction, or maintenance should be considered. In addition, environmental data needs should be determined.