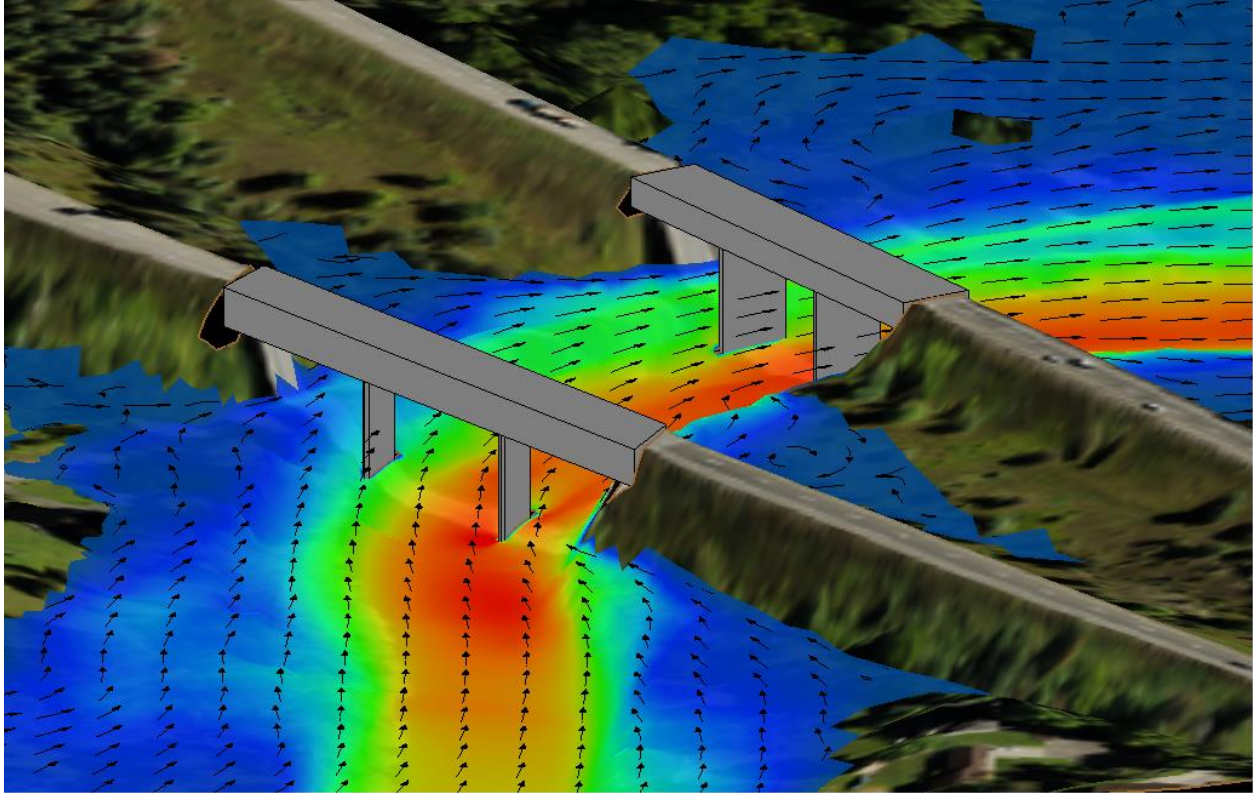


CHAPTER 1

INTRODUCTION



Note: For trunkline projects, direct questions and comments to the Hydraulic Unit Supervisor, Environmental Services Section.

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If you require assistance accessing this information or require it in an alternative format, contact the Michigan Department of Transportation's (MDOT) Americans with disabilities Act (ADA) coordinator at Michigan.gov/MDOT-ADA.

1.1 INTRODUCTION/PURPOSE

The Drainage Manual was developed to provide guidance for the design of Michigan Department of Transportation (MDOT) drainage facilities. The purpose of this manual is to serve as a contract and training document for MDOT development and delivery personnel. Michigan public transportation agencies and consultants are encouraged to use this manual.

The Drainage Manual was originally created in 2003 with minor updates in 2006. This manual represents a major update from the 2006 version. Drainage criteria was updated in all chapters. The major updates to the manual include:

- An outline for MDOT Drainage Studies (Planisware Task 3522)
- Updated Atlas-14 rainfall distribution and hydrologic method selection
- Risk-based design for MDOT and local agency program projects
- Drainage standards for temporary inlet spacing, culverts, bridges, and haul roads in the floodplain
- Advanced 2D modeling for open channels, bridges, and culverts
- Advanced stormwater tunnel hydraulics and drop shaft design
- A coastal engineering chapter
- Removal of stormwater MS4 and BMP references, which are now included in the [MDOT Stormwater Treatment Manual](#)

This manual is posted on the MDOT website:

<https://www.michigan.gov/mdot/business/design/drainage-manual>

1.2 OVERVIEW

This manual was derived from *AASHTO Drainage Manual* (2014), FHWA Hydraulic Engineering Circulars, and other FHWA and agency resources.

The MDOT Drainage Manual was updated to give the junior design engineer a basic working knowledge of hydrology and hydraulics. Practice good engineering judgment while using this manual.

Each chapter generally follows this outline:

- Introduction/Purpose
- Definitions
- Policy and Design Criteria
- Design Guidance and Procedure
- Maintenance (if applicable)
- Appendix with Symbols and Acronyms
- Additional appendices (if applicable)

1.2.1 Policy and Procedures (Chapter 2)

The chapter on legal policy and procedure gives an overview of Federal and State regulations that pertain to drainage and provides some guidance on environmental permitting for various stormwater designs.

1.2.2 Hydrology (Chapter 3)

The hydrology chapter presents methods for estimating design flood flows to size drainage facilities. This chapter incorporates the latest Atlas-14 rainfall data and revised hydrologic methods for the EGLE-NRSC method.

1.2.3 Open Channels and Roadside Ditches (Chapter 4)

This chapter explains open channel systems and provides guidance on using 2D hydraulic modeling. Appendix 4-B presents the principles of open channel flow theory.

1.2.4 Culverts (Chapter 5)

This chapter provides procedures for the hydraulic design of highway culverts. The chapter introduces the FHWA HY-8 Culvert Hydraulic Analysis Program and summarizes the design philosophy contained in FHWA's Hydraulic Design Series Number 5 (2012). Guidance for the design of temporary culverts during construction is provided.

1.2.5 Bridge Hydraulic Design (Chapter 6)

This chapter provides guidance on the hydraulic design for bridges. The design procedure emphasizes hydraulic analysis, scour analysis and countermeasure design, and using open channel hydraulic modeling software based on LRFD guidance. Guidance for 2D modeling and for the design of temporary bridges and haul roads during construction is provided.

1.2.6 Inlet and Enclosed Storm Drainage Systems (Chapter 7)

This chapter provides design guidance for inlet and enclosed storm sewer systems. The chapter includes system planning, pavement drainage, gutter flow calculations, inlet spacing, pipe sizing, and hydraulic and energy grade line calculations. Guidance for the design of temporary inlet spacing during construction is provided. An advanced hydraulics section discusses stormwater tunnel systems including hydraulic analysis and drop shaft design.

1.2.7 Stormwater Storage Facilities for Flood Control (Chapter 8)

This chapter provides the general design criteria for detention, wet detention, and infiltration storage facilities, as well as procedures for performing basin sizing and reservoir routing calculations for flood control. MDOT's preferred sheet pile weirs with low-flow orifice details were added to the chapter. Design criteria for storage facilities required for NPDES MS4 treatment can be found in the [MDOT Stormwater Treatment Manual](#).

1.2.8 Coastal Engineering (Chapter 9)

This chapter provides the design criteria for coastal infrastructure projects and guidance on determining design parameters such as stillwater elevation, design wave height, and revetment design. The impact that lake level and coastal storms have on road and bridge overtopping, scour, shoreline erosion, and potential structural damage to superstructures are discussed.

1.2.9 Pump Stations (Chapter 10)

This chapter provides guidance for the design, construction, operation, and maintenance of MDOT pump stations and their configuration. The chapter follows guidance given in FHWA's *Highway Stormwater Pump Station Design* (HEC-24, 2001).

1.3 MANUALS, COMPUTER PROGRAMS, AND REGULATIONS

References to specific computer programs, guidelines, manuals, and regulations are noted within the manual.

1.4 REFERENCES AND HYPERLINKS

The manual provides references wherever designers require more detailed source material. The references listed at the end of each chapter in bold type are recommended documents for the designer's library. Hyperlinks for references are provided at the end of chapters when available.

1.5 UPDATES

MDOT will periodically issue updates to this manual and make them available on the MDOT website provided at the beginning of this chapter.