**NCHRP**

**Project Number**

**20-07 Task 417**

**Reorganization and Strategy to Update the**

**AASHTO Drainage Manual**

**Final Report**

**Detailed Outline for the AASHTO Drainage Manual**

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**INTRODUCTION**

**Background**

The AASHTO *Drainage Manual* (2014) provides a template and guidelines that facilitate Departments of Transportation (DOTs) in the development of a highway drainage design manual (**Figure 1**). The 2014 publication superseded the 2005 AASTHO publication, *Model Drainage Manual* (**Figure 2**). However, the Model Drainage Manual has a long history having been first published in 1991 (**Figure 3**). That document set a high standard of excellence and practical value for all subsequent versions of the document.

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| Figure 1. 2014 Edition. | Figure 2. 2005 Edition. | Figure 3. Original 1991. |

The original Model Drainage Manual was written in general terms so that any agency can add specific design criteria reflecting their own policies, saving significant time and research. Since the original 1991 publication, many DOTs hydraulics and/or design manuals have been developed based on the information and cumulative experience represented by this document and its subsequent editions. It is truly a benchmark publication reflecting the best knowledge and experience of several generations of DOT hydraulic designers.

The original format of the 1991 Model Drainage Manual was a single document with policy, criteria and design procedures for highway drainage topics (e.g. hydrology, channels, culverts, bridges and so forth). This format was retained until the 2014 edition of the Drainage Manual, which divided the document into two volumes. Volume One contained guidelines and examples for drainage design policies, criteria and standards. Volume Two provided the hydrologic and hydraulic design procedures frequently used by highway hydraulic engineers. One reason for the division between policy (Volume 1) and design procedures (Volume 2) was to more readily update the document as updating the entire manual can take several years.

The AASHTO *Highway Drainage Guidelines* also have a long and valuable history. Shortly after the formation of the AASHTO Technical Committee for Hydrology and Hydraulics (TCHH) in 1970, preparation began on guidelines covering major topics in highway drainage design. The original format was to develop a guideline on a specific topic (e.g. hydrology, culverts, storm drains, etc) that was a stand-alone volume. The first three volumes were published in 1973, and then over the next 20 years additional volumes were written until a total of 14 volumes were available covering a wide range of highway drainage topics. Along the way, consolidated editions were released providing a grouping of volumes, including the 1992 edition that included eight volumes. A metric version of the 1992 edition was released in 1999 and the latest version, the fourth edition released in 2007, was a dual unit document that replaced *volumes* with *chapters* and added one more chapter, Chapter 15 on selecting and utilizing hydraulic engineering consultants.

In many ways the Guidelines parallel the Drainage Manual, but the use and purpose of the two documents is distinctly different. The purpose of the guidelines was to provide guidance on hydraulic design considerations that should be made during planning and design of highway drainage facilities. The Drainage Manual was intended as a base document to allow development of a state specific drainage manual with policy, criteria and design procedures (including example problems). However, both documents cover many of the same topics and both documents are quite large.

The physical size of these two documents and the wide range of topics included often means their content lags behind technology changes and advancements due to the effort required to update the complete documents. Given these and other emerging technology and changes in the industry, and acknowledging that the rate of technological change will only increase in the coming years, it is critical to provide faster implementation of such changes to transportation engineers and designers.

Research under NCHRP Project 20-07 (417) evaluated various alternatives to allow more efficient updating of these two important AASHTO documents. The proposed reorganization suggested by Project 20-07 (417) will permit faster implementation of AASHTO drainage publications and will improve the TCHH’s timeliness in creating updates to smaller, more manageable publications.

**Results**

1. Based on discussions at the 2018 National Hydraulic Engineers conference (NHEC) with the AASHTO Technical Committee on Hydrology and Hydraulics (TCHH), there was a strong preference for merging the two volumes of the AASHTO Drainage Manual (ADM) back into a single volume and archiving the current edition of the Highway Drainage Guidelines (HDG).
2. Given the direction from TCHH to merge the ADM into a single volume, a detailed review of the existing documents focused primarily on the ADM while identifying material in the HDG that might be carried into the next edition of the ADM if the HDG become an archival document. Each reviewer was assigned specific chapters and maintained a working document with track changes and margin notes on issues, changes, and questions. Those track changes documents are part of the final deliverable for NCHRP Project 20-07 (417) and should provide valuable insight to the authors of the new ADM. However, it is recommended that the new ADM authors revisit the HDG to be sure any other relevant information in that document is not overlooked. Additionally, considering the possible time delay between this report and the beginning of the actual writing of the new ADM the new authors should be advised to also investigate new research results, changed government regulations, updated state practices, revised FHWA publications (HDS, HEC, and Technical Briefs) as they develop the final ADM text.
3. Early in the research the project team consulted with the AASHTO Publications staff for guidance on document format. Publications staff favored an organizational structural where volumes of similar chapters could be grouped together and delivered as downloadable PDF files that would allow future updating without republishing the entire ADM. AASHTO is moving away from CD ROM delivery and web-based document (except for very large publications) in favor of PDF delivery.
4. Two alternative ADM document formats were developed that provided an organizational structure that allowed for certain areas or chapters to be updated without having to go through an entire manual update. Option 1 was based on the grouping of chapters into 5 parts as outlined in the preface of the 2014 edition of the ADM. Option 1A was similar, however added an additional grouping with three new proposed chapters, consolidating much of the material that might be subject to more frequent updating. The Panel surveyed TCHH and the conclusion was a strong preference for Option 1A, which was adopted in the ADM chapter outline presented below.
5. Three Technical content options were also developed relying on varying degrees of referencing to existing publications and standards. Option 1 was based on the current ADM blended format, where some design information is presented in detail and other information is provided by reference to a source document. Option 2 was to minimize the use of referencing to make the ADM a stand-alone document as much as possible, which would increase page length over the existing ADM. Option 3 was to increase referencing, particularly when the source document is stable and relatively unchanging, which would decrease the page count from the current ADM. The Panel surveyed TCHH and there was a general preference for the Option 1 blended approach, recognizing that TCHH should be vetting and recommending policy and design procedures, but increasing the use of referencing when appropriate given established design policy and procedures (Option 3). Ultimately, the topics presented by reference should be revisited when the ADM rewrite is underway and the TCHH can review and evaluate the choices to be made.
6. Given the importance and use of referencing, AASHTO Publications staff were also consulted regarding referencing schemes, including the use of hyperlinks. For websites or web-available publications AASHTO has decided to adopt a hybrid referencing scheme that includes a high-level hyperlink with keyword suggestions in the reference list. For Journal articles they are now using digital object identifiers (DOI’s) expressed as hyperlinks.
7. Based on all the above, the proposed outline for a new ADM is presented below. The outline includes extensive margin comments providing recommendations for the potential sources of the material (ADM Volumes 1 or 2, the HDG, NCHRP Research Reports, FHWA resources, etc.), information that might need to be updated, major issues to address etc. This outline represents the primary deliverable for NCHRP Project 20-07 (417).

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