
Chapter 3 - Documentation

TABLE OF CONTENTS

CHAPTER 3 - DOCUMENTATION	3-1
3.1 Overview	3-1
3.1.1 Introduction	3-1
3.1.2 Definition	3-1
3.1.3 Purpose	3-1
3.1.4 Types	3-2
3.1.5 Scheduling	3-3
3.1.6 Responsibility	3-4
3.2 Procedure	3-5
3.2.1 Introduction	3-5
3.2.2 Practices	3-5
3.2.3 Storage	3-6
3.3 Documentation Procedures	3-7
3.3.1 Introduction	3-7
3.3.2 Computer Files	3-7
3.3.3 Schedule	3-7
3.4 References	3-8

List of Appendices

- Appendix 3A-1 Definitions and Abbreviations
- Appendix 3B-1 Documentation Data Sheet for Hydrologic & Hydraulic Computations
- Appendix 3B-2 Suggested Outline for VDOT H&H Analysis Report
- Appendix 3B-3 Field Engineer's Hydraulic Report

Chapter 3 - Documentation

3.1 Overview

3.1.1 Introduction

An important part of the design or analysis of any hydraulic facility is the documentation. Appropriate documentation of the design of any hydraulic facility is essential because of:

- The importance of public safety
- Justification of expenditure of public funds
- Future reference by engineers (when improvements, changes, or rehabilitations are made to the highway facilities or adjacent property)
- Information leading to the development of defense in matters of litigation
- Information is available to public

Frequently, it is necessary to refer to plans, specifications, and analysis long after the actual construction has been completed. Documentation permits evaluation of the performance of structures after flood events to determine if the structures performed as anticipated or to establish the cause of unexpected behavior, if such is the case. In the event of a failure, it is essential that contributing factors be identified in order that recurring damage can be avoided.

3.1.2 Definition

The definition of hydrologic and hydraulic documentation as used in this chapter is the compilation and preservation of the design and related details, as well as all pertinent information related to the basis of design and decisions. This should include drainage area and other maps, field survey information, source references, photographs, engineering calculations and analyses, measured and other data, flood history including narratives from newspapers, individuals such as highway maintenance personnel, and local residents who witnessed or had knowledge of an unusual event.

3.1.3 Purpose

This chapter describes the documentation that should be included in the design files and on the construction plans. While the documentation requirements for existing and proposed drainage facilities are similar, the data retained for existing facilities are often slightly different from that for proposed facilities, and these differences are discussed. This chapter identifies a system for organizing the documentation of hydraulic designs and reviews to provide as complete a history of the design process as is practical.

The major purpose of providing good documentation is to define the design procedure that was used and to show how the final design and decisions were made. There is a myth that avoiding documentation will prevent or limit litigation losses as it supposedly precludes providing the plaintiff with incriminating evidence. This is seldom if ever the case and documentation should be viewed as the record of reasonable and prudent design analysis based on the best available technology. Thus, good documentation can provide the following:

- Protection for the Department by proving that reasonable and prudent actions, were in fact, taken (such proof should certainly not increase the potential court award, and may decrease it by disproving any claims of negligence by the plaintiff)
- Identifying the situation at the time of design which might be very important if legal action occurs in the future
- Documenting that rationally accepted procedures and analysis were used at the time of the design which were commensurate with the perceived site importance and flood hazard (this should further disprove any negligence claims)
- A continuous site history to facilitate future reconstruction
- The file data necessary to quickly evaluate any future site problems that might occur during the facilities service life
- Expediting plan development by clearly providing the reasons and rationale for specific design decisions

3.1.4 Types

Three basic types of documentation should be considered: preconstruction, design, and construction or operation.

1. Preconstruction documentation should include the following if available or within the budgetary constraints of the project.
 - Aerial photographs
 - Topographic mapping with contours
 - Watershed map or plan including
 - Flow directions
 - Watershed boundaries
 - Watershed areas quantified
 - Natural storage areas
 - Existing and proposed contours
 - Surveyed data reduced to include
 - Existing hydraulic facilities
 - Existing controls
 - Profiles - roadway, channel, driveways
 - Cross sections - roadway, channels, faces of structures
 - Flood insurance studies (including any available hydraulic model data), and maps by FEMA

- Soil Conservation Service soil maps
 - Field trip report(s) which may include:
 - Video cassette recordings
 - Audio tape recordings
 - Still camera photographs
 - Written analysis of findings with sketches
 - Reports from other agencies (local, State or Federal), VDOT personnel, newspapers, and abutting property owners
2. Design documentation should include all the information used to justify the design, including:
- Reports from other agencies
 - Hydrological report
 - Hydraulic report
3. Construction and operation documentation should include:
- Plans
 - Revisions
 - As-built plans and subsurface borings
 - Photographs
 - Record of operation: during flooding events, complaints, and resolutions

It is very important to prepare and maintain, in a permanent file, any available as-built plans and plan revisions for every drainage structure to document subsurface foundation elements; such as, footing types and elevations, pile types, and (driven) tip elevations, etc. There may be other information which should be included or may become evident as the design or investigation develops. This additional information should be incorporated at the discretion of the designer.

3.1.5 Scheduling

Documentation should not be considered as occurring at specific times during the design or as the final step in the process, which could be long after the final design is completed. Documentation should be an ongoing process and part of each step in the hydrologic and hydraulic analyses and the design process. This will increase the accuracy of the documentation, provide data for future steps in the plan development process, and provide consistency and continuity in the design even when different designers are involved at different times of the plan development process.

3.1.6 Responsibility

The designer should be responsible for determining what hydrologic analyses, hydraulic design, and related information should be documented during the plan development process. This designer should make a determination that complete documentation has been achieved during the plan development process which will include the final design. To assist in this determination, refer to Appendix 3B for the following:

- Project Documentation Checklist (Appendix 3B-1)
- Suggested outline for a VDOT Hydrologic and Hydraulic Analysis Report (Appendix 3B-2)
- Field Engineer's Hydraulic Report (Appendix 3B-3)

3.2 Procedure

3.2.1 Introduction

The designer should maintain a complete hydrologic and hydraulic design and analysis documentation file for each waterway encroachment or crossing. Where practicable this file should include such items as:

- Identification and location of the facility
- Roadway functional classification data
- Photographs (ground and aerial)
- Engineering cost estimates
- Actual construction costs
- Hydrologic investigations
- Drainage area maps
- Vicinity maps and topographic maps
- Contour maps
- Interviews (local residents, adjacent property owners, and maintenance forces)
- Newspaper clippings
- Design notes and correspondence relating to design decisions
- History of performance of existing structure(s)
- Assumptions

The documentation file should contain design/analysis data and information that influenced the facility design and which may not appear in other project documentation.

3.2.2 Practices

Following are the practices related to documentation of hydrologic and hydraulic designs and analyses.

1. Hydrologic and hydraulic data, preliminary calculations, analyses, and all related information used in developing conclusions and recommendations related to drainage requirements, including estimates of structure size and location should be compiled in a documentation file
2. The designer should document all design assumptions and selected criteria including the decisions related thereto.
3. The amount of detail of documentation for each design or analysis should be commensurate with the risk and the importance of the facility. Typically, culverts would normally require less documentation, whereas bridges and other major drainage structures would require more.

4. Documentation should be organized to be concise and complete, so that knowledgeable designers can understand years hence what predecessors did.
5. Circumvent incriminating statements wherever possible by stating uncertainties in less than specific terms - (e.g., "the culvert may cause back water" rather than the "culvert will cause back water"). Be objective in your statements, and opinions.
6. Provide all related references in the documentation file to include such things as published data and reports, memos and letters, and interviews. Include dates and signatures where appropriate.
7. Documentation should include data and information from the conceptual stage of project development through service life to provide successors with all information.
8. Documentation should be organized to logically lead the reader from past history through the problem background, into the findings, and through the performance.
9. In the case of lengthy documentation assemblies, a summary and table of contents at the beginning of the documentation will provide an outline of the documentation file to assist users in finding detailed information.

3.2.3 Storage

Where and how to store and preserve records is an important consideration. Ease of access, durability, legibility, storage space required, and cost are the prime factors to consider when evaluating alternative methods of storage and preservation.

The designer should maintain the documentation files including: microfilm, microfiche, digital media, magnetic media, etc. where it will be readily available for use during construction, for defense of litigation, and future replacement or extension. The designer should retain only documentation that is not retained elsewhere. Original plans, project correspondence files, construction modifications, and inspection reports are the types of documentation that usually do not need to be duplicated. Hydrologic and hydraulic documentation should be retained with the project plans or other permanent location at least until the drainage facility is totally replaced or modified as a result of a new drainage study or a minimum of 10 years after construction.

3.3 Documentation Procedures

3.3.1 Introduction

Documentation procedures for the major hydrologic and hydraulic chapters are in the Procedure section for the respective chapters. The items described should be in the documentation file. The intent is not to limit the data to only those items listed, but rather to establish a suggested minimum requirement consistent with the hydraulic design procedures as outlined in this manual. If circumstances are such that the drainage facility is sized by other than normal procedures or if the size of the facility is governed by factors other than hydrologic or hydraulic factors, a narrative summary detailing the design basis should appear in the documentation file. Additionally, the designer should include in the documentation file items not listed below but which are useful in understanding the analyses, design, findings, and final recommendations.

3.3.2 Computer Files

The following items should be included in the documentation file, and be clearly labeled:

- Input data listing
- Output results of alternatives
- Version of software
- Limitations and capabilities of software
- File names and dates
- Verification of methodology and solution /results
- Quality control practices
- Derivation of formulas for desktop applications (spreadsheets)

3.3.3 Schedule

The designer should refer to the VDOT Road Design Manual for required Hydrologic and Hydraulic Computation Report submittal times in advance of roadway milestones; such as, Field Inspection, Right-of-Way, etc.

3.4 References

American Association of State Highway, and Transportation Officials. 1982. *Highway Drainage Guidelines*

American Association of State Highway, and Transportation Officials. 1999. *AASHTO Model Drainage Manual*