1.6 Documentation

1.6.1 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)
- information leading to the development of defense in matters of litigation
- public information

Frequently, it is necessary to refer to plans, specifications and analyses 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.

1.6.2 Definition

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

1.6.3 Purpose

Documentation shall be included in the design files and on the construction plans. While documentation requirements for existing and proposed drainage facilities are similar, the data retained for existing facilities are often slightly different than that for proposed facilities and these differences are discussed. This section identifies ConnDOT's system for organizing the documentation of hydraulic designs and reviews so as 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 arrived at. Often there is expressed the 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);
- providing a continuous site history to facilitate future reconstruction;
- providing the file data necessary to quickly evaluate any future site problems that might occur during the facilities service life; and
- expediting plan development by clearly providing the reasons and rationale for specific design decisions.

1.6.4 Types

There are three basic types of documentation which shall be considered. The types are preconstruction, design and construction or operation.

1. Preconstruction documentation may include the following if available or within the budgetary restraints of the project.
   - aerial photographs
   - contour mapping
   - watershed map or plan including:
     flow path for determination of times of concentration and watershed delineation
     watershed boundaries
     watershed areas
     natural storage areas
   - surveyed data reduced to include:
     existing hydraulic facilities
     existing controls
     profiles - roadway, channel, driveways
     cross sections - roadway, channels, faces of structures
   - flood insurance studies and maps by FEMA
   - Natural Resource Conservation Service soil maps
   - field trip report(s) which may include:
     video cassette recordings
     audio tape recordings
     still camera photographs
     movie camera films
     written analysis of findings with sketches
   - reports from other agencies (local, State or Federal), Department personnel, newspapers and abutting property owners

2. Design documentation shall include all the information used to justify the design, including:
   - reports from other agencies
   - hydrologic report with all relevant backup data and computations
   - hydraulic report with all relevant backup data and computations
   - approvals as required
   - design related correspondence (internal and external)

3. Construction or operation documentation shall include:
   - plans
   - revisions
   - as-built plans and subsurface borings
   - photographs
   - record of operation including complaints and resolutions during flooding events

It is very important to prepare and maintain in a permanent file the as-built plans for every major 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.

1.6.5 Scheduling

Documentation shall 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 rather be an ongoing process and part of each step in the hydrologic and hydraulic analysis and design process. This will increase the accuracy of the documentation, provide data for future steps in the plan development process, and provide consistency in the design even when different designers are involved at different times of the plan development process.

1.6.6 Standard Practices

Following are the Department's standard practices related to documentation of hydrologic and hydraulic designs and analyses.

1. Hydrologic and hydraulic data, preliminary calculations and analyses and all related information used in developing conclusions and recommendations related to drainage requirements, including estimates of structure size and location, shall be compiled in a documentation file.
2. The designer shall document all design assumptions and selected criteria including the decisions related thereto.
3. The amount of detail of documentation for each design or analysis shall be commensurate with the risk and the importance of the facility.
4. Documentation shall be organized to be as concise and complete as practicable so that knowledgeable designers can understand years hence what was done by predecessors.
5. 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.
6. Documentation shall be organized to logically lead the reader from past history through the problem background, into the findings and through the performance.
7. An executive summary at the beginning of the documentation will provide an outline of the documentation file to assist users in finding detailed information.

The items outlined in the respective chapters of this manual shall be included in the documentation file. The intent is not to limit the data to only those items listed, but rather establish a 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 shall appear in the documentation file. Additionally, the designer shall include in the documentation file items not listed but are useful in understanding the analysis, design, findings and final recommendations which may not be included in the documentation sections of the various chapters.