

Chapter 1 Introduction

1-1. Purpose and Scope

a. Purpose. This manual provides guidance for the design of reinforced, concrete lined flood control channels which convey rapid and tranquil storm water flows to prevent flooding. This guidance presents provisions for coordinating the disciplines involved in the design of channels, selecting channel type, and identifying the critical aspects of designs which require quality assurance inspection during construction. Channel design involves determining the overall channel configuration including appurtenant structures, designing reinforced concrete structures and pavement or concrete lining, determining type and location of joints, designing subdrainage systems, and designing appropriate safety features.

b. Scope. This guidance addresses trapezoidal and rectangular flood control channels lined with reinforced concrete. Guidance is not included for the design of channel linings formed by gabions, riprap, shotcrete, gunite, or grouted mattresses.

(1) Trapezoidal channels. Trapezoidal channels have sloped sides and are formed by excavating in situ materials. The sloped sides and channel bottom may require paving for protection, depending on the stability of the sides and the resistance of the in situ materials to erosion.

(2) Rectangular channels. Rectangular channels have vertical or near vertical sides which are formed with reinforced concrete retaining walls, I-walls, or U-frame structures. The channel bottom may be paved or unpaved depending on the resistance of the in situ material to erosion.

1-2. Applicability

This guidance applies to all HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities having civil works responsibilities.

1-3. References

Required and related publications are listed in Appendix A.

1-4. Design Philosophy

Flood control channels are constructed for the purpose of conveying heavy storm water flows through and from areas which would otherwise be inundated, usually resulting in property damages and loss of life. Typically, these projects are owned and maintained by local sponsors. These channels usually: are the primary feature of local flood protection projects, extend for great distances, require significant construction costs due to their extensiveness, and present extreme consequences should failure occur. Therefore, channel design solutions should be developed in a logical and conservative manner which provides for economical construction and serviceability and ensures functional and structural integrity.

1-5. Coordination

Although this guidance pertains primarily to the structural design aspects of flood control channel design, close coordination with other design disciplines and the local sponsor is required. Other disciplines involved in the design are hydrologic, hydraulic, concrete and materials, geotechnical, environmental, and construction. Some of the critical aspects of the design process which require coordination are:

a. Estimates of design slope and runoff volumes, selection of channel cross-sectional area, and location of required energy dissipation and juncture structures.

b. Design water surface elevations.

c. Topography of area containing the channel alignment and existing elements, structures, utilities, etc.

d. Preliminary estimates of geotechnical data, surface and subsurface conditions, and location of existing structures of utilities.

e. Evaluation of technical and economic feasibility of alternative designs.

f. Refinement of the preliminary design to reflect the results of more detailed site exploration, laboratory testing, and numerical testing and analyses.

1-6. Channel Section

The proper cross section for a reach of channel is one that provides adequate hydraulic capacity at the minimum cost. Economic considerations for selecting the channel section include the costs of design and construction, right-of-way, required relocations, and maintenance and operation. A trapezoidal channel is usually the most economical channel when right-of-way is available and is, therefore, the more commonly used channel section. A rectangular channel may be required for channels located in urban areas where the right-of-way is severely restricted or available only at a high cost.

1-7. Safety Provisions

Channel designs should include safety provisions for the needs of the public and operations personnel. Local sponsors are responsible for the safe operation of channels, and designers should coordinate designs with the sponsor so that appropriate provisions are incorporated to ensure safe operation of the project. Railing or fencing should be provided on top of rectangular channel walls and walls of chutes or drop structures for public protection. Ladders should be provided on the sides of rectangular channel walls and steps provided on the sloped paving of trapezoidal channels to provide safe access for operations personnel.

1-8. Aesthetic Provisions

The merits of incorporating environmental quality into channel design have been established. EM 1110-2-38 and EM 1110-2-301 provide guidance for channel alignment, landscaping, and aesthetic treatment of channel linings.

1-9. Relationship between Design Assumptions and Construction Practices

The designer should identify the design assumptions, details, and specification requirements which are essential

to design integrity. These items should receive assurance inspection during construction to assure that actual field conditions and construction practices are in compliance with the design assumptions and specification requirements. Some assurance inspection items for channels are listed below. These items should be adjusted as appropriate for the particular design.

- a.* Subgrade preparation (materials, compaction, and finished grade).
- b.* Reinforcing steel (materials and placement).
- c.* Concrete (materials, strength, mixing, placing, thickness, and other dimensions).
- d.* Waterstops and joints (type and installation).
- e.* Subdrainage system (pipe material, valves types, filter materials, and other installation requirements).

1-10. Computer Programs for Structural Design

A listing and description of some of the current computer programs which are suitable for the structural design of elements of rectangular channels are given in Appendix B. Corps programs and user's guides describing program capabilities may be obtained from:

U.S. Army Engineer Waterways Experiment Station
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