

Introduction

I. Objective of Study

The objective of this study summarized in this report was to evaluate innovative methods of flood protection and flood fighting for locations where conventional embankment levees are not suitable. Although earth embankment levees designed, constructed and maintained by the Corps of Engineers provide cost-effective and reliable protection against flooding for many communities and facilities, they cannot be used in all locations. In some locations the cost/benefit ratio for a conventional levee is too high, and in other locations sufficient land is not available for construction of a conventional levee. In these locations it would be desirable to have alternative systems of flood protection that could be constructed at a lower cost, or on narrower strips of land. Cost effective alternatives to conventional earth embankment levees would make it possible for the Corps of Engineers and its community partners to provide protection for areas that cannot now be protected using conventional levees. A review and evaluation of published literature, commercial products, and a survey of professional practice were made with the objective of assessing the state of the art and the state of practice with regard to innovative concepts for flood protection. The Principal Investigators were Virginia Tech Professors J. Michael Duncan and James K. Mitchell and Graduate Research Assistants Christian Lovern and James Coffey.

Information gathered on innovative systems of flood protection and flood fighting was presented at a Workshop held at Virginia Tech on November 6, 1997 to identify a short list of methods that are worthy of further, more intensive study. This information was presented to representatives from the U.S. Army Corps of Engineers Chief's Office, Waterways Experiment Station, other Corps Districts, and to several representatives from private practice, and academia. After the presentations, the methods were discussed by all present at the workshop, with the objective of arriving at a short list of two to five most promising methods that are worthy of more detailed study and evaluation.

II. Report Content

This report summarizes the results of the preliminary investigation done at Virginia Tech and the general evaluation of each method by those at the Workshop. Also included is a summary of comments from Workshop attendees about each method discussed, stability calculations, a simplified approach to evaluate stability characteristics for different flood fight methods, information sheets for each method, addresses for distributors and other sources of information, and cost estimate data for several methods.

III. Evaluation Criteria

Each method was evaluated using the following criteria, as compared to conventional flood protection systems:

1. Required footprint (width)
2. Cost
3. Maximum water levels that can be retained
4. Durability
5. Aesthetics
5. Ease of construction

Additional considerations for methods that can be placed, removed, and reused were:

1. Time required to install
2. Simplicity of design
3. Required manpower to install
4. Terrain adaptability
5. Required storage space
6. Seepage through section joints
7. Soil fill requirements

Pre-designed systems proposed for use in flood fight situations were evaluated analytically for stability in terms of:

1. Factor of safety against sliding
2. Induced hydraulic gradient beneath the structure
3. Induced bearing pressure
4. Location of resultant on the base of the structure

A simplified analytical approach was developed that can be used to quickly evaluate their stability. Permanent installations were not analyzed in this fashion because it is assumed that detailed engineering studies will be performed in each individual application.

Methods were originally separated into two categories: innovative temporary flood fight and innovative permanent flood protection techniques. It became clear during the discussion at the Workshop that the purposes of the innovative methods presented are often situation-dependent, and cannot easily be separated into only two categories. Thus the attempt is made in this report to separate methods into distinct categories, and it is suggested that the engineer involved with flood protection choose an appropriate method based on the application requirements.

IV. Use of This Report

This report is intended for use by the U.S. Army Corps of Engineers and others involved in flood protection design for urban and rural areas, in flood fight situations and long term flood protection management. At least one point of contact is included for many methods if further information is needed.