COASTAL ENGINEERING

Santa Barbara
Specialty Conference
October, 1965

AMERICAN SOCIETY OF CIVIL ENGINEERS
FOUNDED 1852

J. A. Battjes

COASTAL ENGINEERING

Santa Barbara Specialty Conference October, 1965

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

AMERICAN SOCIETY OF CIVIL ENGINEERS
345 E. 47TH STREET
NEW YORK, N.Y. 10017

Price $10

ACKNOWLEDGMENTS

This conference was sponsored by the Waterways and Harbors Division of the American Society of Civil Engineers through its Committee on Coastal Engineering. Appreciation is expressed to the Los Angeles Section, ASCE, and in particular to William J. Herron, Jr., M. ASCE, for their assistance, particularly in providing programs and funding arrangements; to the Santa Barbara - Ventura Counties Branch of the Los Angeles Section, ASCE, and, in particular to Wallace C. Penfield, M. ASCE, Chairman of the Local Arrangements Committee, for dealing with the meeting arrangements; and to the U. S. Army Engineer District, Los Angeles, for photographs supplied to illustrate the cover and the section title pages of this publication.

All of the material from this conference was compiled by Thorndike Saville, Jr., M. ASCE. Without his outstanding organizational effort and diligence this publication would not have been possible.

CONTENTS

CHAPTER 3

COAST & GEODETIC SURVEY TSUNAMI PROPAGATION PROGRAM

Gaylord Miller
University of Hawaii
Honolulu, Hawaii

SYNOPSIS

Several programs for the computer solution of wave propagation in a two-dimensional velocity field have been devised in the last few years. These programs fit an analytic surface to points in the neighborhood of the wave ray which is being advanced. The ray curvature is then computed at the point in question using this local analytic surface. Difficulties with this technique are that the computed analytic surface changes abruptly from one grid square to the next, and that the surface-fitting technique is poorly adapted to data which are not on a rectangular grid. The method of computing the ray paths for the tsunami propagation program described here is based on a spatial convolution technique. Values and derivatives are determined from a numberical point of view basically, using spatial weighted averages. The weighting function is chosen for its wave number response (of ocean bottom roughness) in a way appropriate to any given tsunami frequency. There are no special discontinuities that occur as the ray progresses from one grid square to another. The computer technique in some way incorporates the "common sense" used when similar calculations are performed by hand.

CHAPTER 21

PREDICTOR EQUATIONS FOR BEACH PROCESSES & RESPONSES

Wyman Harrison
U. S. Coast and Geodetic Survey, Norfolk, Virginia

SYNOPSIS

Two variations of linear multiregression analysis of environmental variables in the beach-ocean-atmosphere system at Virginia Beach, Virginia are presented. The first variation is a least squares search procedure that is used to segregate out, from a large set of data, a small number of significant beach process elements (independent variables) that explain most of the variability in a given beach response element (dependent variable). The second variation of the analytical method employs a screening procedure that seeks specifically for the best predictor equation, where a beach response is taken as the predictand and several beach process elements are taken as predictors.

Results of the first analytical procedure show that if about 5 or 6 variables are segregated out of any group of about a dozen, these few account for essentially all of the variability explained by all twelve. Predictor equations obtained by the second analytical variation are tested against a set of independent data and, with one exception, are found to make reasonable predictions.

(Full article published in Journal of Geophysical Research, Vol. 70, No. 24, December 15, 1965, pages 6103-6109)

CHAPTER 35

SAND BY-PASSING AT SANTA BARBARA HARBOR

William J. Herron, Jr.
U. S. Army Engineer District
Los Angeles, California

SYNOPSIS

Santa Barbara has served coastal shipping since 1782. It was a well sheltered roadstead with a stable shoreline for 150 years when efforts were initiated to provide a secure harbor. One of the first known efforts was a harbor study made in 1922 by Colonel Leeds. In 1927-28 the existing breakwater was constructed and the result was severe erosion of the adjacent beaches.

The effects of the breakwater upon littoral sand movement has been the subject of intensive studies by Coastal Engineers and Oceanographers from 1930 to date. Three problems resulted from this interference with natural processes, accretion west of the harbor, erosion east of the harbor and creation of a trailing sandspit from the tip of the breakwater, that if allowed to grow would eventually close the harbor. A future erosion problem will result from reduction of sand supply due to urbanization of the area and construction of water conservation features.

Corrective measures have been periodic dredging of the sandspit and harbor area with deposition on the eroding beach from 1935 to 1952, and continuous dredging from 1956 to date by a small city owned dredge.

It is proposed to enlarge the harbor to provide complete enclosure and add an offshore breakwater to provide a sand trap, protection for a dredge, and protection of the harbor entrance.

Construction will probably start in 1967.

CHAPTER 41

ON THE OPTIMAL DESIGN OF RUBBLE-MOUND HURRICANE BARRIERS

Ronald T. McLaughlin
Massachusetts Institute of Technology
Cambridge, Massachusetts

SYNOPSIS

The optimal design of rubble-mound hurricane barriers is considered as a problem in maximizing an objective. On the basis of the function of a hurricane barrier and the effects of failure, a benefit function is constructed and its maximization outlined. The concept of a design wave is discussed in this context. The type of statistical data on waves and surges needed for such a function is defined and a feasible method for obtaining such data is laid out.

The actual design of the barrier is presented as a problem of sub-optimization or minimization of the cost for each level of protection. The decision variables and constraints are identified and the necessary data are outlined. As a by-product some significant gaps in existing research results are identified.

As many as possible of the concepts outlined above are demonstrated by means of a specific design study of a barrier for the East Passage of Narragansett Bay, Rhode Island. This study involved prediction of wave generation, estimation of refraction and design for a range of design waves. From the results it was possible to determine the general features of a minimum-cost design and recommend specific model studies for determining final design details.