Meetings

Coastal Engineering

Development of coastlines has proceeded so rapidly in recent years that problems emerging from intense use have nearly out-paced our knowledge to solve them. Because coastal problems vary so widely from area to area depending on local economic interests and topography, they are often attacked at a local level, outside the mainstream of national planning. Both engineers and scientists from many different but interrelated disciplines have become involved in coastal studies—hydraulic engineers, oceanographers, statisticians, marine geologists, and hydrologists. In recognition of the need to bring together varied workers and disseminate research results of common interest, the Coastal Engineering Research Council of the American Society of Civil Engineers has joined with other groups in different countries to organize occasional international conferences. These conferences were brought to life in 1950 by the Council on Wave Research, University of California, Berkeley, to determine the state of the art and science related to design of coastal works. As pressures on coastlines mounted with time, problems became more complex; and there was a continued need to bring forth recent research results as well as feed new ideas into the field. Thus, the conference now has become a focal point for projecting new advances in a relatively young field of engineering.

The Eleventh Coastal Engineering Conference opened 16 September 1968, at the Institution of Civil Engineers in London. Twenty-seven countries were represented. During the 5-day conference, papers covered a wide gamut of subjects from wave theory to practical expedients for shore protection.

Models have proven useful in predicting the consequences of proposed engineering works on hydraulic and salinity conditions in estuaries. A hydraulic model of the James Estuary, Virginia, showed how channel deepening leads to greater haline stratification of estuarine water and to reduced volume transport. With continued deepening of estuaries to accommodate larger ships, it was asked, how deep can we go until the transporting power of sediment is diminished to a point where shoaling prevails. The effects of changing estuary shape by deepening, land fill, or barraging are often manifold. Enclosure of the Severn Estuary, Britain, with a single barrage was reported to involve multiple changes in siltation as well as on tides and bottom geometry. However, it was demonstrated the structure could also yield multiple benefits beyond the initial aim, as improved shipping access and power generation, as well as better road communication and shore protection. With the potential of models being realized, substantial interest centered on improved model practice. J. Leendertse presented a new computational model for solution of two-dimensional tidal flow utilizing computer capabilities. A mathematical model of the St. Lawrence River estuary was developed to supply boundary conditions for further analyses in a corresponding hydraulic model. Discussion of estuary papers pointed up a common need to establish greater accuracy in model testing as well as to assess the degree of repeatability. To further our understanding of models it was deemed essential to understand the effect of scaling on fundamental forces, for with each change of scale fundamental forces behave differently.

Contrary to some thought, boundary conditions may cause radical changes in transfer of energy from wind to water. One experiment using a mobile "wavy" surface in a water flume (K. Zagustin) showed that the pressure distribution over a train of progressive waves developed a noticeable phase-lag with respect to the wave shape—a feature which accounts for some energy transfer because of the normal stress. Another experiment (O. Shemdin) showed how the mean velocity profile in air is influenced by wave characteristics—results which substantiate the Miles theory of wave generation by shear flow. By modeling mean wind forces and corresponding wave spectra, which include wave length and amplitude, E. Plate and J. Nath examined the response of scaled offshore structures to dynamic loading. But until wave spectra used as criteria for making the model waves can be shown to include properly scaled motions and accelerations, effects of wave action on structures must remain relatively subjective.

Movement of sand along beaches is one of the important processes active in formation of shore features such as spits as well as in shore erosion. Although direct measurement of sand transport is difficult to make on natural beaches several attempts were made in different areas and in different ways. E. Bijker attempted to compute longshore current velocity at a site on the Ivory Coast by using normal transport formulas (for example, Eagleson) which relate bed shear and grain size to transportation, and by further introducing bed load and suspended load transport (Einstein). These parameters are not normally included in such a computation because they are incompletely known. The method, however, does not account for orbital velocities in the breaker region nor the varying distribution of longshore current normal to the coast. In another approach, D. Inman related synoptic field measurements of sand transport to wave energy flux. Transport was obtained from tracer distributions and energy from an array of digital wave staffs in the surf zone. Accordingly, longshore transport was found directly proportional to the longshore component of wave power. This applies to "real" waves, unlike model waves with fully developed transport characteristics. Because of inherent limitations in measuring suspended transport with sand tracers it was recommended that future determinations include the ratio of bed load to suspended load. And furthermore, an attempt should be made to measure the instantaneous rates of littoral drift and the corresponding wave motion.

The efficiency of groin structures in trapping littoral drift of sand evoked much discussion. W. Bakker made useful progress on a mathematical theory showing the effects of a groin system on drift—a theory in which on-offshore transport was taken into account. W. Price studied the effects of both permeable and impermeable groins on a "stable" beach in a wave basin and noted, "There is little doubt that erosion will continue but its rate will be reduced. Too often, groins are brought into use more-or-less by trial and error when a beach is in a state of erosion and starved of its sand supply." It was generally concluded that groins promise more than they can produce.

Among the new and unconventional structures described was a flexible, porous, floating breakwater consisting of pulpwood logs. Because the "log-jam breakwater" acts near the surface where most wave energy exists, it caused significant attenuation over a wide range of conditions. In another design, a tubular breakwater was developed to disperse energy by friction and turbulent jets and thus reduce wave height. The action of air bubblers, often used as barriers for spreading oil, salt water intrusion, and ice formation, was analyzed to provide a means of correlating the vertical velocity field of an air jet-water mixture in model tests with field observations. Because "bubble curtains" require large quantities of air to suppress wave action, use of bubblers as a breakwater was deemed too costly. By successive experiments in a model with a stable beach profile, W. Price and K. Tomlinson demonstrated the effect of artificial seaweed planted on an offshore bed in promoting greater net onshore transport. Field tests on an unstable eroding beach at Bournemough, South England, showed that artificial seaweed can build beaches. Use of seaweed is one of the few methods known to bring material onshore but its use is still in an early stage of development.

The methodology papers presented information on new equipment, field methods, and analytical techniques, key parts of coast engineering research. Introduced were: methods for measuring nearshore currents; a system of daily coast-wide observations at numerous points on the California coast; a computerized linear multi-regression analysis for longshore current velocity; a field program of synoptic sediment and dynamic parameters; a sterowave meter for characterizing surf waves; a systems approach to selecting petroleum port sites; and "stabit," a new armor block for beach defense. Discussion pointed to a need for more routine and reliable measurements of wave direction in addition to concurrent measurements of waves at sea and in the surf zone.

A series of "case histories" showed how experiments and theory could be used, as well as expedients on hand, to solve practical problems in different parts of the world. Whether or not these cases were successful, they allowed many to learn from the experience of others. Among the cases presented were: the design of jetties for lagoon entrances and river mouths, development of artificial beaches, recession of terraces, shoaling of harbor entrances, and protection of dunes by stone mounds on a sandy beach. Although numerous case histories were reported for different parts of the world, few recorded the failure of structures and their life history in relation to forces of the environment. With passage of time coastal engineering problems will become more complex and solutions more difficult.

Papers will be published as proceedings by the American Society of Civil Engineers, 345 East 47 Street, New York 10017. They will be available in May 1969 at a cost of $12. As for future conferences, the Council recommended Washington, D.C., for fall 1970 and Canada for 1972.

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