Fact Sheet

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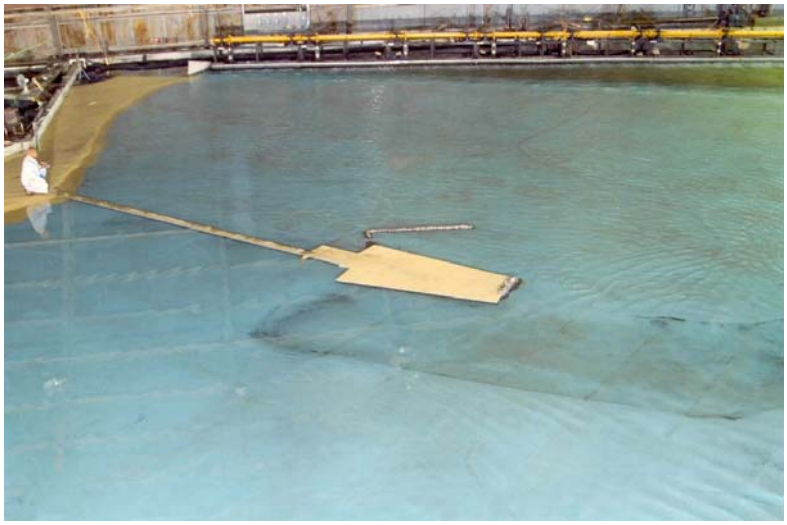
Design for Enhancement of Wave-Induced Circulation at Kaunakakai Harbor, Molokai, Hawaii

Purpose: To study wave conditions, wave-induced current patterns and magnitudes, and sediment movement patterns at the existing site and develop alternative plans that will alleviate poor water circulation and sediment buildup in the area.

Background: Kaunakakai is located on the south-central coast of the Island of Molokai,, Hawaii. The harbor is located adjacent to Pier Island at the end of a causeway that extends seaward about 1,900 ft from shore. It consists of a deep draft port adjacent to the west side of the island and a small-craft harbor, protected by breakwaters, on the east side of the island. The area immediately east of the causeway was a mud flat. Poor water circulation had resulted in the collection of a large amount of sediment and debris. The original causeway was built on piles, which allowed currents and sediments to flow through the structure. In later years, it was reconstructed using fill materials. Subsequent modifications included extending the facilities seaward, filling the area, and building new facilities on the fill. These actions inhibited the flow of currents and sediments around and through the structure.



Facts: At the request of the U.S. Army Engineer District, Honolulu, a 1:75-scale physical hydraulic model was designed and constructed at the U.S. Army Engineer Research and Development Center by the Coastal and Hydraulics Laboratory to study wave, current, and sedimentation conditions at the harbor and develop alternative plans to enhance circulation and alleviate sedimentation. The model reproduced approximately 6,600 ft of the Molokai shoreline, the existing causeway and harbors, and bathymetry in the Pacific Ocean to an offshore depth of 60 ft. Included was the relatively flat, shallow reef that extended seaward about 3,200 ft. A 70-ft-long unidirectional, spectral wave generator, an automated data acquisition and control system, capacitance-type wave gauges, and coal tracer materials were used in model operation. Experimental results for a series of 20-ft-wide culverts in the causeway revealed that currents would jet through the culverts with relatively high velocities, meander in eddies, and dissipate or only slowly migrate to the west. It was determined that a 600-ft opening extending seaward from the shoreline (representing a pile-supported causeway, or a bridge) would result in continuous current and sediment flow downcoast in a westerly direction.

Points of Contact: For additional information, please contact Mr. Robert Bottin at 601-634-3827 (ray.r.bottin@erdc.usace.army.mil) or Mr. Dennis Markle at 601-634-3680 (dennis.g.markle@erdc.usace.army.mil).