



COASTAL PROTECTION REVETMENT

ESPLAÑADE AVENUE
PACIFICA, CALIFORNIA

PROJECT DESCRIPTION

During the El Niño winter of 1997–1998, rapid sea cliff retreat occurred, undermining and destabilizing ground beneath 12 residences along Esplanade Avenue in Pacifica, California. City, State and Federal (FEMA) government agencies recognized that Esplanade Avenue, which provides access to a total of 21 residential properties, was threatened and ultimately vulnerable to active coastal erosion. Cotton, Shires and Associates, Inc. (CSA) was retained by the City of Pacifica to investigate the sea cliff failure and provide design of a rock revetment (seawall) intended to guard against continued wave attack and cliff retreat. In addition, we were charged with: 1) assessing whether the houses between Esplanade Avenue and the sea cliff were salvageable from an engineering standpoint; 2) evaluating the potential for emergency reopening of a local quarry in Pacifica to produce revetment stone; and 3) providing guidelines to be addressed during upcoming slope stability investigations and foundation design for houses proposed to be rebuilt at the top of the bluff.



ENGINEERING SOLUTION

Investigation and design of a protective rock revetment was completed in conjunction with Skelly Engineering, and project construction was inspected by CSA during the summer and fall of 1998. The project construction cost was approximately \$2 million and was carried out by Power Engineering Contractors. Key aspects of revetment design included selection of adequate armor stone size (8–10 tons), keying of imported stone below beach and alluvial deposits well into firm bedrock, and selection of an appropriate revetment slope and height. Selected design parameters were based on oceanographic analysis including consideration of maximum possible still water levels, wave run-up, the design wave force and anticipated scour depth. Final quarry stone selection included consideration of constituent mineralogy, rock density and anticipated durability in a dynamic marine environment.

