US Army Corps of Engineers®
Engineer Research and Development Center

National Erosion Control Development and Demonstration Program (Section 227)

Miami Beach, Florida

Background

The City of Miami Beach project site extends along the shoreline for approximately 762 m (2,500 ft) with a southern limit near 63rd Street. The Florida Department of Environmental Protection has established survey monuments along the Dade County shoreline at 305 m (1,000 ft).

View of Miami Beach, Florida

Prior to the recent emergence, the Dade County shoreline was inundated by the Pamlico Sea, which left thin deposits of Pamlico sand lying unconformably over the widespread Miami Oolite. The Dade County shoreline consists of a barrier island with a bay behind it, but is not a typical young shoreline. Where the typical barrier island is a sand dune moving progressively over the bay sediment, the Dade County barrier island (i.e., Miami Beach) probably developed on a shallow sandstone reef where mangroves grew and trapped additional sediments creating a stable island. A series of three reef lines with areas of sand in between exist offshore of the project site. These reef lines vary in relief (rises in elevations above adjacent sandy areas) from low relief (<1 m (3.3 ft)) to high relief (>3 m (9.8 ft)). The continental shelf offshore of the project site is narrow with the shelf break located only a few kilometers from the shoreline.

Analysis of the Wave Information Study revised Phase II database indicates that the incident direction of wave energy along the Dade County shoreline is bimodal. Nor′easters produce large waves which strike the Dade County shoreline from a steep northerly angle during much of the fall and winter months, and the easterly/southeasterly trade winds produce smaller but more persistent waves from the eastern and southern sectors during the rest of the year. The direction of peak wave energy is from the northern sectors, as evidenced by southerly net sediment transport, but the wave energy incident from the southern sectors is significant. The mean tide range is 0.77 m (2.5 ft) with spring tides of 0.93 m (3.1 ft) mean low water. The Federal Emergency Management Agency estimates 5-year return period storm surge in the area as 1.04 m (3.4 ft), 10-year as 1.61 m (5.3 ft), 20-year as 2.01 m (6.6 ft), 50-year as 2.59 m (8.5 ft), and100-year as 3.11 m (10.2 ft).

The shoreline recession rate in the demonstration project site ranges from 4.27 m (14 ft) to 7.62 m (25 ft) annually (excluding the effects of beach fill). Shoreline recession in this area is in direct correlation to local impacts of tropical and extratropical storm events.

Problem

The 63rd Street demonstration project site can be described as an "erosional hot spot" within the federally authorized Dade County Beach Erosion and Hurricane Protection Project (BEC&HP). The authorized BEC&HP is designed to provide a specific level of storm damage reduction and recreation benefit through the establishment and maintenance of a beach nourishment design template. This design template must provide for the life of the project in order for realization of the return on Federal and non-Federal investments. Monitoring of the BEC&HP indicates that shoreline recession at the demonstration project site exceeds the rates experienced on adjacent shorelines.

Technology

A design has been selected using Reef Ball™ units as an offshore reef breakwater. Reef Balls™ are hollow concrete hemispheres designed for marine habitat enhancement. Placed in parallel rows as an offshore breakwater, Reef Balls™ will reduce the wave energy reaching the beach both by physically blocking the incident waves and by generating turbulence through the interstices in and around the concrete units. More information on Reef Balls™ is available at *www.ReefBall.com*.

Reef Balls™ are usually fastened to a hard substrate with fiberglass reinforcing bars. However, the Miami site has a sandy substrate. To provide stability and prevent the units from sinking into the sand, the Reef Balls™ will be mounted on concrete articulated mattresses.

The purpose of the breakwater is to reduce wave energy reaching the beach, thereby reducing the movement of the sand, extending the time between renourishments, and increasing the storm protection to adjacent buildings. Additional benefits of the Reef Ball™ design include improved habitat for marine life, and as the Reef Balls™ become covered with marine growth, the design will provide recreational benefits as a snorkeling trail.

The primary objective of the demonstration project is to maintain template dimensions between renourishments in an innovative or nontraditional manner. This demonstration project will also document the performance of other methods implemented to maintain the beach nourishment design template at other erosional hot spots in the BEC&HP (e.g., use of submerged rubble-mound reef for wave attenuation, and use of T-head groins or headland structures for sediment retention).

Status

Physical model testing of the proposed design has been completed, and a final design has been determined based on the model tests. The design has been presented to State and Federal agencies for permitting. A coastal processes evaluation of the project site was completed in coordination with the Dade County BEC&HP. Innovative and non-traditional products and/or methodologies for reducing erosion at the project site were solicited.

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Available Documentation

Martin, T. (2004). "Section 227 study Miami Beach, Dade County, Florida," *Proceedings, Coastal Structures 2003*, ASCE.

Program Authorization

Water Resources and Development Act of 1996 (Public Law 104-303, 110 Stat. 3658) dated October 12, 1996.

Additional information can be found at *http://chl.erdc.usace.army.mil/section227*.