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Submerged Artificial Reefs for Beach Erosion Control

An alternative method of shoreline stabilization and beach erosion control is the use of an offshore submerged breakwater. Artificial reef units such as the Reef Ball™ (see web site at http://reefball.com) can be used to achieve not only shoreline stabilization, but environmental enhancement and recreational snorkeling and diving opportunities. An example of such a system in the Dominican Republic is shown in the Figure below, and presented in the following section.

Figure 1. One ReefBall artificial reef unit (left) and the submerged 3-row ReefBall breakwater (right).

Dominican Republic Submerged Artificial Reef Breakwater Examples

The Gran Dominicus project, constructed in the summer of 1998, has continued to perform exceedingly well, gaining sand in the first two years and remaining stable in the second two years. The Iberostar project is less than 9 months old, but already is showing beach stabilization. The beaches on both sides of these projects are stable or slightly accretionary, showing absolutely no adverse impacts to the adjacent beaches by these two projects.

Figure 2. Aerial Photograph of Dominican Republic Projects

This aerial photograph was taken 5 July 2002. Gran Dominicus is located to the east (right) of the pier, and Iberostar is located west (left) of the pier. Although the beach gained 10 to 13 meters of width in the first 3 years due to the installation of the submerged Reef Ball artificial reef breakwater in the fall 1998, the beaches further to the east and west of the project have remained stable.

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The performance of the submerged Reef Ball artificial reef breakwater is demonstrated in the graph below showing the before and after beach conditions. Figure 3 shows the beach profile taken near the center of the photograph in Figure 2 above, showing sand accretion and gain in beach width seaward of the Gran Dominicus Resort following the installation of the submerged Reef Ball artificial reef breakwater. Figure 4 shows before and after photographs.

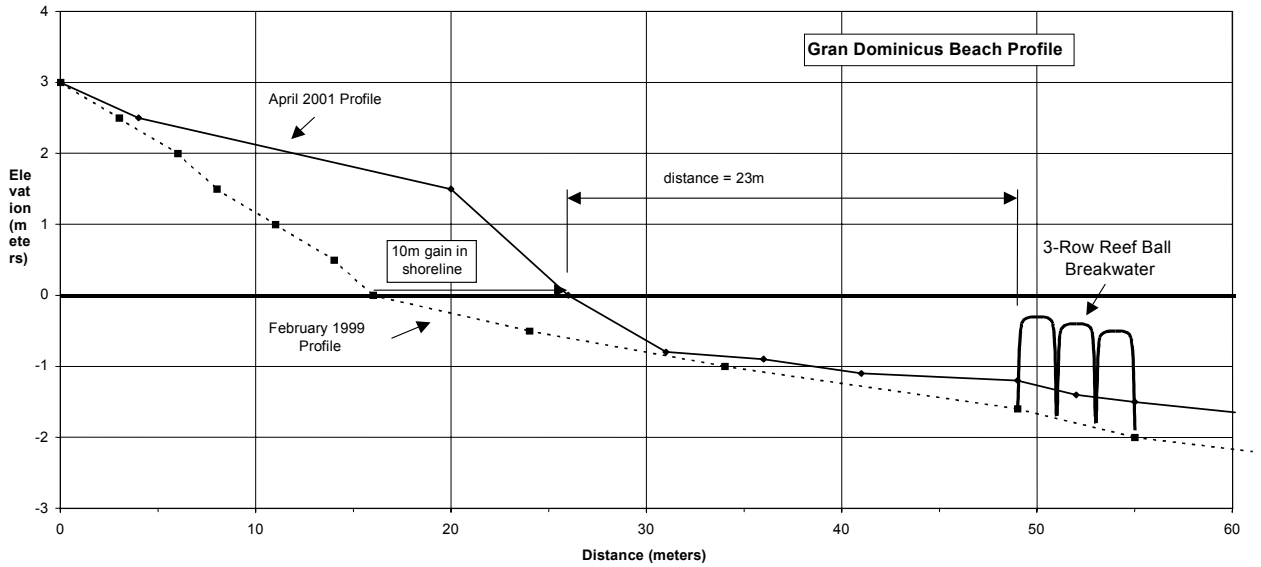

Figure 3. Comparative Beach Profiles for Gran Dominicus Submerged Reef Ball Artificial Reef Breakwater

Figure 4. Increased Beach Width at Center of Projects - looking west.
February 1999 (left) compared with April 2001 (right) showing large natural sand accretion.

Stability of the Reef Ball artificial reef units has been proven by the direct hit by a Category 3 Hurricane (Georges) on the Gran Dominicus project in the fall of 1998 shortly after deployment of over 400 Reef Balls, with absolutely not one Reef Ball moving. Large waves from Hurricane Mitch in the fall of 1998 also were unable to cause any movement in any of the reef units. The submerged artificial reef breakwaters at Gran Dominicus and Iberostar also have provided significant environmental enhancement, with soft and hard benthic growth including corals on the reef units, and several species of fish observed, including small colorful tropical and reef fishes, such as sergeant majors, blue tang, damsel fish, snapper, pompano, etc. Many people were observed snorkeling on the artificial reef breakwaters.

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Proposed System for Oasis

The submerged Reef Ball artificial reef breakwater system recommended for consideration for the Oasis project is very similar to the two systems installed in the Dominican Republic. The proposed breakwater system would help stabilize the beach in front of the development, without adversely affecting the adjacent beaches. A conceptual design of a Reef Ball artificial reef submerged breakwater offshore of Oasis is shown in Figure 5 below.

Figure 5. Conceptual Design of Offshore Submerged Artificial Reef Breakwaters

The effectiveness of a submerged breakwater system will depend on the weather conditions following the project deployment, especially tropical storms and hurricanes, and the amount of sand moving in the littoral system. Although no guarantee or prediction of the amount or speed of sand accretion from the proposed artificial reef breakwater system can be made, the artificial reef breakwater will provide additional wave attenuation to assist with beach stabilization, without causing adverse impacts on the adjacent beaches.