

3D Physical Model Testing of an Artificial Surfing Reef Gold Coast, Australia

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ABSTRACT

Background

A 1:50 scale hydrodynamic model was used to examine the performance of an artificial reef structure to be constructed at the Gold Coast, Queensland Australia. Construction of the prototype reef will commence in September, 1998. The longshore extent of the prototype reef is approximately 300 m, extending 600 m offshore to water depths of approximately 11 m. The reef will be constructed using massive sand-filled geocontainers. This is the first purpose-built surfing reef structure to be built in the world, and it is anticipated that tourism within the Gold Coast region will be significantly enhanced.

The reef structure is a key component of the Gold Coast City Council's NORTHERN GOLD COAST BEACH PROTECTION STRATEGY (ICM, 1997). In combination with beach nourishment, the objectives of the reef are to:

- Widen the beach and dunes in the Surfers Paradise (northern Gold Coast) area, to provide an increased storm buffer and additional beach amenity;
- Improve surfing conditions.

Several studies were completed prior to construction of the reef and beach nourishment. These included an economic cost-benefit analysis, an assessment of biological impacts, and an investigation of regional coastal impacts. Extensive field and numerical modeling studies were

then undertaken to optimize the reef design (Black et al., 1998a, 1998b,...). The design criteria to be met by the reef were explicitly formulated by Council prior to final design.

Physical Model Testing

Three-dimensional physical model testing was undertaken by Unisearch Ltd., Water Research Laboratory (WRL), University of New South Wales. The model was constructed in WRL's 26 x 16 m wave basin, at an undistorted length scale of 1:50. The model incorporates approximately 800 m of Gold coast shoreline, with the nearshore profile extending approximately 800 m offshore to water depths of 12 m.

Video and image analysis tools were used to obtain and analyze the results of the model test program. Multiple video and digital cameras were mounted overhead the basin, and up to 10 capacitance wave probes were used to monitor waves heights across and adjacent to the reef structure. Nearshore current velocities were measured using dye tracing and mini flow-meters.

Qualitative mobile bed testing (sand tracer) was undertaken to assess the likely re-alignment of the shoreline in the lee of the reef structure. This was a critical component of the model study, because beach widening was a desired outcome, but the formation of a tombolo joining the reef to the beach was not. The existing nearshore bathymetry was constructed (fixed bed), and then sand placed along the shoreline to represent beach nourishment. Initial calibration tests was first undertaken with no reef in place, then a simple offshore breakwater structure was modeled, prior to installation of the complex reef structure.

Additional hydrodynamic (fixed bed) testing was undertaken for specified design combinations of water-level, wave height, wave period and incident wave direction. Wave shoaling, refraction and diffraction were examined, in order to confirm and refine the earlier numerical modeling studies.

The 'surfability' of the reef for a range of design wave conditions was also examined. Parameters measured included peel velocity, peel angle, and wave height/board speed at take-off.

The final paper and conference presentation will present the results of the above analyses, incorporating digital images of model tests to illustrate the various phenomena discussed.

