

**Client:** Tonkin and Taylor International

**Year:** 2008

**Project Reference:** 2007068

**WRL Technical Report:** Physical Modelling of Bounty Bay Breakwater, Pitcairn Island (2008/14)



The Pitcairn Islands are an extremely isolated south-eastern extension of the Tuamotus Archipelago of French Polynesia, and are accessible only via a 30 hour boat ride from the Tahitian Island of Mangareva. The Pitcairn Islands consist of four separate islands: Pitcairn, Oeno, Henderson and Ducie, with the main Pitcairn Island being the only permanently inhabited. The British Government's Foreign and Commonwealth Office (FCO) has commissioned Tonkin & Taylor International (T&TI) to prepare a concept design for a breakwater at Bounty Bay, on the north-eastern side of Pitcairn Island. Subsequently, T&TI commissioned WRL to undertake a physical modelling investigation of the proposed breakwater and Bounty Bay harbour.

The need for the breakwater is to:

- Reduce the wave climate on the inside of the harbour jetty at Bounty Bay to enable safer embarkation and disembarkation from long boats and ships tenders in a greater variety of conditions
- Reduce the damaging effect of extreme waves striking the jetty

Bounty Bay is the primary landing point for access onto Pitcairn Island, with the coastline being extremely rugged for most parts. The island's longboats and small fishing boats are housed at Bounty Bay in sheds accessed from a slipway in the lee of the Bounty Bay jetty. Bounty Bay faces in a north-easterly direction and there are no offshore islands or reefs to provide protection from wave attack. All supplies are landed at Bounty Bay, and all trade with passing cruise liners operates out of Bounty Bay. In recent times this trade has required the islanders to take their wares out to the cruise liners in the longboats. Unless sea conditions have been unusually calm at the time of the ship visit, the ships' Captains have been reluctant to launch their ships' tenders and allow passengers ashore.

The physical model constructed by WRL consists of a 1:55 scale 3D wave basin model of Bounty Bay, with the model topography extending from approximately +7 m CD down to a depth of -20 m CD. Model tests have been conducted for three wave directions of northwest, north-northeast, and east (deepwater directions), for both operational and 100 year ARI design wave conditions.

The modelling program allows for testing of a primary eastern breakwater, as well as a secondary western breakwater with the following goals:

- Assessment of existing wave processes at the site (shoaling, refraction, diffraction, penetration)
- Assessment of breakwater(s) performance for wave reduction
- Analysis of damage to the breakwater during design events

As a result of the physical modelling undertaken by WRL, the breakwater layout and armouring design was altered to better meet the project targets.