ABSTRACT

To optimize the ship mooring condition inside of Lekki Port, Nigeria, which is planned to accommodate large Post-Panamax Container Vessels (10,000 TEU), a 1:58 3D physical ship mooring model test was conducted for 2 quay structure types (slope-type and vertical quays) and 2 plans of breakwater length (300m and 150m). Based on the wave data statistical analysis together with the measured test results of the wave disturbance inside of the port, the movements, mooring line forces, and the fender forces of moored vessels, the operational downtime for vessels at the berths was estimated as a reference for the general layout optimization of the quay and breakwater. The test results generally showed that, for the 300m-long breakwater plan, the spectral peak wave period measured at the berths inside the port was about 60-70s, and the total significant wave heights at the berths of the vertical quay plan were relatively larger than the slope type quay plan. As a comparison, for the 150m-long breakwater plan, the measured wave heights inside the port, vessel motions and mooring forces increased significantly, which resulted in noticeable augment of operational downtime. Thus, the general layout was modified accordingly based on the slope-type quay with 300m-long breakwater.

KEY WORDS: Lekki Port, Nigeria; Ship Mooring Physical Model Test; Wave Disturbance; Vessel Motions; Mooring Forces; Downtime Estimation; General Layout Optimization

BACKGROUND

Located at the Bay of Guinea, east of Lagos, Nigeria, the development of the new harbour of Lekki Port as shown in Figure 1 is planned to accommodate large Post-Panamax Container Vessels (10,000 TEU) servicing import-export operations. To optimize the ship mooring condition in the port (Oortmerssen, 1975 and 1976), a 3D physical ship mooring model test with a model scale of 1:58 was carried out based on different plans of the port general layout to measure and determine the wave disturbance in the port, the movements, mooring forces of vessels moored at the berths, and to estimate the operational downtime for each berth.