ANALYSIS OF ENGINEERING FEASIBILITY OF AN OPEN PIER AGAINST COASTAL HAZARDS ALONG LUZON ISLAND

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INTRODUCTION

As an archipelago, the Philippines highly depends on ports for inter-island trade and commerce. However the country is vulnerable to coastal hazards such as typhoons and tsunamis. To serve the growing demand for commercial cargo transport in the northern region of the country's largest island Luzon, an open pier is being proposed to be built along the western seaboard. This paper presents a methodology of carrying out a coastal engineering assessment of the feasibility of an open pier possibly without protective breakwaters. The analysis aims to determine the wave climate of the project coast under prevailing non-storm conditions under which the port is expected to operate. The study also aims to quantify the historical storm tides along the project coast as basis for the vertical siting of the pier structure for engineering design. Finally, a study of the tsunami hazard is undertaken to consider the possible significance of infrequent but potentially catastrophic hazard into the engineering design basis of the pier.

METHODOLOGY

The project area lies along a curved coast which is about 2 km from a large river (Figure 1). A site inspection indicated that the coastline is eroding and is thus likely approached by large prevailing waves during the southwest monsoon season. Wave climate under prevailing, non-storm conditions was determined based on a wind wave model, considering the various approach directions of offshore waves, the synthesis of which yields an optimal layout for an open pier. Local bathymetric data was consolidated into a regional unstructured mesh (Figure 2) for storm surge modeling. Historical typhoons over a minimum 35-year period of record that tracked within a 150-km radius around the project coast were shortlisted for the critical typhoons. A storm surge model was then applied to determine the non-overtopping soffit elevation, or NOWSE, of the pier. Tsunami susceptibility of the site was assessed and an incursion analysis of tsunami runup was carried out.

RESULTS

Figure 3 shows a comparison of the observed (blue line) and simulated (red) water levels at Cebu Port during typhoon Haiyan 2013 with a determination coefficient of 0.88. A storm surge of about 0.4 m is evident from the storm tide history. Based on the critical combination of storm surge and storm waves, the required NOWSE is governed by the combination of the maximum storm wave at a nominal storm tide. A synthesis of the all the critical storm tides indicated the historical NOWSE to be at MTL+3.37 m based on typhoon Betty 1980.

Figure 1 Study area

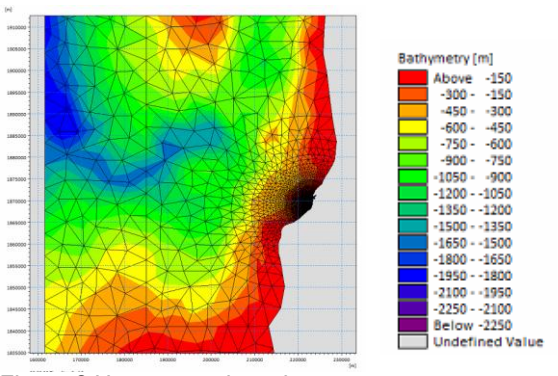

Figure 2 Unstructured mesh

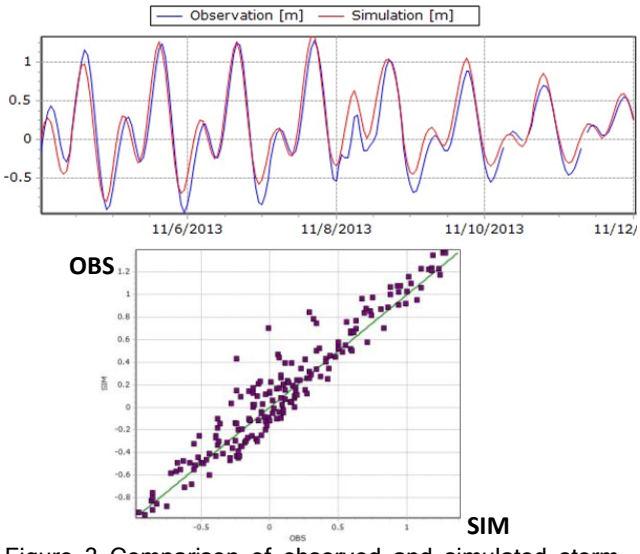

Figure 3 Comparison of observed and simulated storm tides