Engineering Solution to Piling Works under Extreme Wave Condition

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ABSTRACT

This paper carries out a comprehensive statistical data analysis of the wave condition to simulate a wave transformation model and to be verified by 3D physical model test. It comes to that under such extreme wave condition, the traditional construction techniques cannot accomplish the work on schedule. Therefore, the jack-walking construction platform is proposed as a solution, which is walking on the top of piles to avoid the influence of wave on the operational window of piling works. With the advantage of stability and effectiveness for piling works under extreme wave conditions, it has a broad promotion prospects.

KEY WORDS: Extreme wave condition; wave transformation model; piling; jack-walking construction platform.

INTRODUCTION

Hadarom port, as an extension of Ashdod port and Hayovel port in Israel, is designed for Maersk Triple E-class container vessel of more than 18,000 TEU, with an overall length of 400 meters. In general, the work scope of Hadarom port comprises a 60-hectare reclamation container terminal formed by the dredging materials form the channel and harbor basin, a 600-meter extension of the existing main breakwater, an 1480-meter lee breakwater as the revetment for the reclamation area, and an overall 2200-meter quay line for berthing of container vessels and tug boats as shown in the following Fig. 1.

Among the above, Quay 28, which is a steel pipe pile-based open platform structure, is in the center of the construction area and parallel to the entrance channel of the port, as shown in the following Fig. 2. Due to the ground treatment of fine sand layer under the main breakwater extension, it makes Quay 28 a critical role in temporary protection against the extreme wave condition. Therefore, 18 3500-ton weighted caissons are applied as retaining wall structure at the rear of the pile-based platform since the caissons are prefabricated and could serve as a temporary protection for the port construction work as quickly as possible.

However, due to the wave reflection in front of the vertical wall of installed caissons, it makes the wave condition of the piling works even worse and brings more challenge to the construction technique. In this paper, a jacking platform is proposed for piling works under such wave condition based on the statistical data analysis and wave transformation model.

Fig. 1 General Layout of Existing Ashdod port and Hayovel Port, and Hadarom port under construction