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Investigating the Behavior of Offshore Platform to Ship Impact

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Abstract

Offshore platform structure has the ability to resist wave loading, wind loading, operation loading, and ship collision, therefore, it is important to investigate the structural behavior of platform taking into consideration soil-structure-pile interaction when the platform is subjected to ship impact at a different location on deck slab. The present study deals with platform supported by pile foundation. The effect of soil-pile interaction on behavior of platform to lateral impact load is investigated by using finite element simulation which is performed by ABAQUS software. From the results obtained, it is obvious that the ship collision position on platform will be reflected on ultimate capacity of structure so the structure will undergo to loose ultimate capacity due to damage that occurs from the ship collision. This study comprises investigation of pile lateral displacement, pile twist angle, pile shear force distribution, pile bending moment distribution and deck slab displacement. It also clarifies that the pile displacement has been reflected on pile critical length. The twist angle of the pile is more sensitive to soil type and loading condition. It is seems that the shear force distribution and bending moment distribution are affected by loading condition and soil type. Finally this study shows that the response of deck slab depends on soil type, soil-pile interaction and loading condition.

Keywords: Ship Impact; Offshore Platform; Clay Soil; Loading Condition.

1. Introduction

Offshore platforms are normally used for berthing of oil tankers. So the design of these platforms must be considered as the resistance to heavy impacts from ships in addition to the environmental loads [1]. Fenders can be described as absorption energy device whose fundamental target is to transform severe impact load into a reaction that both the structure and the ship can safely sustain [2]. The popular method which is used in fender systems design is the kinetic energy method [3]. Several researches have dealt with the problem of offshore structure to the collision of the ship. In 1983 Edvardsen et al. worked on the resistance of offshore structures against the impact loading from vessels and dropped objects [4]. In 1983 Amdahl investigated the circular tube deformation to lateral impact. The lateral force was applied parallel to the axis of the tube by using rigid plate [5]. In 1988 Wierzbicki and Suh investigated the circular tube deformation to the lateral impact. The load was applied by a line impact onto one section of the tube [6] In 2000 Al-Jasim investigated the berthing dolphin of Khor-Al-Amaya terminal number 8 to impact load from an oil tanker of 330000 DWT at 60% cargo [7]. In 2003 Hussein studied the dynamic response of three-dimensional offshore structure to couple load which consists of ship impact and wave loading [8].

In 2012 Kadim studied the dynamic response of dolphin of Khor-Al-Amaya berth No.8 to ship berthing impact [9]. In 2014 Travanca and Hao investigated the dynamic behavior of offshore platform to impact with high energy from vessel. This study included a procedure to improve equivalent systems [10]. In 2016, Hasan analyzed the Um-Qaser dolphin structure, He also investigated the influence of pile dimensions and soil characteristics on structural behavior

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