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Effect of Triangle Cables Configuration on the Behavior of Reinforced Concrete Submerged Floating Tunnel under Hydrodynamic Load

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Abstract

This study aimed to perform a further analysis regarding the Reinforced Concrete Submerged Floating Tunnel of Triangle Cables Configuration (RC-SFT TCC) system fitting to attain the structure with the optimum configuration. The TCCs were inducted into several configurations, namely C1, C2, C3, and C4 that remined the two angle inclined cables of 36˚ and 45˚ respectively with a different pattern. Subsequently, a numerical modelling was also carried out using Finite Element Method (FEM) with the employment of SAP2000. Buoyancy Weight Ratio (BWR) of 1.3-1.5 were also added in this study to provide the optimum of the RC-SFT configuration. The modelling result showed that the C1 provided the most optimum configuration due to the maximum axial forces of 1145.1 kN. The C1 was also considered giving a better performance due to load-deformation behaviour than the C2, C3, and C4 models. Finally, it can be confirmed that RC-SFT is feasible to be applied as an alternative infrastructure due to its results.

Keywords: reinforced concrete, submerged floating tunnel, triangle cable configuration, numerical modelling, hydrodynamic load;

1 Introduction

Submerged Floating Tunnel (SFT), also called Archimedes bridge, is an alternative solution to traffic structure for waterways crossing. It is balanced by its buoyancy, self-weight, cables configurations and proper restraint which is set up on a shore and submerged at a certain depth under the sea water surface. An SFT particularly consists of four components. First, the tube, made up of tunnel segments, allows traffics and pedestrians to get through. Second, the restraint structure connects the SFT to shore. Third, the cable configurations are moored to the seabed and keep the SFT in a balance position, which is the weight of SFT is less than the buoyancy force in order to preserve the structure to be remained floating. Fourth, the structural foundations are constructed in the seabed to install the cable configurations [1]. Furthermore, the SFT offers the valuable advantages of green economic construction that the cost construction of a unit tunnel segment will not normally increase as the total length of the SFT increases, which is compared to a conventional bridge [2]. Thus, the SFT is more considered to be constructed across the long span water. Another one, the SFT is only a preferred solution for the water area where the conventional bridge is not fitted, due to the environmental-friendly features of SFT, i.e. less

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