ABSTRACT

This paper discusses the development of the Atlantia’s new battered four-column TLP, called the FourStar™. For a given deck size, the footprint of the battered column TLP is larger than a conventional vertical-column TLP. This results in several advantages, namely: improved stability, enabling quayside hull–topsides integration, wet tow of the integrated TLP system, and installation without the use of a heavy-lift vessel. The larger keel footprint also results in improved hydrodynamic behavior and smaller tendon requirements. Finally, the battered column gives improved pontoon access for SCR installation.

The FourStar TLP consists of four columns of (rounded) rectangular cross-section, aligned along the diagonals of a square and battered towards the geometric center of the platform. The columns are connected by conventional rectangular pontoons, whose aspect-ratio is optimized to improve the hydrodynamic performance. The application of this concept to various payloads, including wet- and dry-tree production platforms, and various environmental conditions, including GOM, West Africa, and offshore Brazil has been studied. This paper emphasizes the hydrodynamic and structural aspects of the concept and discusses the results from an extensive series of wave basin model tests carried out recently. Finally, the advantages of this new concept over a vertical column design are quantified for a typical GOM application, and its scalability is discussed.

INTRODUCTION

Atlantia’s new battered four-column TLP - FourStar™ - was developed to provide a more economical solution for deeper waters and larger payloads, where SeaStar is no longer an optimal solution.

The FourStar TLP’s unique characteristic is its battered columns. Figure 1 shows a rendering of the FourStar supporting a typical wet-tree production facility. The four columns of the FourStar are battered towards the center of the platform; thus, for a given topsides geometry, the base footprint and the water plane moment are larger than a conventional vertical column TLP. Therefore, it can be designed to provide sufficient stability to enable quayside integration of the topsides with the hull, thus eliminating the risk and cost of an offshore heavy lift. Moreover, the larger base footprint results in tendon porches being further away from the center of the platform, compared to a conventional vertical column TLP. This feature maximizes the effective arm of the tendons, thus leading to smaller tendon requirements.

Figure 2 provides a detailed view of the FourStar hull form. The basenode design leads to a continuous load path through the outer shell, resulting in lower weight densities and an optimized stress distribution. Also the diagonally-oriented columns allow for their strong axis to effectively resist the bending moments due to the topside payload and wave-structure interaction effects.

In the following sections the application of the FourStar hull to a typical wet-tree GOM application is discussed. The resulting FourStar design is then compared to a conventional vertical column TLP design for the same application. Finally the scalability of the concept is studied through applications for various payloads and environments.