

## **Evaluating the Impact Load on the Offshore Platform During Float-over Topside Installation**

*Jong-Jin Jung, Woo-Seob Lee, Hyun-Soo Shin*  
Maritime Research Institute, Hyundai Heavy Industries Co., Ltd.  
Ulsan, Korea

*Yun-Hak Kim*  
Offshore Installation Engineering Dep't, Hyundai Heavy Industries Co., Ltd.  
Ulsan, Korea

### **ABSTRACT**

For the installation of a topside of offshore platform onto jacket, lift method with crane barge has been a common concept. However, the increasing weight of topside and high costs for crane barges has led designers to consider the float-over method as an alternative.

The float-over method uses a floating barge to transport and install a topside. The barge is maneuvered inside the legs of jacket and lowered down to mate the topside onto the jacket. During the mating operation the topside and jacket experience impacts through the contact points.

This paper describes how to evaluate the impact load during float-over topside installation to design the contact substructures such as leg mating unit(LMU), deck support unit(DSU) and fender system. The installation operations are classified by docking, ballasting and undocking stages. At each stage, the impact loads on LMUs, DSU and fenders are evaluated with non-linear time domain analysis. The developed analysis techniques have been applied to real offshore projects.

**KEY WORDS:** Topside installation; float-over method; floating barge; offshore platform; jacket; leg mating unit(LMU); deck support unit(DSU); fender

### **INTRODUCTION**

Conventionally, the topside of offshore platform has been installed onto jacket by crane barge with lift method, in which the topside is constructed as modular parts in onshore and assembled during installation. If a super heavy-lift crane barge is available the topside could be installed with one integrated part. However, the increasing weight of topside and high costs for crane barges has led designers to consider the float-over method as an alternative.

In the float-over method the topside is constructed as one integrated part in onshore, transported and installed by a floating barge. Due to the several benefits(Hartel and Beattie, 1996) for design and installation

this method has been utilized more frequently in last 2-30 years(White, Ramzan, Rawstron and Miller, 1986; Kocaman and Kim, 2008). In the 80s only about 5 float-overs had been executed, while nowadays about 5 float-overs are executed each year(Seij and Groot, 2007).

This paper summarizes briefly major installation equipments of float-over installation such as leg mating unit(LMU), deck support unit(DSU) and fender system, in which impact loads occurs during the mating operation.

This paper also describes how to evaluate the impact load during float-over installation to design the contact substructures. The installation operations are classified by docking, ballasting and undocking stages. At each stage, the impact loads on LMUs, DSU and fenders are evaluated with non-linear time domain analysis. The developed analysis techniques have been applied to real offshore projects.

### **INSTALLATION EQUIPMENT**

In the float-over installation the barge is maneuvered inside the legs of a jacket and lowered down to mate the topside onto the jacket. During the mating operation the topside and jacket experience impacts through the contact points.

To establish the analysis methodology to evaluate the impact loads, following equipments has to be considered among the various equipments used in the float-over topside installation.

#### **Fenders**

The surge and sway fenders are used to absorb impact loads on the jacket and to keep the barge in its position. The sway fenders are tapered to facilitate entry of the barge into the jacket slot(see Fig. 1).

Rigid fenders can be used for a narrow gap between barge and jacket legs, or soft fenders can be used for a wide gap. The fender system has to be designed considering deformation and energy absorption.