

Foundation Aspects for the Load-Out of 24,000-Tonne Jack-Up Rig

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1.0 ABSTRACT

Massive 24,000 Tonne Jack - up Rig was fabricated, in various stages, at the fabrication yard of Yard number 2. Schematization of the foundation system become very important due to heterogeneous soil characteristics across the fabrication yard and due to progressive build-up of the structure. It become a challenge to the Geotechnical engineer to plan an economic foundation system to take care of the settlement behavior during different stages of fabrication.

Foundation system was schematized on four skid - way system. During load-out, the load was transferred in such a manner that the quay wall was capable of sustaining the load with control settlements. The calculated behavior matches very well with the recorded observations of the foundation system.

This paper deals with the analysis , design and behavior of the foundation system of the jack - up rig.

2.0 KEY WORDS

Jack-up rig, Skid-way, Concrete blocks, Piles, Quay-wall, Compression strut, Settlement

3.0 INTRODUCTION

Fabrication of the 24,000 Tonne Jack - up rig was planned to be carried out at Yard No. 2. The exact location of fabrication was chosen in such a way so as to take the maximum advantage of the existing facilities. It was therefore decided to fabricate the Jack - up rig where previously two mammoth Jackets, each weighing more than 35,000 Tonne were fabricated. Just before the fabrication of the Jack - up rig, various Jackets , weighing between 2,500 and 3,500 Tonne, were fabricated in the same area. The sub - soil in the area was therefore subjected to considerable amount of consolidation and compaction under the heavy loads at different time over the past several years.

4.0 FOUNDATION SCHEME

The schematization of the foundation system was done , keeping in view the future requirements of the foundations with respect to the following stages of progress and operation of the 'Jack - up rig'

1. Supporting system during the fabrication of the 'hull'
2. Supporting system of the three 'Spud - legs'
3. Supporting system during the 'Jacking up and Jacking down' tests of the rig
4. Supporting system during the 'Load - out' of the Jack - up rig
5. Safety of the existing 'Quay wall' during load -out of the rig
6. Overall stability of the entire foundation system
7. Economizing the foundation by using the existing facilities and foundations

The Jack - up rig, consists of three numbers of Spud - legs, which will eventually carry the entire weight of the rig, are spaced in a triangular manner of spacing 74.75 m, as shown in fig. - 1. The configuration of the 'Hull' of the Jack - up rig is also shown in fig. - 1. During the fabrication of the rig, the Hull was to be supported initially. The three 'Spud - legs' will have separate foundation system.

5.0 SUBSOIL PARAMETER

Sub - soil parameters at the Fabrication yard generally consists of 'Fill' material at the top varying in thickness between 4.0 meter to 23.40 meters, followed by a deposit of 'Transported soil'. The 'Transported soil' varies in thickness between 9.0 meter to 23.50 meters. Thereafter 'Bed - rock' was encountered having different weathering effect.

Fig. - 1 also shows the detail plan of Bore hole locations in the area. Fig. - 3 shows a typical Bore-log. The salient design soil parameters for the foundation design of the Jack - up rig is shown in Table-1.

The 'Fill' material at the top generally consists of loose to medium dense silty fine Sand (SM) followed by silty angular Gravel with fine sand, in saturated medium dense condition. Where the 'Fill' material extends to a greater depth the material consists of medium to dense and very dense Sand (SM) and Gravel (GM).

The 'Transported soil' generally consists of Silty sub - rounded Gravel with fine to coarse sand (GM), saturated, medium to very dense in nature. At a greater depth 'Transported soil' consists of silty fine Sand with shell fragments, silty angular Gravel with fine to coarse sand (GM) dense to very dense in nature. Bedrock consists of highly weathered bedrock of Shale, crumbles to silty sand and rock fragments very dense in nature followed by partly weathered bedrock of Shale.