



OTC 18268

Installing Jackups in Punch-Through-Sensitive Clays

R. Brennan and H. Diana, ConocoPhillips; R.W.P. Stonor and M.J.R. Hoyle, Noble Denton Consultants Ltd.; C.-P.Cheng,¹ D. Martin, and R. Roper, ENSCO Intl. Inc.

¹ Formerly Noble Denton Consultants Ltd.

Copyright 2006, Offshore Technology Conference

This paper was prepared for presentation at the 2006 Offshore Technology Conference held in Houston, Texas, U.S.A., 1-4 May 2006.

This paper was selected for presentation by an OTC Program Committee following review of information contained in an abstract submitted by the author(s). Contents of the paper, as presented, have not been reviewed by the Offshore Technology Conference and are subject to correction by the author(s). The material, as presented, does not necessarily reflect any position of the Offshore Technology Conference, its officers, or members. Papers presented at OTC are subject to publication review by Sponsor Society Committees of the Offshore Technology Conference. Electronic reproduction, distribution, or storage of any part of this paper for commercial purposes without the written consent of the Offshore Technology Conference is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of where and by whom the paper was presented. Write Librarian, OTC, P.O. Box 833836, Richardson, TX 75083-3836, U.S.A., fax 01-972-952-9435.

ABSTRACT

The paper describes some of the problems of installing a jackup adjacent to a fixed platform in an area with difficult geotechnical conditions. An account is presented of the initial problems experienced at a location that resulted in a punch-through and consequent structural damage to the legs of a modern jackup. The geotechnical conditions and available geotechnical surveys are described as are the subsequent additional geotechnical surveys required to identify whether a similar jackup could be safely re-instated at the location. The analyses indicated that geotechnical remediation would be required and the adopted method of "swiss-cheesing" is discussed. Comments are made on the subsequent successful installation and eventual removal of the second jackup.

The paper is directed towards owners and operators wishing to install jackups at locations where punch-through sensitive clays are present. It provides conclusions on the requirements from geotechnical surveys at such locations and on the benefits and implications of undertaking geotechnical remedial programs.

Punch-through represents a major risk in the operations of jackup platforms in certain geotechnical conditions and the avoidance of such risks by the techniques described has a considerable economic value.

SUMMARY AND INTRODUCTION

In August 2004 a new jackup was installed at the Belida B wellhead platform (WHP) offshore Indonesia in the Natuna Sea in order to drill over a conventional steel jacket. The water depth at the location was 249ft (75.9m). The jackup was positioned on the south face of the jacket with a heading of 210 degrees.

The unit was successfully located in the desired position (despite some sliding problems encountered due to spudcan craters left by a previous unit) and elevated out of the water in order to apply full preload. The preload had been held for just over 2.3 hours when additional penetration of the starboard leg was observed. Despite attempts to maintain the unit in a level condition the situation grew rapidly worse and the hull swayed and yawed to starboard until it stabilized in an afloat condition with its legs broken just below the hull. The unit was successfully removed for repairs. The legs which had broken off and were embedded in the seabed were then recovered by a floating sheer-leg crane.

The operators of the field were anxious to complete their drilling program and during the following year arrangements were made to examine whether a jack-up could be safely installed at the same location. The jackup selected was of the same design as that which had been damaged during the earlier installation attempt. New geotechnical survey data was obtained from the disturbed soil locations where the legs had been removed and this indicated that the risk of a punch-through was still present. Means of remediating the seabed were examined and as a result of these studies it was decided that a process known as "swiss-cheesing" should be adopted in order to ensure that the jackup spudcans would be driven safely through the layer of stiff material found to be overlying a weaker layer. The method required drilling multiple holes to weaken the soil underneath the spudcans.

The holes were drilled and the new jackup was subsequently installed at the site. Particular care was taken to track the penetration depth and resistance of each leg during the installation and this data was subsequently analyzed in order to assess the accuracy of the predictions that were made. These results are presented together with comments and recommendations intended to assist in the safe installation of jackups in similar punch-through-sensitive soils.

ANALYSIS OF 2004 PUNCH-THROUGH

Earlier Jackup Installations

One jackup rig had previously drilled at the WHP-B location on two separate occasions. The rig was a Friede and Goldman L-780-C Mod II design and the spudcan craters it left were visible in the bathymetry survey that was obtained before the new rig was placed on the site as can be seen in