

RIG MOVE

SUPPORT AND SERVICES



Keppel

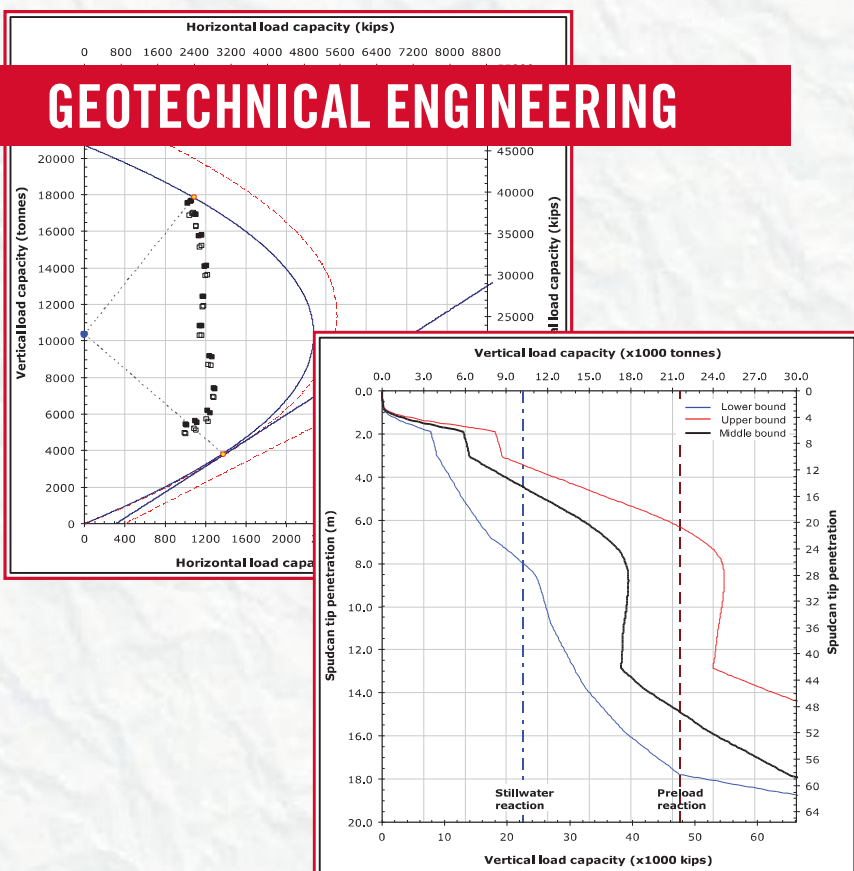
**Offshore Technology
Development**

RIG MOVE SUPPORT & SERVICES

Offshore Technology Development (OTD) offers various structural and geotechnical engineering services as well as rig move monitoring system and technical support to ensure safe rig moves. We strive to provide cost effective solutions to our Clients, optimising the vessel's operational safety.

In order to achieve a safe installation and operation of the jack-up rig, our experienced jack-up and geotechnical team are able to provide professional & customised services to cater to your needs; services include:

GEOTECHNICAL ENGINEERING



- **GEOTECHNICAL SITE INVESTIGATION REVIEW**
- **LEG PENETRATION ANALYSIS**
- **FOUNDATION STABILITY ASSESSMENT**

Our geotechnical team is able to review the geotechnical site investigation data provided by Customer. Based on the geotechnical site investigation data, soil parameters such as lower bound and upper bound friction angles and shear strength will be interpreted for subsequent leg penetration analysis and geotechnical assessment. Our geotechnical team is also able to provide advice and recommendation for site improvement when necessary.

With the proper geotechnical site investigation data, our geotechnical team is able to perform a leg penetration analysis to derive the load versus leg penetration curve. With this information, the rig operator will know the estimated leg penetration behaviour especially during jack-up leg lowering and preloading operations. In addition, the leg penetration curve will show if there is any potential of geotechnical hazard such as punch through.

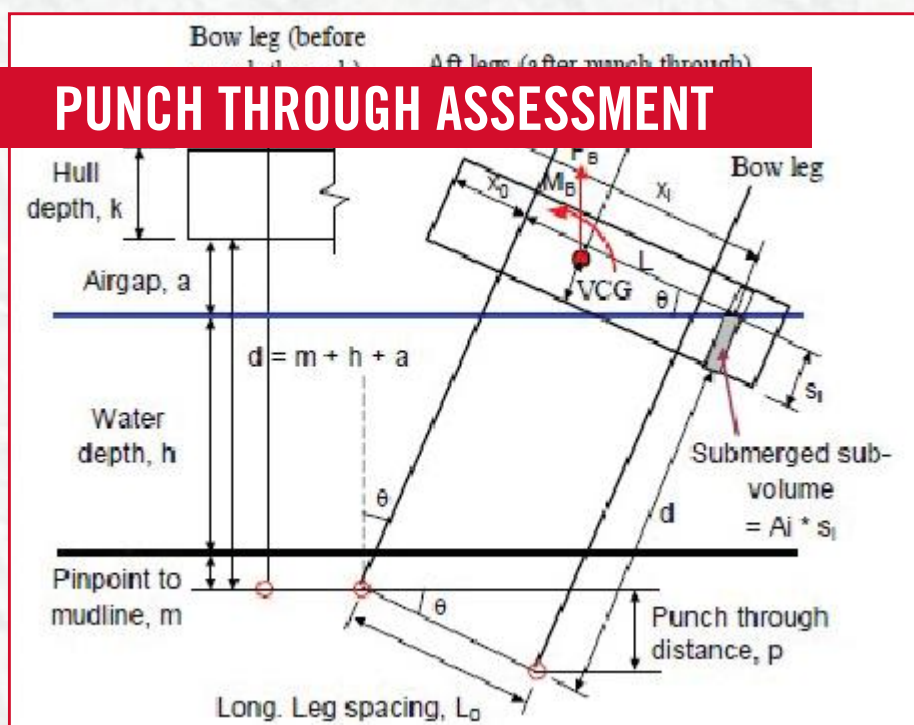
SITE SPECIFIC ASSESSMENT



- **JACK-UP SITE SPECIFIC ASSESSMENT**

Our jack-up team is able to perform jack-up site specific assessment to determine the suitability of the jack-up rig to operate in a particular site. The assessment can be done in accordance to SNAME 5-5A, ISO 19905-1 and/or any specific requirement from Customer. The objective is to assess the suitability of the jack-up in terms of structural and foundation capacities based on the environmental condition, the elevated configuration and the geotechnical condition for a particular site.

PUNCH THROUGH ASSESSMENT



- **LEG PUNCH THROUGH CAPABILITY ASSESSMENT**
- **JACK-UP PRELOADING PROCEDURE**

If potential punch through is identified, our jack-up team is capable to perform leg punch through capability assessment. The objective is to assess the leg strength and the holding system under a simulated punch through condition for a given leg penetration, water depth, air gap/ draft and specific loading condition. This assessment allows the rig owners or operators to clearly understand and assess the potential risks and plan for mitigation in advance when necessary.

Punch through incidents normally occur during preloading operation. If not planned and executed properly, preloading in a punch through potential site may result in damage to the leg structure of the jack-up. Hence, it is important to have a proper plan and preloading strategy especially in a punch through potential site. Our jack-up team is able to recommend a specific preloading procedure specially designed to mitigate the risk of punch through.

GOING ON/OFF LOCATION STUDY



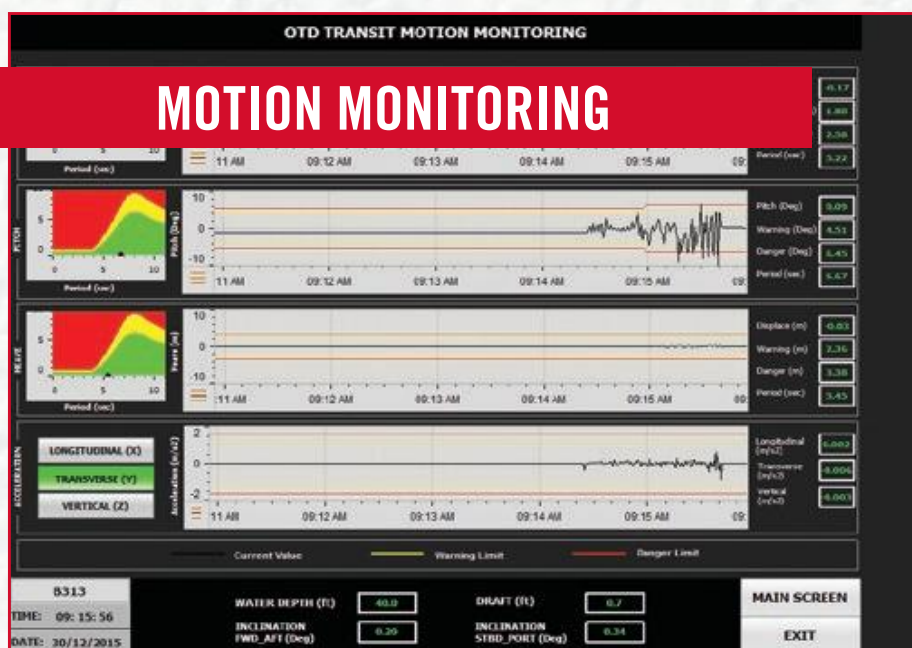
- **MOTION ANALYSIS**
- **LEG TOUCH DOWN ANALYSIS**
- **HULL IN WATER ANALYSIS FOR LEG EXTRACTION**

For rig moves, our team is able to perform motion analysis to calculate the rig natural periods, the response amplitude operators (RAOs), short term & long term extreme responses.

For going on location, our team is able to perform a leg touch-down analysis to determine the allowable motion curve in terms of roll and pitch versus the period.

For going off location, our team is able to perform a hull in water analysis to determine the safe over draft limit in attempt to pull the jack-up leg with consideration of sea state, leg penetration, geotechnical condition, water depth, and specific loading condition.

MOTION MONITORING

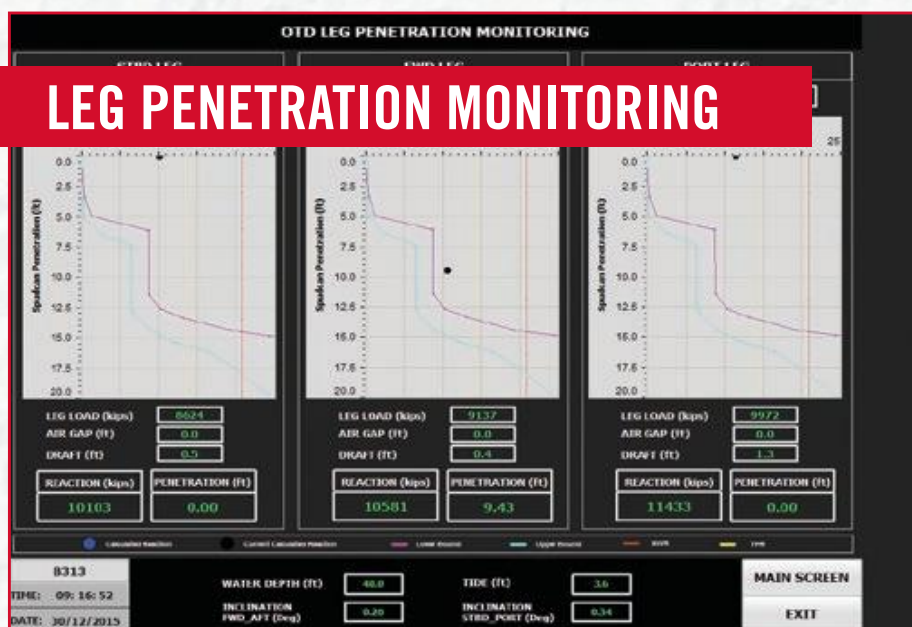


- **MOTION MONITORING SYSTEM**
- **LEG IMPACT MONITORING SYSTEM**

For monitoring of vessel motion during transit operation, OTD offers a motion monitoring software which tracks the real-time information of vessel motion against the maximum allowable limits and alert the operator if needed. In addition, during vessel installation, the software also compute the leg to seabed distance when the legs are approaching the seabed.

The software consist of a central computer which communicates with different sensors through wireless communication. The portability of the system allows the quick installation of the system, which can be shared between different vessels as per required basis.

LEG PENETRATION MONITORING



- **LEG PENETRATION MONITORING SYSTEM**

During preloading operation of the vessel, OTD leg penetration monitoring system monitors the leg reaction on each leg against the leg penetration.

The system utilises air gap sensor and leg length values to determine the penetration on each leg and alert the operator if reaction on any leg is reaching to boundary limits, thereby making the preload operation safer.

INCIDENT SUPPORT



- **RIG RECOVERY**
- **DAMAGE ASSESSMENT**
- **NAVAL ARCHITECTURE & STRUCTURAL ANALYSIS**

In the event that a jack-up suffers from incidents such as punch through or leg damage, we are also capable of providing emergency response and engineering support to assist our Client to deal with such incidents. Our supports and services include on-site deployment for preliminary damage assessment, project coordination, and special structural and NA analyses related to the incident.

TRAININGS



- **JACKING SYSTEM**
- **FIXATION SYSTEM**
- **MONITORING SYSTEM**
- **RACK PHASE DIFFERENCE (RPD) MANAGEMENT**

We provide various systems trainings such as training for Jacking System, Fixation System, and Monitoring System. The trainings materials cover the systems with aspect of operation, installation and maintenance.

In addition, we also provide RPD management training. Some locations may have certain geotechnical conditions such as sloping or uneven seabed, which will cause eccentric loading and induce bending moment to the leg/ hull interface. If not managed properly, the RPD will increase and it may cause some damage in the leg members. Our team can provide RPD training for the rig crew to be equipped with RPD management skills to handle such situation during rig moves.

TECHNICAL SUPPORT



- **PRE-RIG MOVE SYSTEM INSPECTION**
- **ON-SITE OPERATIONAL SUPPORT**
- **OFFICE ENGINEERING SUPPORT**

For pre-rig move system inspection, OTD offers a detail health status check for jacking, fixation and monitoring systems to ensure no fault is present in the system and to avoid downtime during jacking operation. At the end of inspection, a report is submitted which includes the detail findings of inspection together with the recommended components that need to be changed prior to rig move.

As the jacking operation is considered as one of the critical operation during rig installation, OTD offers its expertise in engineering and operational support to assist crew in making decision during jacking operation.



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