ZADCO Extends Life on Major Offshore Complex in the Persian Gulf by Performing Structural Integrity Assessment

Using SACS to Implement a Substructure Modeling and Analysis Methodology
Reduced Costs, Shortened Inspection Times

Reliable Operating Life
Situated in the Persian Gulf about 80 kilometers off the coast of Abu Dhabi, United Arab Emirates, Zakum oil field is one of the world’s largest, most productive oil fields owned and operated by Zakum Development Company (ZADCO) on behalf of Abu Dhabi National Oil Company (ADNOC). The field consists of 450 wells tied to approximately 90 platforms, with Zakum Central Complex as the principal offshore platform accommodating separation facilities, a gas treatment plant, water injection plant, power generation plant, pipeline risers and pigging traps, and associated utilities. A 375-by-46-meter platform, the Zakum Central Complex consists of nine jackets, eight interconnected decks, and three riser support towers.

With jackets installed in 1980 now nearing anticipated operating life, ZADCO initiated a structural integrity assessment for requalification of the aging jackets to extend reliable asset life and to support continued operation of the Zakum offshore facility. As part of the life extension process, ZADCO needed to verify and update models independently generated by different engineering contractors and examine their design level assessments. The project required reviewing current loading data, modifications, metocean data, marine growth profiles, and inspection and corrosion information, and upgrading the models accordingly. Structural analyses using SACS and SACS Collapse were integral to ZADCO’s methodology for assessing and requalifying the jackets, as well as for identifying critical welded nodes and updating risk-based inspection frequency.

Optimizing Subsea Inspections
As part of the life extension process, ZADCO sought to identify critical welded nodes, which are essential for platform integrity, and update the risk ranking and risk-based inspection frequency. The interoperability of Bentley software enabled the project team to simulate various failure scenarios, allowing them to fully understand the behavior of the structural components and rank the criticality of the nodes. Conducting iterative analyses and ultimate strength assessments using SACS and SACS Collapse on the independent jacket models allowed the team to measure structural redundancy and optimize the number of critical subsea nodes for inspection, reducing the number of inspections by 50 percent.

The ability to efficiently explore different strength and mitigation alternatives using Bentley’s offshore structural design and analysis capabilities resulted in significant time and cost savings and improved overall lifecycle asset management for Zakum Central Complex. Prior to the project, 17 nodes per jacket, totaling 153 nodes, were identified as critical and requiring inspection. After performing the life extension assessment, ZADCO identified only 76 joints as...
being critical for inspection, half the original amount. This resulted in reducing inspection durations from 40 to 20 days and cutting costs by USD 165,000 per inspection period.

**Achieving Sustainable Benefits**

Using SACS and SACS Collapse improved design efficiency, required fewer resource hours, reduced costs, and shortened the project schedule. ZADCO achieved a 30 percent reduction in engineering resources, which yielded a cost savings of USD 20,000 per jacket, for a total savings of USD 180,000 for all nine jackets. Bentley software enabled accidental asset damage to be quickly modeled and analyzed to study platform reserve capacity, mitigating risks associated with platform collapse and potential marine pollution. Implementing a proactive maintenance process based on substructure modeling, accurate analysis, and asset criticality extended structural reliability and integrity of the Zakum Central Complex for continued operation and production.

The interoperability of Bentley applications permitted the project team to evaluate multiple ways in which to analyze and determine jacket strength and facilitate risk-based ranking to identify critical nodes for lifecycle asset management. Having advanced structural analysis technology ensures platform robustness and safety of the onboard personnel, and it eliminates costly platform repairs. Compared to conventional methodologies, the availability of separate jacket and deck SACS models enables better model maneuverability for future engineering analyses. The substructure decoupling solution offers sustainable benefits, saving significant time and costs associated with model updating and analysis, and demonstrates the success of this modeling methodology for managing complex mega-structures.