

MEGA CRANE LIFT IN TEXAS CITY

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Abstract

The FCCU 3 unit (Cat 3) was constructed at BP's refinery in Texas City in 1960. The unit can process 120,000 barrels per day and is the refinery's major gasoline producer. In 2006, it was determined that the 401-E Fractionator tower needed to be replaced during the next scheduled "turn around" (TAR) and, consequently, BP and Jacobs started planning for its replacement. This tower measured approximately 25' in diameter, 155' in length and weighed 1,000,000 lbs.

The time required to dismantle the old tower within the unit and then construct the replacement tower in place would significantly extend the TAR duration. To minimize the duration, the tower was fabricated, delivered, placed on a temporary foundation and "dressed out" prior to the TAR.

Cat 3 is surrounded on three sides by other operating units and a Texas City Terminal Railroad Co. easement on the fourth side. This easement also serves as a pipeline right-of way (ROW). Within the ROW are twenty-two pipelines carrying various products, two major fresh water pipelines and ten pipelines that service the refinery. Also, there are two steam pipelines and three propane/butane pipelines located at grade. All pipelines were required to remain in place and in service. This easement was the only feasible location to situate the replacement tower for dress-out and the crane for the heavy lifts.

Lampson International was selected as the lift crane supplier. Placement of the crane in the ROW necessitated a minimum radius of 205' and a boom length of 340' to assure clearance during extraction and insertion of the towers. Engineering calculated the compressive loads on the soils to be approximately 6,000,000 lbs. Lampson provided the initial matting layout and design using simplified assumptions to model the soil/mat interaction. Gaia Environmental obtained over 75 soil borings to evaluate the subsoil stratigraphy. Kenneth Tand and Associates (KETA) performed laboratory tests to evaluate the bearing strength of the subsoils and performed the geotechnical engineering analysis. From this analysis, KETA issued engineering recommendations to improve soil bearing reactions. KETA also performed 3-D finite element analysis as a QA check on Lampson's design of the matting system.

The vessel was fabricated in Channelview and shipped by barge to the Texas City dike. It was transported on a 24 axle transporter through Texas City and set on the temporary foundation using a twin tower gantry lift system. When the bare vessel was placed on the foundation it weighed 600,000 lbs. After dressout which included installing ladders and platforms, piping, electrical (conduit, wire, lighting and

instrumentation), internal structured packing and insulation, its weight had increased to 1,200,000 lbs.

The Lampson crane was field erected on the west end of the ROW over operating pipelines sensitive to differential displacement due to the confined work area. An additional layer of steel mats was provided to protect the fresh water lines directly beneath the crane erection area by reducing differential settlement. Two temporary bridges had to be constructed over the steam and propane pipelines in the main lifting area. Three layers of timber mats were placed on each side of the lines. Steel mats were placed on the timber mats to cross the spans and complete the bridge. At the crane lift location, an additional layer of steel mats was placed on 3 layers of timber mats.

Base line settlement reaction data was obtained by maneuvering the crane along the travel path under “no load” and “loaded” (250,000 lbs) conditions. The concept was to induce settlement before performing the major tower lifts. Deflection and rebound were monitored and differential settlements recorded.

The old 401-E tower was lifted out of the unit on October 22, 2008, and the new tower was set back on the existing foundation 4 days later. BP’s 18 months of planning, and their commitment to safety resulted in replacing the tower without incident. The turn around was completed as planned and the tower operated as designed during and after startup.