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Deployment of Self-Propelled Modular Transporter for Vessel Installation

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Abstract

The traditional way of installing large vessels has always been to employ the use of cranes. The Water Handling Debottlenecking Project team has, instead, made use of a different technology—employing a Self-Propelled Modular Transporter (SPMT) to install nine vessels in situ. These SPMT units have many advantages over crane installations, such as safety and efficiency, not to mention lower costs due to their self-propelled capabilities.

Keywords

Self-Propelled Modular Transporter (SPMT), Transportation, Vessel Transportation, Vessel Installation, Horizontal Vessel

1. Introduction

The traditional use of cranes to install large vessels is becoming increasingly impractical as the size of modern vessels continues to increase. The weight and dimensions of these vessels now require ever larger cranes, which in turn need support cranes to assist in their construction.

It is for this reason that the Water Handling Debottlenecking Project team made use of a different technology to install 9 large vessels—Self-Propelled Modular Trailers (SPMTs). These trailers have many advantages over crane installations, such as safety and efficiency. SPMTs have also been proven to be much cheaper, thanks to their self-propelled capabilities.

The installation process begins by positioning the SPMT unit next to the vessel. The trailer is then hydraulically lifted and placed over the vessel. Once in position, the legs of the trailer are lowered down to the ground, securing it in place. Next, the hydraulic jacks are engaged, lifting the vessel and placing it on top of the trailer. Finally, the straps are tightened down, securing the vessel in place.

The entire process is comparatively speedy and significantly safer. There is no need for large cranes, which can be dangerous and cumbersome. The SPMT units are also much more efficient, and capable of moving around independently without any help from cranes or other equipment. This allows for a much quicker installation, saving time and money.

2. Crane Logistics

The logistics of moving a vessel that can be as much as 60 m long with a diameter of 8m and weighing more than 200 tons can be, at times, overwhelming. In the past, cranes have been used for heavy equipment installation, and a strong foundation is required before a crane of this size can even be used [1].

Typically, we have employed crane mats-steel or wood plates weighing several tons each, that must be prepared before the crane arrives at the job site. It can take several days for the crane components to arrive and be prepared for assembly before the dirty work can begin. Refer to **Figure 1**.

One of the major ironies of using a large crane for vessel installation is the need for a second crane to be onsite to construct the larger crane. The assembly of a large crane on site takes a minimum of five days under ideal conditions. Wind and other weather conditions can create situations where the preparation cannot continue [2]. Inspections and subsequent approvals are required, which can add a further three weeks before being able to lift and install the vessel.

3. Site Challenges

Large cranes require significant real estate. There must be adequate space to install the crane and allow clearance for the counterweights during rotation. Safety is always the highest priority for Saudi Aramco Project Management Team (SAPMT). The use of any large crane, particularly in a brownfield site (existing facility), requires a lift and a rotation [3]. The time the vessel is suspended in the

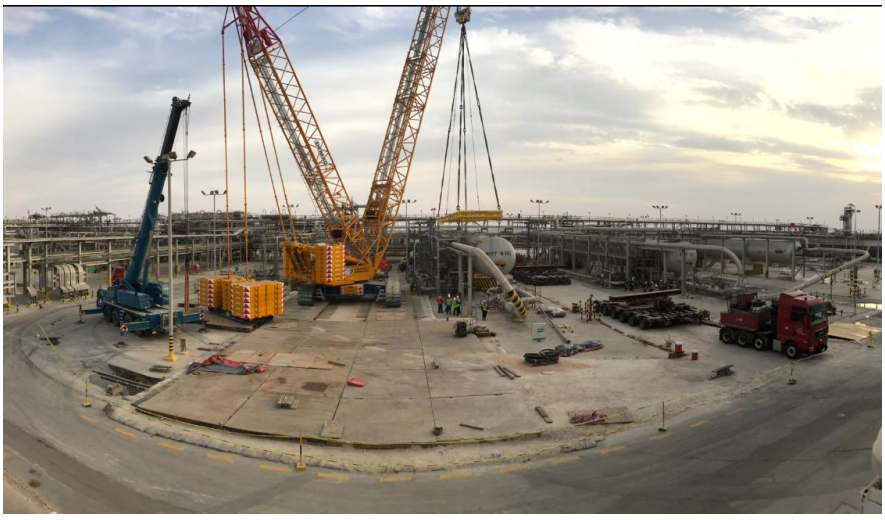

Figure 1. Conventional crane installation at a brownfield location.

air can create additional safety concerns.

It is not uncommon for clients to expect solutions to be deployed in relatively short time frames or to require multiple large vessels to be installed at active facilities. Considering the extensive efforts and risks of using a typical crane, SAPMT sought to develop a safe and suitable alternative that could mitigate the risk and enhance the installation process.

4. Introducing the SPMT

Our project had an installation requirement similar to those laid out above—multiple large vessels were needed at active operating facilities. The answer was the use of a Self-Propelled Modular Transporter, a platform vehicle with an extensive array of wheels. SPMTs are used to move gigantic things such as giant bridge sections, oil refinery equipment and even complete oil platforms, cranes, motors, spacecraft, and even superyachts. Refer to Figure 2.

A typical SPMT has a grid of computer-controlled axles. As these vehicles are modular, they can frequently be in a train of over 28 axles long. In addition, for exceptionally long projects, multiple vehicles can operate side by side or one behind the other with perfect computer control. Each axle is individually controllable and can swivel through 270˚. A control system coordinates the axles to allow the SPMT to turn, move sideways, or even rotate in place. This gives the SPMT great agility. In addition to moving horizontally, an SPMT can also move vertically. While the vertical stroke is limited, the lifting envelope is typically more than sufficient when installing a horizontal vessel.

SAPMT implemented the Self-Propelled Modular Transporter to bring several

Figure 2. Vessels onboard an SPMT being transported through an operating facility.

significant benefits to the table. First and foremost, the SPMT is a significantly safer method of installation. The SPMT can be rapidly deployed and later driven off-site, reducing the preparation time for installing the vessels from three weeks to a mere two days. Its subsequent removal saves a further two weeks onsite, as the necessary time is reduced to a single day. Finally, deploying the SPMT saves around 50% of the costs usually associated with a traditional crane installation.

5. Clear Benefits

For the project, the benefits were clear. The SPMT requires no onsite assembly and minimal special surface preparation. The vessel is secured to the SPMT and driven to the installation site. Only a short time is required to reconfigure the SPMT to allow it to slip sideways in between the two foundations' saddles. Once complete, the vessel is lifted, positioned between the foundations, and lowered onto the base. The whole operation can be done in a single shift, from start to finish. Saudi Services for Electrical Mechanical, the construction contractor's Project Manager, stated: "We can do in a day what other contractors take weeks to do."

As the SPMT can move between the existing foundations, there is no time when the vessel is suspended in the air, thus eliminating many of the key safety concerns of crane lift installation, such as the threat of high winds disrupting the process or putting personnel and equipment at risk.

One of SAPMT's biggest advocates of the SPMT is the plant foreman of Hawiyah GOSP-4, Mr. Hussain Al-Zahrani, who said: "I am fortunate enough to have witnessed the installation of pressure vessels in both the conventional crane method and with the SPMT. It is safe to say that the SPMT surpasses the crane installation in terms of safety in several aspects. For instance, the components that are used to build the crane are large to the degree that several access points in the GOSP are blocked until the crane is assembled. Moreover, the time needed to ensure installation readiness is a fraction of the time required to build the crane. In addition, the installation through a crane requires exponentially higher manpower, especially while the crane is suspended mid-air to guarantee successful installation."

Naturally, the site logistics and constraints vary from project to project, but where it is possible to make use of an SPMT, it has been proven to be a safe and efficient method for installing large horizontal vessels, eliminating hazards, reducing costs, and improving the required timings needed to complete the project when compared with using a conventional crane [4]. SAPMT will continue to implement SPMT options wherever the opportunity arises.

6. Conclusion

Deploying SPMT accrues a wide range of advantages over traditional techniques of installing large vessels. Moving gigantic vessels can be a challenging exercise for transporters, especially due to the complexities that come with crane logis-

tics, taking several days to arrive and assemble. Sometimes large crane installations require a second crane for installation, necessitating additional approvals. Large cranes further require significant physical space, complicating site challenges. SPMT, as an emerging technique, combats most of these problems. SPMT utilizes computer-controlled axles, allowing easier control, swivelling, and coordination. SPMT can further move vertically, and horizontally, rotate sufficiently to install horizontal vessels. SAPMT advocates for SPMT as it does not require onsite assembly, which eliminates key safety concerns, saves time, has lower manpower requirements, and is cost-efficient. Although every project is different due to site logistics and constraints, SPMT promises greater benefits than cranes and other traditional techniques.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Sohn, H.W., Hong, W.K., Lee, D., Lim, C., Wang, X. and Kim, S. (2014) Optimum Tower Crane Selection and Supporting Design Management. *International Journal of Advanced Robotic Systems*, **11**, No. 8. https://doi.org/10.5772/58438

[2] Larsson, R. and Rudberg, M. (2019) Impact of Weather Conditions on in-Situ Concrete Wall Operations Using a Simulation-Based Approach. *Journal of Construction Engineering and Management*, **145**, 1-22. https://doi.org/10.1061/(asce)co.1943-7862.0001662

[3] Shapira, A. and Ben-David, A. (2017) Characteristics of Equipment Planning for Multi-Crane Building Construction Sites. *Buildings*, **7**, Article 81. https://doi.org/10.3390/buildings7030081

[4] Tack, M. and Nedlift, W. (2021). Best Practice Guide for Self-Propelled Modular Transporters. ESTA Europe Since 1976. https://estaeurope.eu/wp-content/uploads/2021/07/ESTA-BPG-SPMT-UK.pdf