Rubber-Tired Gantry Cranes for Bridge Construction

From precast concrete production facilities to bridge construction sites, gantry cranes are routinely used to perform the heavy lifting

by Monica Schultes

The first thing you see on many jobsites is the boom of a crane. Cranes have been used throughout the history of construction, and a wide variety are used on today's projects, each handling a specific task. The sheer variety of crane types, each with its own advantages and disadvantages, makes it challenging to select the right machine. Each project is unique and may require a combination of different types of equipment.

Picking the right crane for a bridge project involves understanding the jobsite, the surrounding terrain, and the weight and length of the materials or components to be handled. Weather conditions, as well as project schedule and duration, also come into play. Project teams therefore consider which types of cranes to select and how many will be needed from the earliest planning stage. Replacing a bridge while minimizing the project's impact on both the surroundings and the traveling public necessitates creative thinking. The rubber-tired gantry crane, often referred to as an RTG, is a unique combination of an overhead lifting device and a mobile crane, making it a good fit for tight sites. The big differences between a gantry crane and a boom or counterbalance device are the gantry crane's stable platform and its minimal space requirements.

Rubber-tired gantries are popular with precast concrete fabricators for work at precasting facilities. They have also become popular with contractors, who use them to erect bridge beams and to move and install deck panels and other components on the construction site.

"Although Mi-Jack Travelift rubber-tired gantry cranes may not replace all types of cranes nor service every project," says Jerry Studer, Southeast regional sales manager for MI Jack Products' Travelift division. "They do offer material handling versatility that some contractors may not have considered."

Limited Space

Where space is limited, such as an infill project where a new structure is placed in the gap between two parallel bridge decks, RTGs come into their own. An RTG can be driven with two legs on each of the existing structures or roadways, straddling the gap to be filled (**Fig. 1**).

In some cases, such as high-traffic areas, departments of transportation specify the use of RTGs to avoid lane closures.

The RTGs require a limited drive aisle to operate, typically a 5-ft runway on each side (**Fig. 2**). They can be used for many facets of the job that require only

Figure 1. With the ability to straddle the gap between the existing structures, a rubber-tired gantry crane allowed work to progress on the Interstate 65 bridge over the Alabama River without lane closures. It also eliminated the need to transport cranes to other areas of the project. All Photos: Mi-Jack Products.

Figure 2. The rubber-tired gantry crane requires just 5 ft of aisle way on either side to handle loads.

a narrow lane for crane access and where the entire work envelope is underneath the gantry.

Some RTGs have a 16-wheel design to reduce ground load pressure over the traditional 8-wheel design. While rubber tires are most frequently used because of their cost, mobility, and flexibility advantages, some projects dictate the use of gantry cranes with rail wheels.

A gantry fitted on a rail system could be used to distribute the load to a specific area or where transporting materials is limited to certain fixed dimensions. In a situation with extremely narrow access, stationary rails are appropriate. However, as GPS steering technology has become more accurate, it has replaced the need for rails in some applications.

Figure 3. For the widening of Interstate 75 in Fort Myers, Fla., a gantry or straddle crane was the only solution. RTGs with clear spans of 84 ft cleared the median gap between the existing twin-span bridges. Two gantry cranes controlled by GPS, each having one set of tires on the west span and the other on the east span, minimized lane closures and lessened environmental encroachments.

Caloosahatchee River Project

For certain projects such as the widening of Interstate 75 (I-75) in Fort Myers, Fla., a gantry or straddle crane is the only solution. Two RTGs with clear spans of 84 ft were able to span the median gap between the existing twin-span bridges (**Fig. 3**). The operators tried to steer the large cranes themselves, but they had a difficult time keeping the cranes on the allocated path because the bridge had a slight continuous curve. The solution was an auto-steering system based on GPS technology that guided the twin RTGs so the operators could concentrate exclusively on maneuvering the loads into position. Use of the GPS system is growing, and has taken the place of corrective steering and rail systems in some situations. While keeping the crane on the straight and narrow is a challenge, automated self-centering technology to avoid overcorrections has also progressed. Using the GPS system for the Caloosahatchee River project made the large machines easy to direct and kept the cranes from bumping into barrier walls, allowing the operators to concentrate on their picks as well as other conditions. The GPS steering guided the cranes through the new bridge's 1-degree horizontal curve and up and down the 3.5% slope, as well as delivering materials 50 ft below the bridge deck.

Tandem Lifts

RTG capacity ranges from 30 to 300 tons. "We haven't met a beam we can't lift," says Studer. Although a single RTG may be able to lift a large beam, tandem lifts are becoming more popular because they distribute the load of both the beam and gantry over more wheels and a larger area, often providing a more practical and economical solution (**Fig. 4**). "Tandem lifting with two Travelifts can be more practical than one larger crane with heavier capacity," says Studer.

Tandem lifts may seem more challenging, but the RTG setup and rigging is forgiving if, for instance, one operator is driving

Figure 4. Expanding the lanes of an interstate bridge that services thousands of cars per day poses right-of-way and traffic flow challenges. Gantry cranes can provide a practical and economical solution where access is limited.

slightly faster than the other. There is additional leeway in the rigging to allow time to avoid a critical situation.

Tandem lifting has been around in precast concrete yards for decades. On a jobsite, the bridge layout is often straight or on a slight curve, making the tandem pick easy to achieve.

Handling an extremely long beam with one RTG typically requires a large spreader bar nearly the length of the beam, which adds a significant amount of weight and cost. In that case, the solution that makes the most sense is a tandem lift. Two smaller spreader bars also make twisting or bending of the long beam less likely during handling.

Plan Your Lift

When the crane supplier gets involved early in a project to assist contractors, estimators, and engineers, they can recommend the correct crane size and type and provide wheel loads depending on the beam weights that need to be lifted. There are three critical dimensions required when specifying an RTG: the inside clear width (span), hook height, and wheelbase. Because those dimensions are project specific, RTGs are usually custom built. Boom-type cranes typically require a counterbalance machine with weights or outriggers. A boom-type machine takes up a lot of space, and the farther it has to reach, the less weight it can lift. In contrast, a gantry crane can always lift and travel with its maximum capacity. Lifting a 100-ft-long bridge beam and positioning it might require a 250- to 300-ton boom crane, as opposed to a 50- to 70-ton RTG.

There is often a mix-and-match approach to crane selection, because gantry cranes can't do it all. For example, other equipment is still needed to drive piles and perform some of the foundation work.

RTGs were first used in the bridge market in the late 1990s to place heavy bridge beams. Recognized for their functionality and versatility, now they are the workhorses shuttling materials around the jobsite. "You could use an RTG that is one-third the size of a boom crane to reach across the site. It all comes down to the job, the site specifics, and the budget," Studer says.

Contractors want to be as cost competitive as possible and use their own fleet first. When acquiring new assets, they often look at what they have used in the past. More contractors are becoming comfortable with RTGs. Minimizing lane closures might be the initial reason, but eliminating the time and trouble to reposition a large boom crane is an added bonus.

Setup and Operation

While a small, 25-ton, rough-terrain crane can be hauled on one truck and quickly assembled, most projects require larger cranes that take multiple loads and several days to set up. Transporting an RTG requires between three and six trailers. For most projects, the components arrive on Monday and by Friday the cranes are up and ready to go. Because there are almost always boom-type cranes on site for other purposes, they can assist with the assembly of the RTGs.

There was a time when operators trained on load charts, but now electronic instrumentation has automated the use of such information for operators. For gantries, operators don't have to worry about outriggers, tail swing, and boom radius, which simplifies the ability to operate them and eases the requirements.

Even though the machines look big and bulky, 90-degree rear-pivot steering is standard. Like forklifts, RTGs can pivot on a zero inside-turning radius, and lead-wheel steering allows the operator to drive sideways, spin like a carousel, crab steer on an angle, or pivot steer.

Conclusion

While gantry cranes will likely never completely replace standard crawler or boom cranes, they can be another tool in the general contractor's toolbox. Gantry crane technology is improving, making it possible to deliver safer, faster, and more efficient cranes. RTGs are a common sight at prestressed concrete facilities and are being used with increasing frequency on bridge construction sites.

EDITOR'S NOTE

The ASPIRE® *team has published multiple articles covering jobsite techniques for accelerated bridge construction (ABC). This article is based on an interview with a supplier of a technology that is being more frequently used in ABC. Another example is the Creative Concrete Construction article on self-propelled modular transporter–gantries used to install girders for a project in Mississippi in the Summer 2021 issue of* ASPIRE*. The team invites other construction industry experts to share relevant jobsite topics like this with our readers.*