Integrating Crane and Project 3D Models to Analyze Lifts and Speed Schedule

This innovation was developed for, and used on, the Brandon Shores AQCS (Air Quality Control System) Project performed in Baltimore by URS for Constellation Energy at the Brandon Shores power plant. Total project value was $850 million for two coal-fired generating units, 1400 MW total. Regulatory requirements dictated a 31-month schedule from start of construction to units becoming operational to avoid severe financial penalties for Constellation. This is one of the shortest durations for any project of this type, and may be the shortest schedule for one of this size. As a result, schedule was critical. The innovation was developed to speed construction.

The innovation consisted of developing an animation of the two most critical lifts of the project: the "top hat" covers of the AQCS absorber vessels. The model information was integrated from several sources:

- Project 3D model developed by URS engineers using Microstation PDS software
- 3D model of a Manitowoc 18000 crane from Lift Planner and integrated into the model by URS
- Modeling of the crane boom and jib configuration by URS using Lift Planner software in AutoCad 2008, from information provided by URS's construction superintendent
- Details of the lift plan developed by URS's design coordinator
- Details of the rigging configuration provided by the absorber vessel supplier

From these sources, URS developed an animation using Autodesk 3dsmax of both lifts from beginning of lift, walking the crane through 1000 feet of congested area, and final setting of the "top hat" including boom and load adjustments that needed to be done en route. This innovation allowed a different construction sequence to be used that saved several months from the original construction method and schedule that had been developed by the absorber supplier. This is explained in more detail below.

Critical to the achievement of the project schedule was completion of the work in an area that was logistically challenging because of all the work that needed to be done by different contractors. This area included a new chimney, two absorber vessels, four 6000 HP booster fans with connecting ductwork, along with above-ground utility racks. The absorber vessels were under construction by one contractor, the chimney by a second, and the booster fans; ductwork and utility racks were URS work. Safety exclusion zones were in place around both absorbers within which work could not be performed. The "top hats" were large (70' diameter, 35' high) fiberglass structures that needed to be fabricated at the site by the absorber supplier. Their standard construction method was to fabricate the "top hats" at the base of each absorber vessel. This construction method would have delayed the critical path by months, by preventing other work from getting done in the same area.

The only way to meet the project schedule as dictated by regulatory requirement was to assemble the "top hats" remotely (1000 feet away from the absorbers) and move them in one piece after assembly. Since structures would already be assembled on the ground with this revised plan, the "top hats" could not be moved at ground level. This required transporting the "top hats" from the assembly area to the absorbers using the largest crane on site: a Manitowoc 18000. The revised plan was for the crane to walk with the assembled top hats raised high enough to clear all structures and then place them on the absorbers. The avenue the crane had to maneuver through to reach the absorbers had above-ground cable tray carrying live high voltage cable on one side, and a compressor building, fabric filters, ductwork and booster fans on the other side. Construction supervision did not think the lift could be made, and the innovation was developed to determine how it could be done.

Ultimately the animation developed by URS showed that the Manitowoc 18000 (which is a very large lattice-boom crane) could maneuver to perform both lifts, but that a hydraulic skid for one of the booster fans had to be left out and that columns supporting the utility racks had to be left out as well. A temporary support plan for the racks was worked out. The lifting animation was used to train all individuals and operators associated with the lift, and ultimately the lift was successfully implemented as animated. URS was able to maintain the project schedule, and all project milestones were met or beaten.