

ABSTRACT

Design for Waste Reduction and Efficiency Improvement for the Construction Usage of the Tower Crane

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Webcor Concrete Group's on-site tower crane is currently experiencing unknown forms of inefficiency. The project team used the DMAIC methodology to implement Define, Measure, Analyze, Improve, and Control in order to guide and structure the project. After the project team formulated a problem statement, observations were collected of tower crane deliveries resulting in 470 individual data points. The data was then analyzed using basic statistics, histograms, and lean manufacturing tools in order to identify wastes and inefficiencies. Once the wastes and inefficiencies were identified, root cause analysis was performed. The identified root causes were then used as the basis for improving the current state of the project with design alternatives. Many designs were considered but only 3 were developed to the point where they could be tested. These designs were 5D BIM modeling, the allocation of additional resources in the form of additional carpenters, and kanban spaces with 6s designed to streamline the material delivery process of the tower crane. The three designs were tested using a simulation model producing varying levels of improvement to the 10 day cycle. An economic justification was conducted which showed that kanban spaces was most cost effective. Using the information that the project team learned analyzing and testing the designs along with criteria defined by Webcor, a multi-criteria decision analysis matrix was created to determine the most appropriate design when taking into account Webcor's priorities. The matrix found kanban spaces to be the best design with do nothing being the next best alternative. Through simulation of the kanban spaces, throughput was increased by 8%. It is the formal recommendation of the project team to further pursue the design solution of kanban spaces as it is cost effective keeps Webcor's highest priorities in mind, and eliminates waste identified in the tower crane's operations.

Key Words: waste reduction, tower crane, efficiency, lean, just-in-time