Integrating BIM and ABS for Multi-Cranes Operation Planning through Enabling Safe Concurrent Operations

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ABSTRACT

The planning of tower crane layout and operation is a difficult task. Improper planning can pose significant problems at large construction sites, especially those in which multiple cranes operate with complex interactions. While past research has made significant progress toward the layout planning of multiple tower cranes, relatively insufficient focus has been placed on crane operation planning. In fact, many projects involving multiple cranes suffer from limited flexibility imposed by a site's spatial constraints, requiring further investigation on the operation planning of cranes beyond layout development. In response, this research develops a method of daily operation planning with multiple cranes, by integrating two simulation technologies, i.e., agent-based simulation (ABS) and building information modeling (BIM). This method explores the concurrent and alternative operational options of multiple cranes which might sacrifice execution time of individual tasks but improves overall multi-crane operational performance. Using an actual construction project, computer simulations are conducted, and the results are compared with a commonly used method based on minimized individual task execution times. The results of the case study indicate that the developed method is able to improve the overall schedule time of multi-crane operations, with an average of 9.63% improvement in overall operation time.