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Design

Several researchers have noted the importance of construction monitoring to project success (Bosché 2010; Navon and Sacks 2007). Multivista (2015) defines monitoring in the construction context as “ an ongoing process that stakeholders use to verify conditions on site during the construction process, and requires constant documentation of the project.

” Unfortunately, most construction monitoring efforts have been noted to require a high level of manual involvement in the collection, synthesis, and processing of data, which apart from being time and labor intensive (Golparvar-Fard et al. 2009; Navon and Sacks 2007), often yield actionable insight for decision makers only after costly delays. Recent research efforts have sought to remedy this situation through technological means such as the use of vision-based techniques enabled by the ubiquity of digital cameras (Golparvar-Fard et al.

2015; Abeid et al. 2003), laser scanning to track progress and for quality control of the built environment (Bosché 2010; Akinci et al. 2006), and the use of radio-frequency identification (RFIDs) and other sensors (Cheng and Teizer 2013). Several commercial vendors and original equipment manufacturers are also offering telematics solutions to measure and store equipment-centric data collected from onboard instrumentation (OBI) (e.

g., Earthwave Technologies 2016; Caterpillar 2016). While successes in the aforementioned technologies have been achieved in enabling a degree of automation in the monitoring of operations or handling of equipment-centric sensor data (in the case of telematics), the nature of the technologies does not lend themselves to the authors’ stated objectives of providing realtime

operation-centric information applicable to a variety of construction processes. For instance, vision techniques and laser scanning involve processing time for registration and occlusion handling, and sensor and OBI data on their own provide isolated information about a specific part of the operation or equipment that needs to be further synthesized and analyzed to be given operational context. Real-time awareness and generality of application are thus the prime objectives of the authors' developed methodology, which itself relies on providing sensor data with operational context through synergy with the models of the construction operations.

The remainder of this literature review will describe the use of DES in construction along with the most recent research efforts to ensure DES model validity through the evolving construction project. This paper presents a methodology for real-time monitoring of construction operations by using the growing availability of sensors on the construction site along with the tools of an advanced modeling technique, specifically, that developed for discrete event simulation (DES), which has been identified to be the most appropriate tool for modeling construction operations (Martinez and Ioannou 1999).