



ICMPC 2017

# Material delivery problems in construction projects: A possible solution

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## Abstract

Emerging project management methods for construction projects create new kinds of challenges for the delivery process of materials. The main motive behind introducing such methods is to create short-term schedules, based on a constraint analysis of resources. This approach has two requirements for material deliveries: transparency of material availability and short response times in the supply chain. We propose a potential solution for managing the material logistics of construction projects. The empirically validated solution proposes a shipment tracking-based approach to provide inventory transparency, and a pro-active delivery approach for efficient material deliveries.

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Selection and/or Peer-review under responsibility of 7th International Conference of Materials Processing and Characterization.

*Keywords:* project management; literature review; material delivery solution

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## 1. Introduction

New project management methods that address the shortcomings of traditional methods by adding flexibility to the execution of construction projects, create additional challenges to material delivery processes (e.g. Ballard, 2000; Choo et al., 1999; Chua and Shen, 2001; Koskela and Howell, 2002). The new methods acknowledge the challenge of creating an exact schedule beforehand for a large, complex project. Instead, such methods use continuous planning on a single construction task level. The basic philosophy underpinning the methods is to create short-term schedules for project tasks based on a constraint analysis of project resources.

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Such an approach places two requirements for the material deliveries: the analysis of material constraints requires transparency of material availability for site inventories and other stages of the supply chain, and the short time-span of planning demands short response times along the supply chain. The aim of this paper is to present a potential solution for managing the material logistics of construction projects. The solution consists of a shipment tracking-based approach to provide inventory transparency, and a pro-active material delivery approach for timely material availability. In the first section, we will review literature related to the new project management methods and the implications for material replenishments of construction projects. In the second section, we present our research problem and discuss our research design. The proposed solution for material replenishments of construction projects is presented in the third section; with the final section proffering concluding remarks and direction for further research.

## **2. Literature review**

### **2.1. Challenges in prevalent project management**

The prevalent project management methods have recently been stated as inadequate for controlling the progress of construction projects (e.g. Ballard, 2000; Choo et al., 1999; Chua and Shen, 2001; Koskela and Howell, 2002). Some of the strongest opinion has been presented by Koskela and Howell (2001, 2002) in their argument that the underlying theory of project management is obsolete and that no explicitly stated theory exists on project management. Their main objection is that planning, execution, and control are not utilised in practice as suggested by PMBOK Guide of Project Management Institute. In a similar vein, Johnston and Brennan (1996) have argued that an embracing interpretation of project management is “management-as-planning”, based on a strong causal connection between generating a plan and the resulting operational activity. They conclude that such a straightforward coupling is not feasible, since no plan can ever be detailed enough to enable the mere execution without feedback from the environment. Koskela and Howell (2002) note that reliance on a general plan leads to poor short-term planning. These observations are confirmed, for example, in a study of six construction projects sited in the United Kingdom and Brazil (Santos et al., 2002). Koskela and Howell (2002) recognise that maintaining a comprehensive up-to-date plan is problematic. Therefore, due to an out-of-date plan, the tasks pushed to execution cannot often be performed as they lack either predecessor tasks or other inputs. As Johnston and Brennan (1996, p. 382) state, “That this approach works at all is largely attributable to tacit knowledge and improvisation at the operational level”. From the point of view of the supply chain, however, this management approach and last-minute improvisation, leads to inefficient practices to guard against material shortages. Materials are often ordered either very late; invariably leaving the supplier with uncertain demand and high material buffers to guarantee service level; or too early leading to buffering at the site (Vrijhoef and Koskela, 2000). There has been a clear need for a more interactive management method, where the subsequent steps to be taken in a construction project, are determined from the current status of the project, not from predefined and outdated schedules which are obsolete for controlling practical actions. To overcome the challenges of traditional project management, flexible project management practices have been developed (e.g. Ballard, 2000; Chua and Shen, 2001). In the following, we review the Last Planner System of Ballard (2000) as an example of such approaches. The Last Planner System has been used in the production control of construction projects in the United States (Ballard, 2000), Brasilia (Conte, 2002; Soares et al., 2002), Chile (Alarco´ n et al., 2002), Ecuador (Fiallo and Revelo, 2002), Peru (Ballard and Howell, 2003), the United Kingdom (Townsend et al., 1999), Denmark (Bertelsen and Koskela, 2002), and Finland (Koskela and Koskenvesa, 2003).

## **3. Research problem and solution design**

Based on the identified management challenges in material flow, the following research problem is proffered: How to develop an effective material delivery model for construction projects with near-term task-level scheduling? The literature identified that specific requirements were required for any solution; hence two more detailed research questions were developed: (RQ1) How to gather and convey material availability information to project task scheduling? (RQ2) How to organise efficient material deliveries for projects with near-term scheduling? The methodology used in the research is based on the “Innovation Action Research (IAR)” approach (Kaplan, 1998). The aim in IAR is to initially document major limitations in contemporary practice, identify a new concept to overcome the limitation, and to continually develop the concept through publication, teaching and active

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