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Study of Various Automated Construction Materials Tracking Technology

Saurabh Badjate[1], Pranay Khare[2]
1 P.G. Student, Division of construction management engineering, DYPSOET Pune, Maharashtra, India1
2 Professor, Division of Civil engineering, DYPSOET Pune, Maharashtra, India2

Abstract:Inventory is important especially in construction project as the proper amount of inventory will ensure that all construction activities will be able to carry out according to the planned schedules. Inadequate amount of inventory will result in job stoppage due to materials required for conducting the work could not be specified at time they are needed, waste of labour working hours, and schedule delays. Construction materials constitute a large portion of the total cost in construction projects. It may account for 50-60% of the total project cost. As the cost of materials is important, the management of materials especially at the inventory level are crucial for the successful project completion. The tracking and locating of materials in construction jobsites has increase a great concern among construction entities. The on-site materials tracking and locating are made complicated by the use of traditional tracking process which is labor intensive, error-prone, not reliable and contribute to the increase in construction costs. Thus, this paper provides a review of the existing issues in material tracking of inventory management process in huge construction projects. The findings reveal that there is a need for more proper technology to be implemented in construction project in order to facilitate materials tracking process and at the same time, reduce dependency on paper work reports in inventory management.

Keywords:*material tracking, Inventory management,construction projects.*

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1. BACKGROUND:

The Construction Industry Institute (CII) (CII 1986) has defined materials management as "the planning and controlling of all necessary efforts to insure that the correctquality and quantity of materials and equipment are appropriately specified in a timely manner, are obtained at a reasonable cost, and are available when needed." Materials management is a system, not the organization responsible for performing these tasks (The Business Roundtable 1982). Construction materials management has also been recognized to include the integrated coordination of materials takeoff, purchasing, expediting, receiving, warehousing and distribution (Bell and Stukhart 1986). It is an indispensable part of the project management which can be integrated with engineering to provide an end product that meets the client's requirements and is cost effective (Kini 1999). Materials management extends beyond inventory management. It involves: the procurement of equipment and materials, inspection and delivery to the job site, inventory control and the disposal of surplus material at the time of project completion (Silver 1988).

Materials inventory management is important as materials constitute a large amount in construction costs (Lu et al., 2011). This is because the poor inventory management can affect not only to the increase in costs, but also contribute to schedule and project delays. For large construction projects, the good management and control over inventory is important. It is to ensure that the right quantity and quality of materials and equipment's to be easily specified in a timely manner, obtained at reasonable cost and are available when needed (Bell &Stukhart, 1987). Inventory management in construction project could be affected by several factors such as; inadequate storage space (Sardroud, 2012), over ordering and double handling (Donyavi& Flanagan, 2009); and incomplete and lack of up-to-date information regarding on-site stock (Navon&Berkovich, 2006). The lack and incomplete of up-to-date information regarding on-site stock is caused by the poor tracking and locating of materials in construction sites. Thus, there is a need for a proper inventory management in order for the materials to be tracked and located easily; and without employing additional costs. Tracking of materials and components in construction project is not an easy task. Navon&Berkovich (2006) agreed that materials tracking still remain as a big problem in construction jobsites. The difficulty in tracking over materials and components is contributed by the large amounts of materials and components involved in the development process. Besides that, an on-site material tracking is also bound with the traditional-manual method (El-Gahzali et al., 2011; Kasim, 2010; Jang &Skibniewski, 2008; Navon&Berkovich, 2006), which has several limitations. This limitations has make them unsuitable to be use in construction projects which demand a prompt action primarily in decision making process.

Following are various automated technology used for construction material tracking:

Bar code:A typical bar coding system consists of some hardware, software and certain infrastructure which may be wired or wireless to connect the hardware to the database that stores and analyzes the data collected by the system. The hardware system basically consists of the bar code scanner and the computer. Figure 3 shows bar coding system hardware components. A basic bar code scanner consists of a scanner, a decoder, and a cable which connects the decoder to the computer. There are different types of scanners; however, the most useful are the laser scanners. Some of the scanners have the decoder function incorporated into a chip within the scanner, thus eliminating the need for a separate piece of hardware.

GPS: The Global Positioning System (GPS) is a satellite-based navigation system formed by a network of 24 satellites placed into the orbit by the U.S. Department of Defense. The GPS was originally meant for military applications, but in the 1980s the government allowed civilian use of the system. Since then it is used extensively for a number of civilian purposes on land, at sea and in the air. Basically the GPS helps to record locations from places on the earth and helps in navigating to and from those locations (Garmin 2008). GPS is used in the air industry for navigation by general aviation and commercial aircraft; at sea it is mostly used for navigation by recreational boaters. The land-based applications of GPS are more diverse. Surveyors use GPS for much of their work, because it provides excellent accuracy

and radical cost savings by reducing the setup time at the survey site

RFID:Stand-alone radio frequency identification (RFID), like bar coding, is also an automated data collection (ADC)technology. The term "stand-alone RFID" is used to distinguish this technology from that prototyped on the projects described in this thesis. RFID is a generic term used for technologies that use radio waves to automatically identify, locate, or track objects or assets and people. The most common method of identification is to store a serial number that identifies a person or object, and other information on an RFID transponder or an RFID tag. The RFID tag transmits the identification information to a reader. The reader converts the radio waves reflected back from the RFID tag into digital information that is then passed on to computers which make use of it and process the data

II. Research Objectives:

1. To Study different automated construction materials tracking technology.
2.To Do a field trial on large residential or commercial project.
3. To identify and discuss integration issues with project information technology
4. Explore integration issues of automated materials tracking with the supply chain management process of the construction industry.

III. Research Methodology:

To achieve the above research objectives in the context of two large evolving field trials, an iterative progression through the following steps was followed:

1. Comprehensively review the existing literature on materials management and automated materials tracking and locating.
2. Conduct field trials on two large industrial projects, on one of which the author was present for a significant amount of time.
3. Define the various terms, technologies, and deployment architectures involved in materials management, and automated materials tracking and locating.
4. Define the processes and functions for materials tracking such as receiving, invoicing, requesting (informing), locating, issuing and organizing space, etc.
5. Analyse the different available automated materials tracking technologies in terms of their suitability for materials tracking under different circumstances.
6. Synthesize and analyse the field trials data and the literature review.
7. Developan implementation process for automated materials tracking for key materials and for large construction projects, based on preceding seminar and analysis.

IV. CONCLUSIONS:

The automated materials tracking system was found feasible through RFID and Barcode and can be successfully applied on future construction projects.
The integrated, automated materials tracking system consisting of active RFIDtags, reader,GPS and handheld PC and Barcode was able to collect data about the materials with reasonable accuracy, identify and track materials, and locate materials in the supply chain.
The automated system can be integrated with the project information technology systems and materials management processes. A commercial firm has begun this process.
RFID has more advantages than bar code and any other automated material tracking technology.

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