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Improving Construction Logistics a Case Study of Residential and Commercial Building Project

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Abstract: ***This study concerns logistics at the construction projects. Most construction projects suffer from unnecessary activities on site which indicates the need for improving construction logistics. Hence the purpose of this paper was to investigate, through site observations and interviews, the current logistics situation on the construction site and to suggest possible solution for improving construction logistics. The main focus of this study was on material deliveries and time that craftsmen spend on handling materials. The thesis concludes that skilled craftsmen are transporting the third part of all incoming interior materials by their selves. Due to poor logistics planning workers are also doing lots of rework and extra work. The study showed that, by implementing other logistics solutions, it is possible to reduce the production costs by 65 SEK/m2 of living area and also to shorten the production time by 3.3%. The study actualizes the importance of construction logistics which is often underestimated. The study also showed what consequences ineffective logistics solution could have on the construction project. While, on the opposite, proper logistics planning gives benefits to the project.***

I. INTRODUCTION

A. General

The construction industry is one of the most complex industries. The construction process consists of several phases where many different participants are involved during each phase. The uniqueness of this industry is that it is a project based industry, where each construction project could be considered as a temporary organization. However there is a similarity with other industries as well. The similarity is that all industries are interested in high production efficiency while keeping the overall costs as low as possible (Agerberg et al., 2010). Most construction projects are affected by several factors that have a high impact on the efficiency of the workforce by reducing their overall productivity. This affects quality, time and costs of the project. The reason for that is often poor management of materials, equipment and tools. Proper management of these three important components could increase productivity significantly. These components should be accurately managed on site, in order for the projects to be successful. (Almohsen, Ruwanpura, 2011) Due to its nature, the construction industry is one of the most challenging to work in. The information flow in construction is complex and the process is affected by various factors. One of these factors is logistics which is defined as the management of the flow of materials, tools and equipment from the point of release to the point of use. (European Construction Institute, 1994). As the construction industry is constantly developing, production costs are rising steadily as well, but the production efficiency and the way of working have not developed that much. Improving logistics by reducing activities that do not add value to the final product could be one possible solution to lower the production costs. Activities that do not add value to the final product are defined as “waste” which is directly related to the logistics issue. Waste has been studied earlier by among others Josephson and Saukkoriipi (2007) who concluded that it is possible to reduce the production costs with 30-35% by minimizing the total amount of waste.

B. Research Question

Most construction projects suffer from unnecessary activities on site. This indicates the need for improving construction logistics. Thus the research questions that have been studied are:

1) How does construction logistics of an apartment building project work in practice?
2) How much time do construction workers spend on material handling?
3) How does the current logistics solution affect the construction process?
4) How to improve construction logistics in order to reduce the time workers spend on material handling?

C. Purpose

The purpose of this paper is to study construction logistics process and to give suggestion for improvement by optimizing the material delivery process. The main idea is to investigate the current logistics situation on the construction site with the focus on the

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material delivery process and the time that craftsmen spend on handling materials. The suggestions for improvements have been given based on the results from this case study. The possible economic and production benefit from the proposed solution has been calculated.

D. Delimitation

The limitations with our research are:

1) The study is based on Swedish construction practice.
2) The study is based on two case study of apartment building project.
3) The study is focusing on construction logistics for material deliveries.
4) The study is focusing on main contractor company only.

E. Expectations

According to previous research the need for better logistics solutions in construction projects is evident. Poor logistics not only results in delayed projects but also gives a poor image of the construction industry.

We believe that our work will help the construction companies in Sweden to look on the logistics issue from another angle and realize the possibilities for further improvement within the field of material logistics. This will probably contribute to more effective logistics solutions.

II. DATA COLLECTION AND RESULTS

A. General

In this chapter collected data with results have been summarized. Information comes from site observations where we, for the period of 2 month, chose to observe each bigger delivery to the construction site. We also followed workers who handled material deliveries. Time that it took for construction workers to carry materials has been documented. Observations have been done during the architectural stage of the project. During our study, interviews have been conducted with people involved in the project, both with workers, supervisors and managers.

B. Project Information

For data collection, two projects have been used. Both projects are residential construction projects. We decided to name the projects as Project A and Project B.

1) *Project A:* Project A is located in the south part of Stockholm in Hammarbysjöstad. It consists of four seven-story buildings with total of 100 apartments. The building structure is reinforcement concrete structure with prefabricated outer walls. The total construction area is approximately 14 500 m2. The construction period is from November 2010 to September 2012. The tenure form is condominiums. Material deliveries to Project A are organized in a traditional way. Lorries are coming directly from the supplier to the construction site. Such deliveries do not have reserved time and the contractor does not know what time materials are arriving to the construction site.
2) *Project B:* Project B is located in the west of Stockholm in Blackeberg. It consists of three nine-story buildings with total of 70 apartments. The building structure is reinforcement concrete structure with prefabricated outer walls. The total construction area is approximately 8 500 m2. The construction period is from December 2010 to October 2012. The tenure form is rental apartments. At Project B, Construction Consolidation Center is used. This center is also called Logistics Center and is primarily used for inside wall materials and windows. All deliveries to Project B have reserved time. For this reason we used mostly Project B for material delivery observations.

Table 4.1 Project information

Project	A	B
Location	Hammarbysjöstad, Stockholm	Blackeberg, Stockholm
Total Area excl. garage (m2)	14 544	8 585
Living Area (m2)	8 751	5 148
Number of Buildings	4	3
Number of Floors	7	9
Number of apartments	100	70
Construction Period	Nov 2010 – Sep 2012	Dec 2010 – Oct 2012
Tenure form	Condominiums	Rental apartments

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III. CONCLUSIONS AND RECOMMEMDATIONS

A. Conclusions

The purpose of this study was to investigate how construction logistics works in practice and what happens to material after it arrives to the construction site. By direct observations and interviews, we found out how much time skilled workers spend on handling material. After that the alternative logistics solution for handling material deliveries has been developed.

Our study showed that the importance of construction logistics is underestimated by construction companies. In Swedish construction industry companies are not aware of how important logistics is and what could be the consequences of poor logistics planning. In the apartment building project example, we have analyzed the costs associated with material handling.

Inside wall materials: During the case study, we have discovered that inside wall material is delivered during the structural stage and is stored on site during several months. This way of handling inside wall materials has always been considered as the only way. Thus our study showed that other ways of doing that could be more effective. The suggested logistics solution helps to cut the costs for transporting inside wall materials to the working place and also avoid unnecessary work. For our case study (Project B) we concluded that direct saving potential is 60.44 SEK/m2. Interior materials: Skilled workers spend part of their time on carrying materials to the working place. A third of all materials that arrive to site are handled by ordinary workers and two third is handled by carrying men. We think that it a good idea to hire subcontractor for carrying works. We believe that Construction Company could increase productivity even more if they use carrying men for 100% of all incoming materials. For our case study (Project B) we concluded that direct saving potential for suggested logistics solution is 4.34 SEK/m2.

Saving potential: Except the direct saving potential, there is a possibility to shorten the time for the entire project. Implementation of the suggested logistics solution could reduce the production time by **3.3%.**

B. Recommendations for the Contractor Companies

We recommend Contractor Companies not to use skilled workers for material transport on site. For that work, we recommend to use carrying services or to employ own carrying workers. Another recommendation is to do most of carrying works during evenings.

During our study, many interviews have been conducted. All people we interviewed are working in the apartment building projects and most of them are skilled workers. They all had interesting points of view which should not be underestimated. One general comment was according the material estimation for inside walls. Workers strongly recommend involving them earlier while planning. Their experience could help managers and site planners to achieve high accuracy at the material estimations and to save costs.

C. Recommendations for the Future Research

Our study was focused mainly on large material deliveries and man hours. Our suggestion does not take into consideration cost for all small details and parameters. Thus, for future research, we recommend to put more focus on these things. For example, what are costs for hiring temporary offices and machinery? How much is it possible to save on personnel salaries by reducing the production time? Another recommendation for the future research is how much time subcontractors spend on handling their materials and how does it affect the production time?

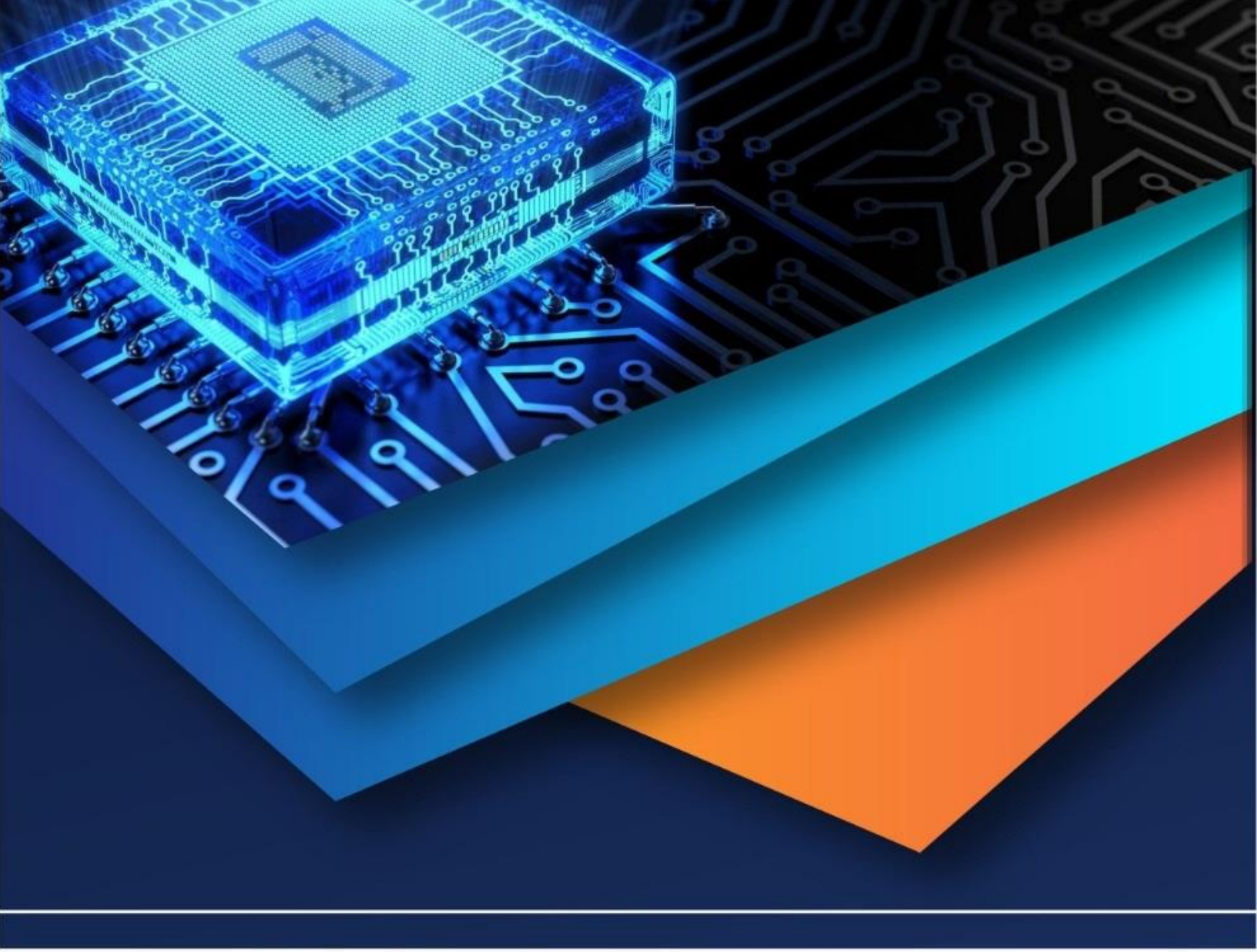
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