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WISAM MOHAMAD S. MASOD

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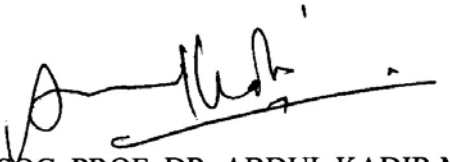

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Date : November 2007

SIMULATION OF ALLOCATION ACTIVITIES OF LOGISTICS FOR SEMI-PRECAST CONCRETE CONSTRUCTION: CASE STUDY

WISAM MOHAMAD S. MASOD

A project report submitted in partial fulfillment of the
requirements for the award of the Degree of
Master of Science (Construction Management)

Faculty of Civil Engineering
Universiti Teknologi Malaysia

November 2007

I declare that this thesis entitled “Simulation of Allocation Activities of Logistics for Semi-Precast Concrete Construction: Case Study” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not currently submitted in candidature of any other degree.

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Especially to my beloved family

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ABSTRACT

The thesis presents a 100 units multi-storey case study endeavor to simulation logistic allocation of activity modeling. It also reviews, assess, and improve the current construction practices in Malaysia. First, building the implementation process diagram for a model of simulation is presented for determining a good and better allocation of activity. Secondly, alternative models for implementation processes and for monitor and control the logistic processes are presented with three missions of government regulation process, site management process, and improvement of IBS process. Finally, a real case study is presented on semi-precast concrete project, on the time completion for each activity that needed to finish the overall project. It will cover financial status, project management consultant, consultant and contractors, local authority, civil engineering works, manufacturing of components, transportation of components, assembly of components and finishing. For the case study, the data were obtained in two stages: (i) during the construction period and (ii) during the interview with participants. During the construction period, data were collected in collaboration with quantity surveyor, site engineer, and site supervisor. During the interview with participants, the interview was conducted with project manager walk-in interviews. The importance of construction logistic in a developing country was clarified as time-based analysis, in which the completion time of semi-precast concrete project in the overall duration to client were calculated separately by using Witness (2001) software, as was an optimization to activity by simulation of the processes .

ABSTRAK

Tesis ini adalah berkaitan penggunaan simulasi model aktiviti logistik dijalankan ke atas satu kajian kes pembinaan 100 unit bangunan bertingkat bagi tujuan semakan, penilaian dan penambahbaikan amalan pembinaan di Malaysia. Pertama, carta proses pelaksanaan satu model simulasi dibangunkan untuk menentukan kebaikan sesuatu aktiviti. Kedua, model alternatif untuk proses pelaksanaan dan pemantauan serta penyeliaan proses logistik ditunjukkan untuk proses peraturan kerajaan, proses pengurusan tapak dan proses pembaikan IBS. Akhir sekali, kajian kes sebenar dibuat untuk projek konkrit separa pra-tuang, ke atas masa siap bagi sesuatu aktiviti sehingga meniapkan keseluruhan projek.termasuk status kwangan, perunding pengurusan projek, perunding dan pemborong, pihak berkuasa tempatan, kerja-kerja kejuruteraan awam, pembuatan komponen, pengangkutan komponen, pemasangan komponen dan kemasan. Bagi kajian kes ini, data diperolehi dalam 2 peringkat iaitu (i) semasa jangka waktu pembinaan dan (ii) semasa sesi temuduga. Semasa jangka waktu pembinaan, data dikumpulkan dengan kerjasama juruukur bahan, jurutera tapak dan penyelia tapak semntara sesi temuduga pula dijalankan bersama dengan pengurus projek di tapak pembinaan. Kepentingan logistik pembinaan bagi negara membangun telah dikenal pasti berdasaran analisis time based di mana masa siap projek separa pra-tuang konkrit dalam jangka masa keseluruhan kepada pengguna dihitung berasingan menggunakan perisian (Witness 2001) untuk mengoptima aktiviti melalui proses simulasi.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

All organisations move materials. Manufacturers build factories that collect raw materials from suppliers and deliver finished goods to customers; retail shops have regular deliveries from wholesalers; a television news service collects reports from around the world and delivers them to viewers; most of us live in towns and cities and eat food brought in from the country; when you order a book or DVD from a website, a courier delivers it to your door. Every time you buy, rent, lease, hire, or borrow anything at all, someone has to make sure that all the parts are brought together and delivered to your door. Logistics is the function that is responsible for this movement. It is responsible for the transport and storage of materials on their journey between suppliers and customers (Donald Waters, 2003).

Materials supply is an important element of operation of construction enterprises and thus a factor affecting the quality of construction projects. The level of materials costs reaches up to 70% of total construction cost estimations, therefore any actions towards rationalization of size, structure and organization of material consumption, delivery, and planning are important in terms of project efficiency and require proper management.

Many industries attempt to integrate logistic process into logistic chains of suppliers and customers, starting with obtaining raw material, through manufacturing, distribution and final sale and service to the end users. Logistic processes, being crucial for successful completion of the project but in fact auxiliary, are often entrusted external professionals specialized in logistic services, and this tendency is also observed in construction (Baumgartner, 1998).

In the field of construction, supply (ordering, transport and storage) and production dominate the logistic processes (Serra, 2003). Supply and production are often difficult to separate due not only to organisational but also technological reasons (considering as erection of in-situ concrete structures and ready-mixed concrete deliveries). Traditionally, contractors taking part in a project were responsible for their individual supply chains to provide materials and services required within their scope of works. At the present time of well-developed market for building materials and services, centralising and outsourcing the project supply logistics is considered to be a more efficient solution facilitating the project control.

A variety of systems and strategies of logistics are used by enterprises. The choice of a logistic model implemented in a project should be based on careful analysis of the supplier's market limitations, structure of material consumption, accuracy of consumption planning and logistic cost minimisation. Also the scope and complexity of the project and its procurement system have a considerable impact on the logistic arrangements. The construction procurement systems evolve and "traditional" systems such as general contracting are often replaced by project manager systems, where the manager acting on behalf of the employer decides on designers, contractors, and supplier's selection (Tenah, 2003). Along with procurement system development, the constellation of decision-makers is changes. For example, the choice of materials, their manufacturers, or even suppliers belongs no longer to the designer or the contractor,

but to the employer or his consultants or project managers. The latter decide also on the logistic system on the building site.

Deciding on project logistics requires a wide knowledge of the building materials market, financing, managing contractors' approaches to supply, and a deep understanding of the logistics impact on the project efficiency in terms of cost, quality, and time. It is of great importance to be aware of logistic costs and their relationship to the model of logistics and assumed decision variables such as batch size, place, and time of the delivery. These depend on current market conditions such as cost of capital, material and transport prices, storage costs and possibilities, safety and environment protection law (Sobotka, 2000).

The study discusses a number of aspects of logistics with regard to a construction process as an organisation and as a participant in a construction project. It is based on the results of recent research on patterns of development of logistic systems in Polish construction enterprises. The enclosed calculations of logistics expenses present the impact of logistic system on costs. Two problems have been analysed: the first consists in the method of introduce logistic process from the total time of a project execution and in determining or estimating their best time according to the deployment logistic model. The second problem is the choice of supply system for all parts such as local authority, financial statue, project management consultant, manufacturing of component, civil engineering, transportation of component, contractor/consultant, and assembly of component. Conclusions of the analysis of the above problems allow substantiating the integration of logistic tasks under a logistics management unit within the project organisation structure in the form of an internal or external logistic organisation. The responsibility of this organisation would be planning and co-ordination of resources supply processes at each part of the project, from the initial planning and design to execution and commissioning. The scope of responsibility of such an organisation may be wider and include management of flows of resources other than materials (equipment, staff and workforce, finance, information), and not only supply but also production.

Actually, the applications of simulation in construction logistics and industrialized building system are increasing rapidly. Consequently, simulation is a unique ability to accurately predict the performance of complex processes at the IBS projects which makes it ideally suited for systems planning. In addition, simulation is emerging as an important developed tool to enhance the logistic process performance of IBS. In overall, a highly processing planning and an accurate logistic of IBS construction process are required to enrich the logistic activities of industrialized building system component.

1.2 Problem Statement

The supply chain of Industrialized Building System at the concrete construction involves many processes. One of the most important processes of IBS is the logistic process, especially if we talk about the logistics management, supply chain management, small limited availability of component, standardization for IBS construction such as (sizing, project management, policy and regulation) and forms on logistic deployment management. In fact, this process is considered as one of the critical effecting factors in term of time, resource, and operation.

Strategic forum for construction (SFFC) in September 2002 highlighted that a considerable amount of waste is incurred in the industry as a result of poor logistics. The requirements of providing the appropriate logistic process for every project enforced multiple efforts to cover that information flow and to enhance once again the workability of IBS projects. It is essential to reduce time, plan the resources and the activities of the whole processes.

The need to adopt an optimized model solution is essential to enhance the optimization, reduces the time, and eliminates the complex routine involved in the process. So there is a lot of opportunity for change. Construction has been slower than other industries to realise the benefits that the application of good logistics can provide.

1.3 Aim and Objectives of Study

An overall goal of this study is to meet the demand for Industrialised building construction component by ensuring a good balance between quality, economic and time needs. As a result of the mentioned background the capabilities of precast concrete component with construction building system for logistic process will be explained. The study concerns three main areas, illustrated in Figure1.1, where prefabricated precast concrete component, logistics supply chain management as a managerial tool and simulation software (Witness2001). However, in this study project these subjects have been put together in order to find a common denominator of the three subjects**.** The research focus is to find and simulate the potential both for this building system and the supply chain management tool in order to introduce the construction process for on order, demand, and delivery. One way of doing this is to use the Witness2001 process in combination with the industrialized building system.

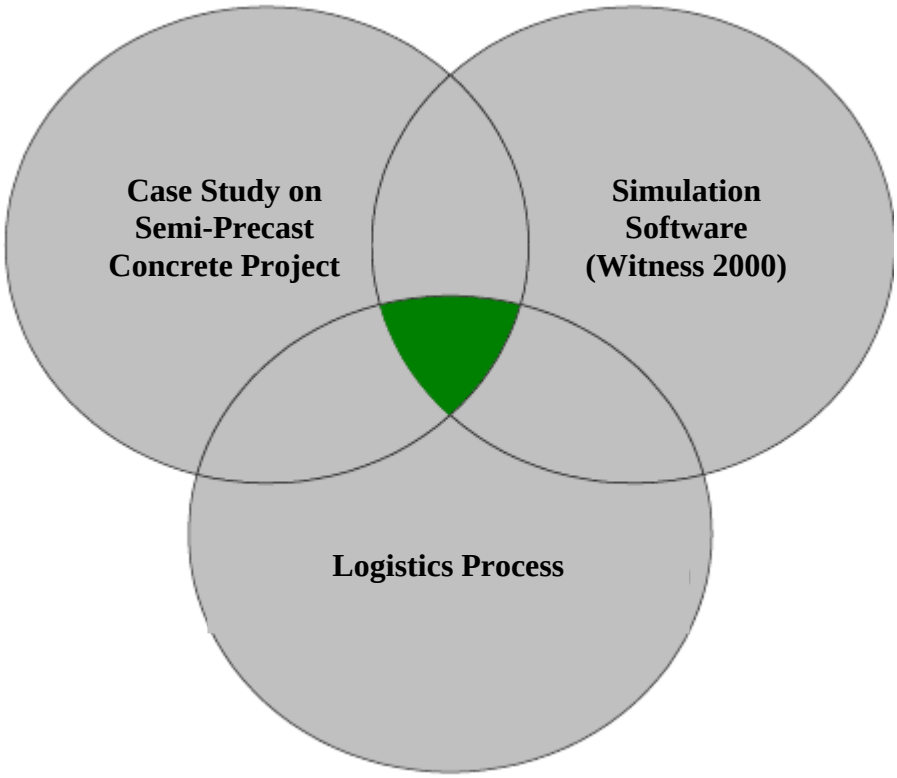

Figure 1.1 Main area of the research project

The industrialized building construction industry has for many years maintained the time-tested but labour intensive traditional approach in construction and investing little in research and development. So the new technological advances shall play a major role in changing the competitive work environment in the construction industry. Concurrently the demand for production and quality increases, the industrialized construction industry must focus itself in innovation and be supportive of new technological techniques in construction.

The objectives of this study by using simulation model (Witness 2001) are as follows:

- To develop an action plan that highlights the steps that needs to be undertaken by the different parts of the industry.
- To identify the key issues that needs to be addressed to improve logistics in the construction industry.
- To simulate and optimize deployment model for industrialized building system house of 100 unit houses project for certain month's completion time.
- To determine catalogue of strategies for activity deployment of IBS house.

1.4 Scope of Study

The scope of this study is focused to selecting and forming the systematic logistic workflow process in overall construction project process in IBS projects. The purpose of this study is to determine whether the ways in which logistics management can provide value for construction process better, faster, and cheaper. The study will also seek criterion for a good logistics vision statement is that it should provide the road map for how these two goals are to be achieved especially in reducing the overall construction period as the follow:

- Examine the logistic process in the IBS construction projects that may play a role in good time achieving at construction projects.
- Explore the problems that are encountered in the simulation design, production, and erection processes in IBS system.
- To introduce the logistics model with influence of time factor on simulation.
- Analyze the deployment process among the parties involved in project simulation.

In general, this study was done in three stages, namely:

- Literary study on IBS and strategic forum for construction logistics.
- Modeling and simulation for achieving a good overall IBS project period as well as the attributes of process, time needed and Alternative models for organization process.
- Data analysis of the results and conclusions.

Making references to relevant books, journals and other sources, as well as conducting literature study on logistics of IBS concrete construction and its applications were performed in the first stage of the research. The second stage involved a modeling and simulation using the (Witness, 2001) technology. The implementation like this technology allows the users to monitor and reduction on time and cost for IBS construction. The third stage of the study was the analysis of the results. The final stage ends with the writing of findings and conclusions, Figure 1.2.

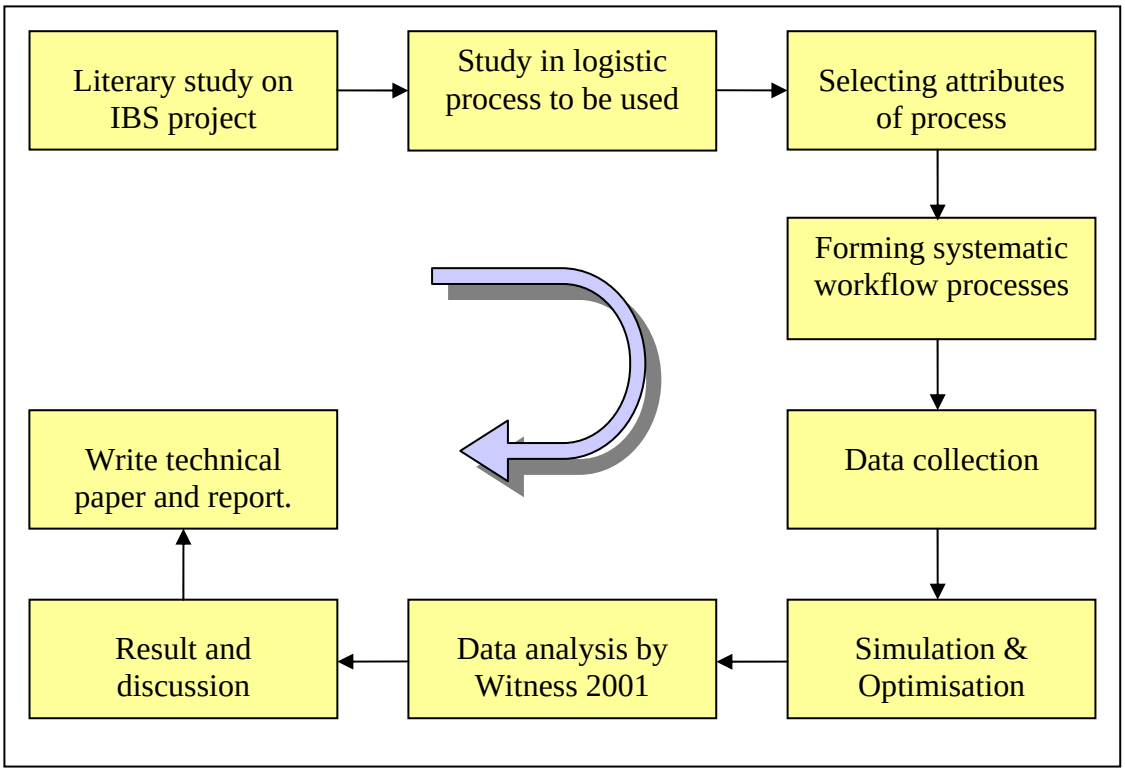

Figure 1.2 Research flow

1.5 Significance of Study

- Proposed simulation model in this study can be applied in the planning of IBS projects especially the logistic process of organization work flow and the execution at the IBS construction projects.
- Propose scheme production of catalog system for IBS such as (specification and standardization).
- Propose alternative models for organization and to monitor and control the process.
- Optimum work flow process in achieving a good overall IBS project period can be calculated from the proposed model.