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JUDUL : **QUALITY CONTROL IN PILE MANAGEMENT SYSTEM**

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QUALITY CONTROL IN PILE MANAGEMENT SYSTEM

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This thesis report submitted in partial fulfillment of
the requirement for the award of
the degree of Master of Science (Construction Management)

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DECLARATION

"I hereby declare that this thesis is written on my own effort except for the quotes and extracts in which they have been cited accordingly"

Signature : _____

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Date : 02 May 2007

To my beloved Mother and Father.

Thank you for your support, guidance and confidence in me.

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ABSTRACT

Construction is an industry that made up by the complex interaction between different players involved in order to complete a particular project. Quality control is well-recognized over the years as being part of the construction inspection and testing of materials and workmanship to ensure that it meets the project requirements. Current approach for quality control on construction process is not as effective as they could be in identifying defects during the early stage of a project. The Objectives of this study were to investigate the quality control for pile management system practiced at construction site and to develop prototype software for pile management system. Data collected through the questionnaires and interviews will be used for analysis and shows the standard of pile management system practiced at site. Prototype software of quality control system for pile management system will be developed using rapid prototype method during the construction process. The finding of the result will reveal the potential and requirement for the quality control system for pile management system at the construction site. The developed prototype will include checklist, piling record, operation information, test result, and work progress. Besides, the prototype will be able to increase the productivity and predictability of piling process.

ABSTRAK

Industri pembinaan adalah satu industri yang terdiri daripada gabungan beberapa individu yang bersama-sama menyiapkan suatu projek yang ditetapkan. Dalam industri pembinaan, kawalan kualiti merupakan salah satu daripada proses penyeliaan dan pemeriksaan bahan-bahan pembinaan dan kemahiran buruh untuk memastikan ia mematuhi projek specifikasi. Kawalan kualiti yang diamalkan pada masa kini adalah kurang memuaskan dalam hal mengesan kerosakan atau kecacatan pada peringkat awal. Oleh yang demikian, objektif kajian ini adalah untuk mengkaji tahap kawalan kualiti yang diamalkan dalam sistem pengurusan cerucuk, dan menghasilkan prototaip perisian untuk sistem pengurusan cerucuk. Butiran maklumat yang diperolehi daripada borang soal selidik and temuramah akan digunakan untuk menganalisa piawaian yang diamalkan dalam sistem pengurusan cerucuk. Prototaip perisian untuk kawalan kualiti dalam sistem pengurusan cerucuk akan direka dengan menggunakan cara “Rapid Prototype” semasa proses pembinaan. Penemuan yang diperolehi daripada keputusan soal selidik dan temuramah akan mendedahkan potensi yang ada pada kawalan kualiti dalam sistem pengurusan cerucuk di tapak pembinaan. Prototaip perisian yang dihasilkan akan mengandungi senarai semakan, rekod cerucuk, maklumat operasi, keputusan ujian, dan perkembangan pada tapak pembinaan. Selain itu, prototaip perisian yang dihasilkan akan meningkatkan productiviti proses “piling”.

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ABBREVIATIONS

ALU	Arithmetic Logic Unit
C&D	Construction and Demolition
GIGO	Garbage In and Garbage Out
GIS	Geographical Information System
GPS	Geographical Positioning System
GRNs	Goods Received Notes
GUI	Graphic User Interface
IDMS	Inspection and Defect System
IT	Information Technology
KBS	Knowledge Base System
LAN	Local Area Network
PC	Personnel Computer
PDA	Personal Digital Assistant
SQL	Structured Query Language
VB	Visual Basic

CHAPTER I

(Quality Control in Pile Management System)

1.1 Introduction

Construction industry is characterized by complex interactions between different players (such as owner, architect, engineers, contractors, consultants, etc.) that involved in a particular project. These interactions typically involve sharing of information and data for purposes such as clarifications, inspections, planning and information on how and when work should be performed. Typically, the documentation of the information shared in such interactions or meetings is paper-based, which require extra resources in terms of office personnel, archiving clerks, office space and equipments **(**Akinci, 2005). Figure 1.1 depicts the typical communication and information sharing between the parties involved in atypical construction project.

The communication between general contractor (GC), owner, the owner's representative, consultants and subcontractors uses typical mailing systems for information sharing. Problems that could arise includes delay in time especially when the documents or information cannot be delivered on time (regular mail, UPS, Fedex), information not received or partial information received (fax), and other problems. In addition, parties could argue that the information was not received on a timely manner (Perdomo, 2002).

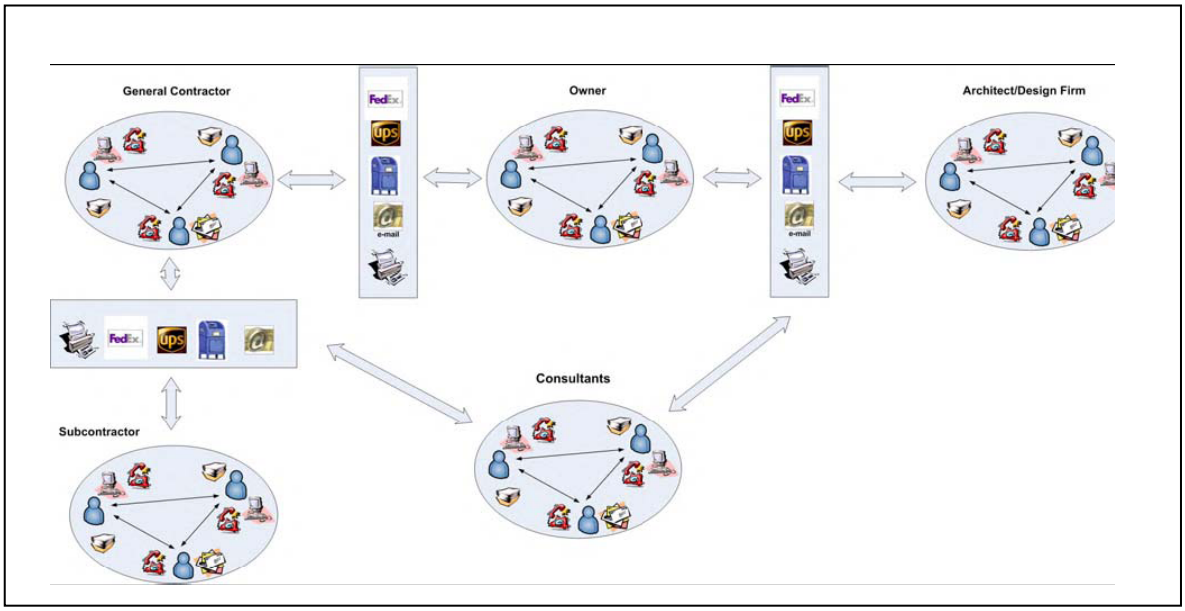

Figure 1.1 : Typical Communication and Information Sharing in Construction
Source : Akinci,2005

Quality control has been recognized over the years as part of construction inspection and testing of materials and workmanship to ensure that the work meets the requirements of the drawings and specification. Current approaches for quality control on construction sites are not as effective as they could be in identifying defects in the early stage of construction process. As a result, defects can go undetected until later phases of construction or even to the maintenance phase, which subsequently causing the project to have costly ramifications.

It has been noted that 6% to 12% of construction cost is wasted due to rework of defective components detected late in the construction phase (Burati and Farrington, 1987) and 5% of construction cost is wasted due to rework of defective components detected during maintenance. 20% to 40% of all these site defects can be attributed to the construction phase (Patterson and Ledbetter, 1989)

According to N.D Opfer (1999), 54% of all construction defects are related to human factors such as unskilled workers or insufficient supervision of construction work. Furthermore, 12% of construction defects are due to material and system failures. These statistics all suggest the importance of inspection for achieving higher construction quality. In addition, it has also been identified that careful inspection during construction is one of the most important factors in preventing structural failures during construction (Yates and Lockley, 2002).

The status of the work at construction sites changes continuously as construction projects evolve over time. Current surveying and quality control approaches are not effective, since they only provide data at specific locations and times to represent the work in place, and the data generated are interpreted manually and are not integrated electronically into the project design and schedule. Consequently, project managers do not get the complete and accurate information about the work in place. This limits their abilities to identify and manage defects, and actively control and manage the construction projects. Frequent, complete, and accurate assessment of the status of as-built conditions at construction sites, identification of critical spatial-temporal and material quality related deviations of work in place, and assessment of whether these deviations constitute defects during a construction project are necessary for active project quality control.

Computer Technology offer new ways to capture information and communication in the field and in the office. Once a novelty, or used primarily as time and schedule organizers, these computer devices will become a common gadgets. Some contractors use them to records inspection, or as daily diary or for project management documentation.

1.2 Background of Study

Not too many years ago, contractors with laptop or desktop computers in their field office trailers were looked upon as being on the cups o f the new computer age. During the late of twentieth century, builders and contractors shed their anti-technology image and began to realize the benefits that can accrue by adopting this new age of construction hardware and software. The internet has become the focal point for design and construction collaboration, and the buzzwords originating in Silicon Valley are now as familiar on the jobsites as backhoes, composite metal decks and rooftop equipment (Levy, 2002).

The internet has a multitude of offerings for the construction market: communication, research and development, sales and marketing, project management, estimating, bidding, procurement, career opportunities and training. In 1999, according to Engineering News Record, (8a) 68 percent of internet use in the construction industry was for communication. Only 4.1 percent was for project management/collaboration, and 19 percent was for research. In 2000, frequency of the usage of internet technology in the construction market in term of average hours per week as shown in Table 1.1.

Table 1.1 : Frequency of Use of Internet Technology

Email	4.5
Project collaboration sites	2.8
Research of manufacturer’s products	2.2
Researching costs/pricing/ordering/purchasing products	1.8

The trend toward integration is not easy to follow. It is expensive and time consuming to initiate and implement, but the increased efficiencies and cost savings become readily apparent. Contractors have long recognized that time is money, and there is no better tool available to maximize time and minimize cost (M. Levy, 2002).

Software has now become a commodity product, offered to subscribers over the internet, available immediately through a global high-speed network of copper or fibre optic cables or via technology. As wireless technology became more dominant, software users increasingly demanded the ability to access programs and associated databases from remote locations, hence the growth of Application Service Providers (ASP).

On a typical construction project, the main objective is to add value to the constructed facility, the contractor's business, the owner's company, and the community. Significant effort is spent to ensure that time and money are not wasted, and to improve quality and working conditions. The driving force behind this research is to outline how computers can be used as tools to add value to a construction project (Haas, 2001).

The word "value" is often used synonymously with the word "benefit." When people refer to something as "having value," they usually mean that it is of benefit. In construction, value is generally viewed as tangible and direct, and is often defined in terms of changes in three metrics, cost (or budget), time (or schedule), and quality. Other measures such as safety, rework, and productivity are also widely used, however, these are intrinsically related to the above three metrics. Although quality is as important as the other two metrics, apart from measuring factors such as rework and owner satisfaction in an effort to quantify it, quality remains an illusive metric. Value is also temporal by nature since it often takes a long time before any value is added by a new technology (Greenwood, 1997). In the present research, the value of introducing a new technology on a construction project is associated mainly with the direct impacts (positive or negative) on the measurable (or tangible) metrics of cost and time (Haas, 2001).

1.3 Previous Research

The development of affordable computer technologies has enabled their deployment in all sectors of industry and commerce. From bar codes on weekly shopping to a hospital consultants recalling a patient's records using a computer; the ability to capture, store and reuse information by a mobile user is now common place (Escofet, 2004) and (Dhawan, 1996) such as e-book in the construction industry and also using a third party software for data collection in the paper of “Applying handheld computers in the construction industry” (William, 2003).

In the paper of “The application of mobile computing system on construction management” had drafted out a construction management prototype where the information collected from construction site is not transmitted instantaneously. If can only be retrieved and analyzed when the mobile device is sent back to office. Further more the interface use in this prototype is a set of static programs which focus more to structure engineering analysis.

1.4 Statement of the Problem

The status of work in place at construction site changes continuously as construction projects evolve over time. Current surveying and quality control approaches are not effective, since they only provide data at specific locations and times to represent the work in place, and the data generated are interpreted manually and are not integrated electronically into the project design and schedule.

Consequently, project managers do not get the complete and accurate information about work in place. This limits their abilities to identify and manage defects, and actively control and manage the construction projects. Frequent, complete, and accurate assessment of the status of as-built conditions at construction sites, identification of critical spatio-temporal and material quality related deviations of work in place, and assessment of whether these deviations constitute defects during a construction project are necessary for active project quality control **(**Akinci, 2002)

Construction quality directly impacts the overall project and built product performance. A means of ensuring effective investment in quality control mechanisms, can directly benefit the construction industry. Prior to the introduction of emerging inspection technologies such as laser scanners and embedded sensors, the decision of how to best assess and control the quality of construction was simplified by the limited range, amount, and applicability of existing quality control tools.

However, as the introduction of advanced sensing technologies improves the number, size, cost, and coverage of available tools, and increases the amount of available quality-related information, the decision-making for quality control investment become easier. The greater coverage and high up-front costs that characterize emerging inspection technologies means that a large amount of quality-related information can be generated from construction sites, but with an ever-present concern for the benefits resulting from these cost outlays.

1.5 Objective of Study

1. To investigate the quality control in pile management system practised at construction site.

2. To develop a prototype software for quality control in pile management at construction site.

1.6 Scope of Study

This study will focus on the activity of pile quality control management system based on the specification standard during the construction process. The study will be carried at the construction sites in Selangor.

1.7 Methodology

The following methodology had been adopted to achieve the objective of the study:-

i) In order to achieve the first objective which is recognise the problem occurs in the construction site and the method of the quality control in pile management system practiced in the construction will be interview and collect from the questionnaires.

ii) Besides, The first objective also identifies the potential and requirement for the pile quality control management system for the information technology at construction site, which the literature review had been carried out.

iii) To attain the second objective this is develop a prototype at a quality control in pile management system for the construction site.

1.8 Organisation of the Report

Chapter 1 consists of the introduction of the study. It also includes the background of study, previous research, problem statement, objective, scope of study and methodology.

Chapter 2 focus on the literature study which mainly concentrates on the information technology and also the application information technology had been practised in the construction. Besides, the importance of the quality control in the construction management also had been included in this chapter.

Chapter 3 explain on the method for the research methodology and how the design for the questionnaire and the interview had been carried out. The process explains the design prototype and consideration for the feature in the system had been included.

Chapter 4 discuss about the analysis data gather from the questionnaire and the interview. The data would be interpreted based on the study objectives. The result for the analysis will be illustrating using bar chart. Besides, the design of prototype and the manual user also would describe in this chapter.

Chapter 5 will conclude the findings of the project and some recommendations and suggestions added for future improvement.