COMPUTER TOOLS IN CONSTRUCATION

IKMAL HISYAM BIN MUBARAK

CIVIL ENGINEERING
UNIVERSITI TEKNOLOGI PETRONAS

JANUARY 2008

Computer Tools in Construction

by

Ikmal Hisyam Bin Mubarak
5996

First draft submitted in partial fulfilment of
the requirements for the
Bachelor of Engineering (Hons)
(Civil Engineering)

JANUARY 2008

Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

Computer Tools in Construction

by

Ikmal Hisyam Bin Mubarak

A project dissertation submitted to the
Civil Engineering Programme
Universiti Teknologi PETRONAS
in partial fulfilment of the requirement for the
Bachelor of Engineering (Hons)
(Civil Engineering)

Approved:

Assoc. Prof. Ir. Dr. Arazi Idrus
Project Supervisor

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

JANUARY 2008

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

Ikmal Hisyam Bin Mubarak

ABSTRACT

Computer Tools have been widely used in various civil engineering applications such as for project planning, design and maintenance activities. They have been proven to be able to help engineers in performing tedious or complicated calculations or smoothen their routine work. Thereby saving the time and cost. However it observed that in construction site computer tools are not being used widely as in other civil engineering activities such as design. The main objective of this study is to investigate the awareness of the availability of computer tools in constructions field, level of usage of computer tools in constructions field and the perception of computer tools in helping the works on site in Malaysia's constructions industry. The scope of this project is focusing on the contractor, developer and professionals that involve in the constructions industry in Malaysia. This research requires the survey method involving preparation and sending questionnaires, conducting interviews and analysing the collected data which will already done within the time frame. Pilot Survey has been conducted and analyzed. At this stage, all 12 interviews have been conducted and the questionnaire distributed has been collected. The data have been being summarized in a simple format and analysed using statistical tool. The result from the analysis shows that all the respondents aware of the availability of the Computer Tools. More than fifty percent from the respondents use Computer Tools in completing their projects in 3 years which shows good indication of the level of usage of Computer Tools. The respondents also shows that simplify complicated task is the most popular perception for the advantages of Computer Tools and the most popular perception of problems chosen by the respondents are expensive and insufficient personnel concerning knowledge of Computer Tools in industry.

ACKNOWLEDGEMENTS

First of all, author would like to deliver a gratitude to the God almighty for all His blessings in everything author has accomplished throughout completing this project. The author also would like to thank Assoc. Prof. Ir. Dr. Arazi Idrus, the author's supervisor for all his guidance and moral support he gave to the author. Not to forget, the author would like to thank Chris, the Graduate Assistance who really co-operated well with the author in completing the survey.

A special thank to the author's friends especially Mohd Zaki bin Baharuddin, Muhammad Fikri bin Hashim and Hannis Salwani Bt Mohd Sazali for giving moral support and ideas since in the early stage of the project. Last but not least, the author greatest gratitude goes to those who have assisted his directly or indirectly starting from the beginning of the project. All the cooperation is highly appreciated and only God could repay the kindness.

Thank You.

TABLE OF CONTENTS

LIST OF FIGURE

LIST OF TABLE

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Computers have revolutionised the way documents are generated. Similarly, information technology is bound to revolutionise the way people exchange information and documents. Information technology (IT) is defined as "the use of electronic machines and programs for the processing, storage, transfer and presentation of information" (Al Hussein et al, 2005). IT encompasses many technologies such as computers, software, networks and even telephones and fax machines. The purpose of IT is to facilitate the exchange and management of information and has a lot of potentials for the information process component of the construction industry. These recent technologies will undoubtedly have a profound impact on how organisations operate on a daily basis (Chiang et al, 2004).

The government has put plenty of effort to enhance the current conventional labor intensive activities towards technological methods of construction. This is being done so that Malaysia is capable of producing fast and high quality products, able to compete with the world in construction industry. Besides that, Construction Industry Development Board (CIDB) has taken many efforts over the recent years to achieve industrialization of Malaysian construction industry by promoting the usage of Computer Tools in Construction

.

Computer Tools in Construction promises several advantages such as shorter the period of the construction, save more cost and reduce more risk by proper management and planning. These advantages indirectly ensure a more efficient and organized construction site, and reduction of completion time of construction can be achieved. Concerning to this matter, Construction Industry Development Board (CIDB) have organize the Introduction to Project Planning using Primavera Project Planner at Kuala Lumpur (CIDB, 2007).

One of the Computer Tools' components practiced in construction industry at the present moment is 3D visualization and simulation for tower crane operations on construction sites. Most high-rise building construction projects rely on tower cranes to perform lifting and hoisting activities. In practice, tower cranes are managed based on demand, urgency, and prioritized work tasks that must be performed within a set period of time in the field. As a computer tool, simulation has proved to be effective in modeling complex construction operations and can be a substantial help in aiding practitioners in construction planning

Tower cranes are the most expensive and frequently shared resources on building construction sites. Efficient utilization of tower cranes greatly depends on skilled judgments that account for a number of technical, schedule, and financial factors. As the number of work tasks and the demand for tower cranes increase, planners may be required to make bold decisions on job conditions for a particular situation. A poor decision is likely to have significant negative effects, which will lead to additional costs and possible delays (Al Hussein, 2005).

Computer will help construction industry to shorter the period of the construction, save more cost and reduce more risk by proper planning using the software like Primavera, like Construction Management Software, Construction Estimating, Construction Scheduling, Construction Estimating Software, Job Costing and etc. Thus, people involve in the construction field must play their important roles by having the skills and knowledge to use the computer in their daily activities. However, there are contractors that still use their manual method and did not have the knowledge to use the computer; therefore they did not adopt the computer tools in their work. They even did not aware the availability of various computer tools in the current market that can simplify and save their cost for their project. There were many research conducts in application of computer tools in construction but this research focus to the construction industry in Peninsular Malaysia only.

1.2 Problem Statement

Applications of computer tools are very important in the construction site. However, what is the actual level of usage of computer tools in construction field in Malaysia? Do they aware of the availability of this tool in the market? and do they know the advantages for using this computer tools in construction industry ? A survey need to be done to identify the current states of computer tools application in Malaysia's construction industry. It will be conducted to provide information on the awareness, level of usage and perception of computer tools among construction professionals.

1.3 Objective and scope of study

1.3.1 Objective

The objectives of this study are:

i. To investigate the awareness of the availability of computer tools in construction field.

ii. To investigate the current level of usage of computer tools in the construction field in Malaysia's construction industry.

iii. To investigate the perception of computer tools in helping works on site.

1.3.2 Scope of Study

This research will measure the perception of awareness, level of usage and effectiveness of computer tools of contractors, developer and engineer. Furthermore, this research focuses only on the construction industry in Peninsular Malaysia. This research also requires preparation of questionnaires, interview and analyse which will be done within the given period.

CHAPTER 2

LITERATURE REVIEW AND THEORY

2.1 Productivity in Malaysian Construction Industry

In 1998, productivity and employment in the construction sector declined by 12.7 and 13.5 percent respectively (1997: 1.9 per cent, 8.6 per cent). With the decline in the productivity and employment growth, output in construction declined by 24.5 per cent (1997: 10.5 per cent). Due to economic slowdown, output in the construction sector is expected to decline by 1.7 per cent while employment is expected to decline by 1.5 per cent. The construction sector productivity is expected to decline by 0.2 per cent. Productivity in-terms of value added to employee for the construction sector grew at 10.6 per cent during the period 1988-1993 following rapid industrialization and modernization of the country. However the low generation of added value content was mainly due to high import content and inefficient management of resources in the construction projects. To improve the productivity of the construction industry, it is imperative to strategize the development of the construction industry. The strategies should include enhancing the managerial skills and technical capabilities of contractors. CIDB in the process of developing and formulating training programmes to this effect (Chiang, 2004).

2.2 Using ICT Resources in Construction

The process involved in the business activities of construction companies includes Marketing, Estimating, Tendering, Design, Construction, Administration, Research and Development. There has been a growth in the use of ICT resources within construction. The effective exploitation of this resource can often lead to the following benefits; It saves employee time, lost phone messages and the three-day time delay often associated with surface mail. It avoids circuitous means of transferring data, for example printing a document, faxing it and the retyping the data at the receiving end in order to save it as electronic file. It offers the company

and individuals the opportunity to publish and distribute their work efficiently, while attaining a high and consistent quality in textual and graphic appearance. It provides access to information and allows communication and distribution of documents in a single, uniform fashion (Harris and McCatter, 2006).

2.3 Computer Aided Cost Estimating

Controlling costs is one of the most important requirements of a construction project. To achieve this control, contractors and sub-contractors must first perform an accurate cost estimation to establish spending targets. Rigorous project accounting must then be employed to ensure that the actual spending will not exceed target. Although it is possible to perform these tasks manually, computers can provide faster and more accurate answers. Unit rate estimating is an analytical estimating technique that predicts cost by calculating the total amount of resources (labour, material and equipment) required for the project and the cost of the resources. A list of this resource known as Bill of Quantities can be developed using detail working drawings and full specification of the design. This type of estimating method is more accurate and it is used at the late phase of design evaluation and tendering stages. To perform a unit rate estimate requires gathering and analysing a large amount of data. Some of the tasks are time consuming and repetitive. Computers are ideal for providing support for these tasks. A survey in 1999 revealed that 44% of main contractors, 65% of sub-contractors and 68% of quantity surveyors, used computer programs for estimating tasks. The type of computer aided estimating application fall into two broad categories, there are Spreadsheet based bespoke programs and Off-the-shelf cost estimating packages. Cost estimating is vital for construction companies in their bidding for contracts and ensuring each project is operating within budget and at a profit. IT applications enable the contractors and program manager to build up more accurate estimates of project cost by taking into account more factors in a detailed project breakdown and to monitor spending during a project (Sun and Howard, 2004).

2.4 Construction Software Available in Current Market, 2007

2.4.1 Construction Management Software

Construction Management Software is the comprehensive Project Management and Accounting software that has fully-integrated modules including Scheduling, Document Control, Job Costing, Accounts Payable, Accounts Receivable, Payroll, Equipment Costing, Purchase Order, Service Management and Inventory. Some of the Construction Management Softwares that available in the current market are VirtualBoss, Sage Master Builder and etc.

2.4.2 Construction Estimating Software

This Software build an accurate and comprehensive estimate, for a residential or light commercial construction project can be a long gruelling process. Construction estimating software can help by gain a competitive advantage by facilitating the preparation of detailed, profitable bids while managing job costs and subcontractor bids. A quality construction estimating program can prepare and monitor outgoing bids as well as many other tasks that constitute the daily business functions of a busy contractor. Just a few capabilities of a good program include:

- Document Preparation: creates reports, schedules, letters, contracts and printable change order forms
- Purchase Order Processing: tracks all purchase orders and incoming inventory
- Archives Previous Projects: builds a database of completed jobs for quick reference when estimating new bids
- Flexibility: allows for instant changes to whole projects, room by room or dimensions as well as make adjustments for unit costs
- Accounting: many programs directly or through a popular accounting program can manage general accounting, billing and payroll functions

Some of the programs that available in the current market are Goldenseal, Bid4Build, Work In Progress, EasyEst Estimating, Estimate Master, CBD Estimating, Estimaster2, Estimating Solutions, BidPilot, Builders Software, National Estimator, BidRite, WinEst and etc.

2.4.3 Construction Scheduling Software

Construction Scheduling Software is a software that help by schedule and control the construction projects effectively. Simple construction scheduling templates, manuals, tools and systems that have been developed from the construction industry out of the necessity to create more accountability and to avoid costly delays and downtime. The advantages for using this software are :

- Projects can be completed on time
- Profit margin can be adjust accordingly due to future workload
- Make all staff responsible to follow the schedule
- Give flexibility time for decision making and adjust accordingly.
- Alert when to order the materials or materials have arrived.
- Give standard templates to create the schedules and save input time.
- Ability to control a single or multiple construction projects
- Save time and cost

Products of this software that available in current market are Microsoft Project, Virtualboss, UDA Scheduling and etc.

2.4.4 Construction Accounting Software

This software will help the contractors in manage their company account for each project. Function that can be access using this software:

- General Ledger
- Cash Management
- Multi currency
- Business Partners
- Inter company posting
- Accounts Payable
- Hired Truck Payroll
- Subcontractors
- Purchase Order
- Accounts Receivable
- Time & Billing
- Payroll

- Job Costing
- Estimating
- Personalizer
- Utilities
- Built in Reporting

Latest software available in the current market are Explorer Software Inc, Sirius GT, JobPower and etc.

2.5 Computing and The Construction Industry

Computer is an electronic device capable of storing and processing information in accordance with a predetermined set of instructions (Stevension, 2002). Development in computers is happening faster than ever. The technology available to the public is astounding and the range of technology available to large companies with money to spend in this area is bewildering. For the construction industry to make full practical use of the available computer technology it must have a sufficient number of people involved who are capable of understanding and using it. A brief review of the general state of computer systems in the industry is beneficial before a considered view can be given to the general level of computer comfort and literacy (Scott, Ponniah and Saud, 1993).

2.6 Application of Computer Tools in Construction

The principal activities of a professional office are based around the constantly updated stock of factual information. Traditionally, that information was stored on paper and a great amount of time and effort was spent producing, storing and retrieving that information. The creation of much of the documentation on, for example, a building contract, is still done by hand. This usually involves photocopying old documents, changing them with a pen and retyping the amended pieces of paper in full. The document is then put back in a filing cabinet somewhere. This is hardly an efficient and error-free way of conducting business. The recent rapid developments in cheap word processors, laser printers and powerful photocopying machines have led to a large increase in the amount of paperwork being produced. Lewis in Neil Scottetal say that because of the unstructured way in

which the computers have been used in the construction industry to date, they have, at the very best, maintained the status quo, but more often than not caused an increase in the administrative overheads. Use of a computer is often avoided at all costs with all information being transferred through a secretary. If this useful tool is to be used to its full potential, then these fears must be quickly overcome. Computers are just a tool, a very necessary tool today, for modern and effective management. If managers are not capable of using this tool properly, then they are not being as effective and efficient as they could be (Scott, Ponniah and Saud, 1993).

CHAPTER 3

METHODOLOGY

3.1 Survey Process

The population for this survey is construction industry in peninsular Malaysia. The sampling method is stratified random sampling. The sample will be sent to 150 Project Manager of Construction Industry. Methods for this survey are questionnaires to ask the perception of awareness, level of usage and the effectiveness of computer tools in construction. Question will be sent by mail. Besides that, there will be an interview with some construction company to get their response towards this survey. The main tools used for this research are questionnaire for data collection and the results will be analyzed using statistic tools. The survey will be sent at the end of November 2007 and the feedback has been collected in January 2008.

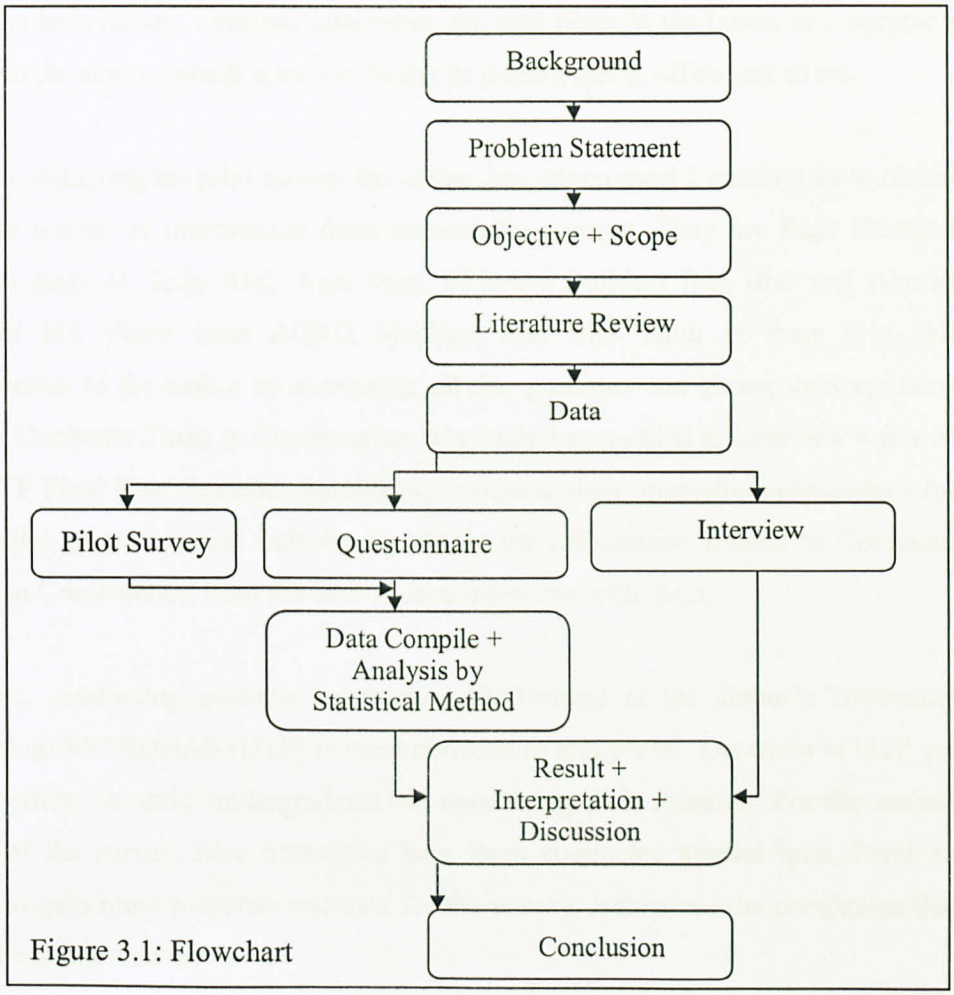

Figure 3.1: Flowchart

3.2 Literature Review Research

The author has assessed to websites as stated in the reference section to obtain information about Computer Tools. CIDB website proves to be very beneficial as it provides a variety of useful information of construction industry in Malaysia. But the database only stored events from 1996 to 2005.

Journal is a very useful source of information to the author because it has stated the previous research done by other researchers about the topic. Furthermore, the references provided in the journal are much important for the author to look for other reliable sources of information.

3.3 Personal Interview

An interview is called personal when the Interviewer asks the questions face-to-face with the Interviewee. Personal interviews can take place in the home, at a shopping mall, on the street, outside a movie theater or polling place, office and so on.

While conducting the pilot survey, the author has interviewed 2 contractors to obtain reliable source of information from dependable sources. They are Raja Shaharul Ahmad Reza B. Raja Abd. Aziz from EKRAM Builders Sdn Bhd and Ahmad Rashidi Md Yusof from AGRO Mahligai Sdn Bhd. Both of them give full cooperation to the author by answering all the questions and giving their opinions due to Computer Tools in Construction. The author proceeded to interview a few of the UTP Final Year Students that already complete their internship programmes for 8 months in construction industry by obtain the information related to Computer Tools in Construction from the face-to-face interview with them.

Besides, conducting personal interview with lecturer at the author's University Teknologi PETRONAS (UTP) is most convenient and useful. Lecturers at UTP are most willing to assist undergraduates in conducting their research. For the second stage of the survey, nine interviews have been conducted around Ipoh, Perak in order to gain more response and data for the survey. Below are the companies that have been interviewed:

- Maju Alfa (M) Sdn Bhd
- Maju Bangun Sdn Bhd
- Biz Villa Sdn Bhd
- Hajadi Sdn Bhd
- Nazarin (NBM) Sdn Bhd
- DKLS Construction Sdn Bhd
- Pembinaan Bumi Asia Sdn Bhd
- Syarikat Pembinaan Caj Maju Sdn Bhd
- Syarikat Yom Pembinaan dan Pembangunan Sdn Bhd

3.4 Tools and Analysis

The main tools used for this research are questionnaire for data collection. Before the final draft of questionnaire was used for data collection, a pilot questionnaire was design and tested in order to get feedback and comment from the respondents. This help to improve and modify the content of the questionnaire. Postal survey was chosen as the survey method as it is cheaper and no interviewer effects

The data collected from the questionnaire have been analyzed using statistic tool. The main software that useful to analyze the data is Microsoft Excel. The author calculates the mean and variance to ranking the criteria that respondent choose. Besides that convert the data into the chart and diagram really helps to interpret and analysing the outcomes of the respondent's opinion.

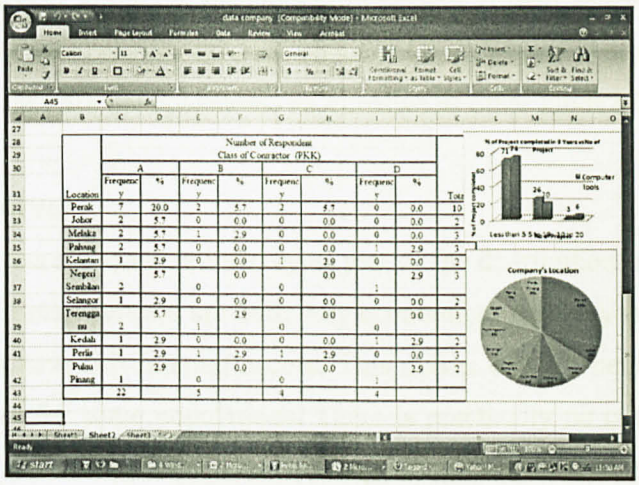

Figure 3.4.1: Microsoft Excel

No	Detail/ Week	FYP 2															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	EW	SB
1	Selection of Project Topic																
	•Propose Topic																
	•Topic assigned to students																
2	Literature review																
3	Submission of Preliminary Report																
4	Data & Information																
	•Design of questionnaire																
	•Questionnaire Distribution																
	•Interview																
	•Data Compile & Analysis																
	•Result ,Interpret & Discussion																
5	Submission of Progress Report																
6	Submission of Interim Report																
7	Oral Presentation																
8	Submission of Final Report																

Figure 3.4.2: Detail schedule for FYP 2

3.5 Questionnaire Distribution

3.5.1 Mail Survey

After questionnaire fabrication, the questionnaire will be distributed to contractors for feedback. Mail surveys are among the least expensive. This is the kind of survey the author can do because the author has the names and addresses of the target population, but not their telephone numbers. The author chooses this method because mail surveys allow the respondent to answer at their leisure, rather than at the often inconvenient moment they are contacted for a phone or personal interview. For this reason, they are not considered as intrusive as other kinds of interviews.

3.5.2 Email Survey

The author also has chosen email survey as part of the distribution method, also as a back up survey. Email surveys are both very economical and very fast. More people have email than have full Internet access. This makes email a better choice than a Web page survey for some populations. There is practically no cost involved once the set up has been completed. An email questionnaire might be able to gather several thousand responses within a day or two.

CHAPTER 4

RESULTS AND FINDINGS

4.1 General / Background Information

4.1.1 Company's Location:

Table 4.1.1: Company's Location

Company's location	No of respondents
Perak	10
Johor	2
Melaka	3
Pahang	3
Kelantan	2
Negeri Sembilan	3
Selangor	2
Terengganu	3
Kedah	2
Perlis	3
Pulau Pinang	2
Total	35

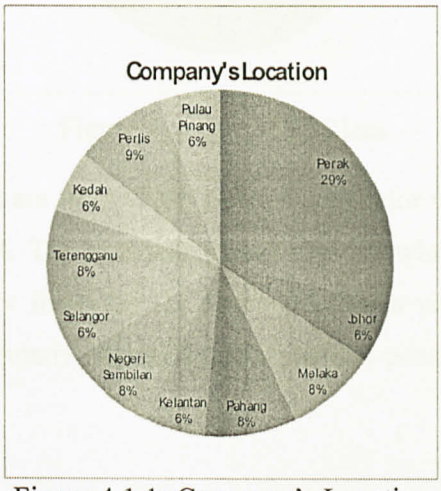

Figure 4.1.1: Company's Location

The pie chart above visually explains that most of the respondents are from Perak. The minimum respondents are from Johor, Kelantan, Selangor, Kedah and Pulau Pinang. Initially, the purpose of knowing the respondent's company's location is to distinguish whether there is any significance difference in the application of Computer Tools in each state.

4.1.2 Respondent's Class

4.1.2.1 PKK Class

Table 4.1.2.1: Respondent's PKK Class

PKK Class	No of Respondents
A	22
B	5
C	4
D	4
Total	35

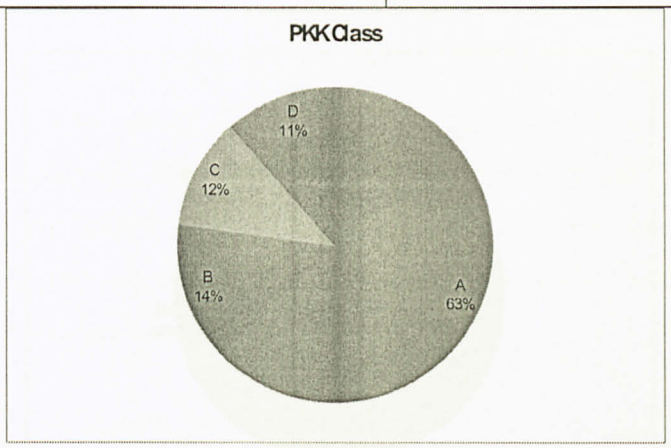

Figure 4.1.2.1 : PKK Class

Most of the respondents are from Class A PKK contractor which is 63%. Class B is 14% and Class C is 12%. The least response is Class D which is 11% from the total respondents. The survey focus on the four main class which is A, B, C and D because this type of company deal with mega projects possibly using the Computer Tools in daily task.

4.1.2.2 CIDB Class

For CIDB class, 63% of the respondents are from G7 Class, which is the highest class in CIDB class. 14 % from the respondents did not indicate the CIDB Class, possibly they did not register with CIDB. 9% from the respondents is G4 and 8% from them is G6. Both class G3 and G5 are have 3% from the total respondents.

Table 4.1.2.2: Respondent's CIDB Class

CIDB Class	No of Respondents
G7	22
G6	3
G5	1
G4	3
G3	1
Unknown	5
Total	35

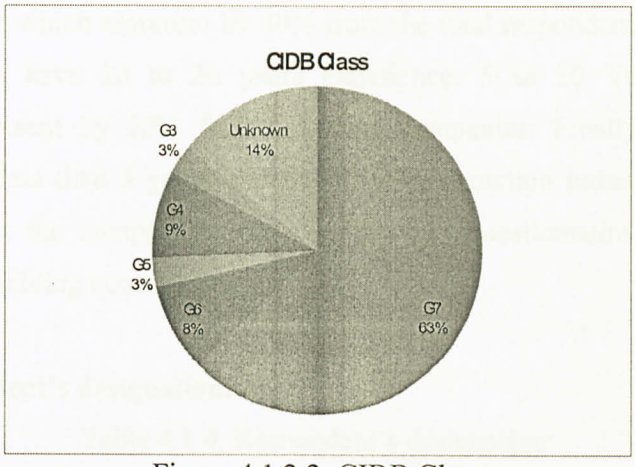

Figure 4.1.2.2: CIDB Class

4.1.3 Company's experience in construction project?

Table 4.1.3: Company's experience

Company's experience (Years)	No of Respondents
Less than 5	3
5-10	7
10-20	11
More than 20	14
Total	35

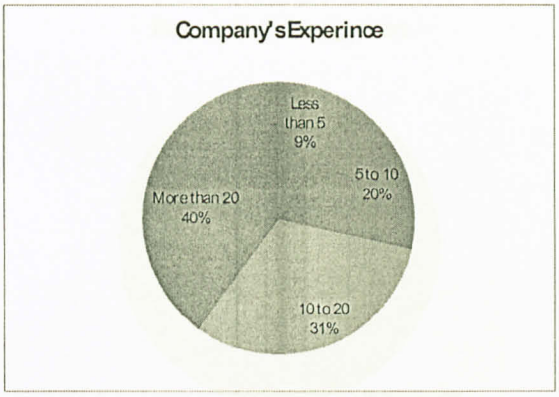

Figure 4.1.3: Company's experience

From the chart above, most of the respondents' company's experiences more than 20 years experience which represent by 40% from the total respondents. 31% from the total companies have 10 to 20 years experience. 5 to 10 Years Company's experience represent by 20% from the total companies. Finally, 9% from the company have less than 5 years experience in construction industry in Malaysia. This shows that the companies which replied the questionnaire have sufficient knowledge on building construction.

4.1.4 Respondent's designation:

Table 4.1.4: Respondent's designation:

Respondent's designation	No. Of Respondents
Project Manager	14
Project Engineer	2
Construction Manager	7
General Manager	4
Other (Engineer, Quantity Surveyor, etc)	8
Total	35

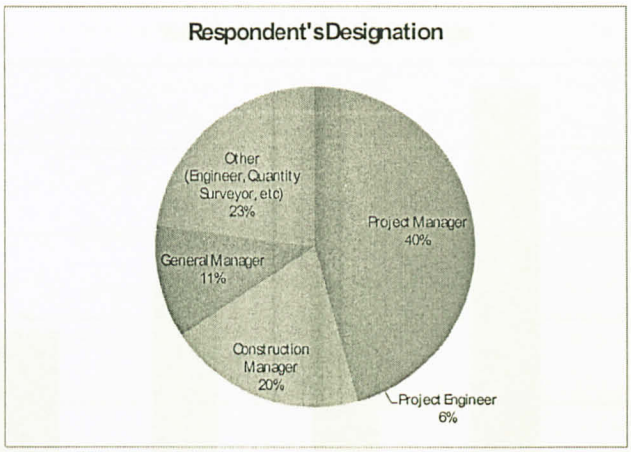

Figure 4.1.4: Respondent's designation

From Figure 4.1.4 above, 40% from the total respondents are Project Manager. Second highest respondents are Engineer, Quantity Surveyor and etc which fall into group of Other. 20% from the respondents are Construction Manager and 11% are General Manager. Finally 6% from the respondents are Project Engineer. Most of the respondents are from managerial level. 40% from the overall respondents are project managers. There are even managing director and general manager that respond to the questionnaire. From the positions that the respondents held, it can be logically assumed that the answers given is from experienced workers. Furthermore, it can also be assumed that the experience and high level of technical knowledge is required to answer the questionnaire.

4.1.5 Respondent's Experience:

Table 4.1.5: Respondent Experience:

Experience (Years)	No. of Respondents
Less than 5	5
5 - 10	6
10 - 15	6
15 – 20	10
More than 20	8
Total	35

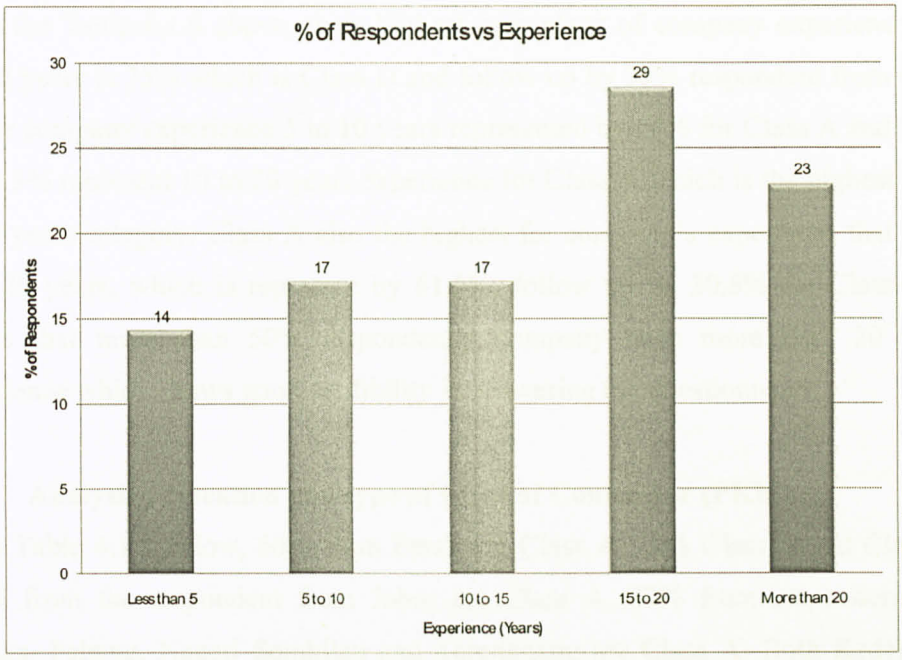

Figure 4.1.5: Respondent experience

There are 29% from the respondents have 15 to 20 years experience, follow up by the 23% which represent more than 20 years experience. 17% from the respondents represent 5 to 10 years and 10 to 15 years experience. The minimum respondent is 14% which represent respondent's experience less than 5 years. Half of the respondents have more than 15 years experience in building construction. Therefore the credibility of the respondent's answers or comment cannot be denied.

4.1.6 Analysis of Class of Contractor PKK and experience:

Table 4.1.6: Analysis of Class of Contractor PKK and experience

Experience	Number of Respondent Class of Contractor (PKK)								Total
	A		B		C		D		
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	
Less than 5	0.0	0.0	1.0	25	0.0	0.0	3.0	75	4
5 - 10	3.0	50	0.0	0.0	3.0	50	0.0	0.0	6
10-20	10.0	83.3	0.0	0.0	1.0	8.3	1.0	8.3	12
More than 20	8.0	61.5	4.0	30.8	0.0	0.0	1.0	7.7	13

From the Table 4.1.6 above, there highest percentage of company experience less than 5 years is 75% which is Class D and follow up by 25% respondent from Class B. For company experience 5 to 10 years represented by 50% for Class A and Class C. 83.3% represent 10 to 20 years experience for Class A which is the highest in 10 to 20 years category. Class A also the highest for company's experience that more than 20 years, which is represent by 61.5%, follow up by 30.8% for Class B. It shows that more than 50% respondent's company have more than 20 years experience which shows good credibility in answering the questionnaire.

4.1.7 Analysis of location and type of Class of Contractor (PKK):

From Table 4.1.7 below, 60% from Perak are Class A, 20% Class B and Class C. 100% from the respondent from Johor are Class A. 67% from respondents for Melaka, Pahang, Negeri Sembilan and Terengganu are Class A. Both Kedah and Pulau Pinang, have 50% respondent each for Class A and Class D. Perlis have equally distribute respondents for Class A, Class B and Class C. The questionnaire collected for Perak is the highest compare to other state because due to the location of the author studied, UTP which is in Perak and the contractor more concern and alert about the important of the survey which conducted by the student of this university. Therefore Perak got the highest collected questionnaire.

Location	Number of Respondent Class of Contractor (PKK)								Total
	A		B		C		D		
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	
Perak	6	60	2	20	2	20	0	0	10
Johor	2	100	0	0	0	0	0	0	2
Melaka	2	67	1	33	0	0	0	0	3
Pahang	2	67	0	0	0	0	1	33	3
Kelantan	1	50	0	0	1	50	0	0	2
Negeri Sembilan	2	67	0	0	0	0	1	33	3
Selangor	2	100	0	0	0	0	0	0	2
Terengganu	2	67	1	33	0	0	0	0	3
Kedah	1	50	0	0	0	0	1	50	2
Perlis	1	33	1	33	1	33	0	0	3
Pulau Pinang	1	50	0	0	0	0	1	50	2

Table 4.1.7: Analysis of location and type of Class of Contractor (PKK)

4.2 Awareness and level of usage of Computer Tools for construction activities

4.2.1 Awareness:

Table 4.2.1: Awareness of the availability of Computer Tools for construction activities

Awareness	No of Respondents
Yes	35
No	0
Total	35

Figure 4.2.1 below shows that, all of the respondents aware of the availability of Computer Tools. The truth of answering the question can be determine by referring to the answer of question number three, refer appendix. All the respondents providing the name of software that they have in their company. Therefore the credibility of the respondent's answers towards awareness cannot be denied.

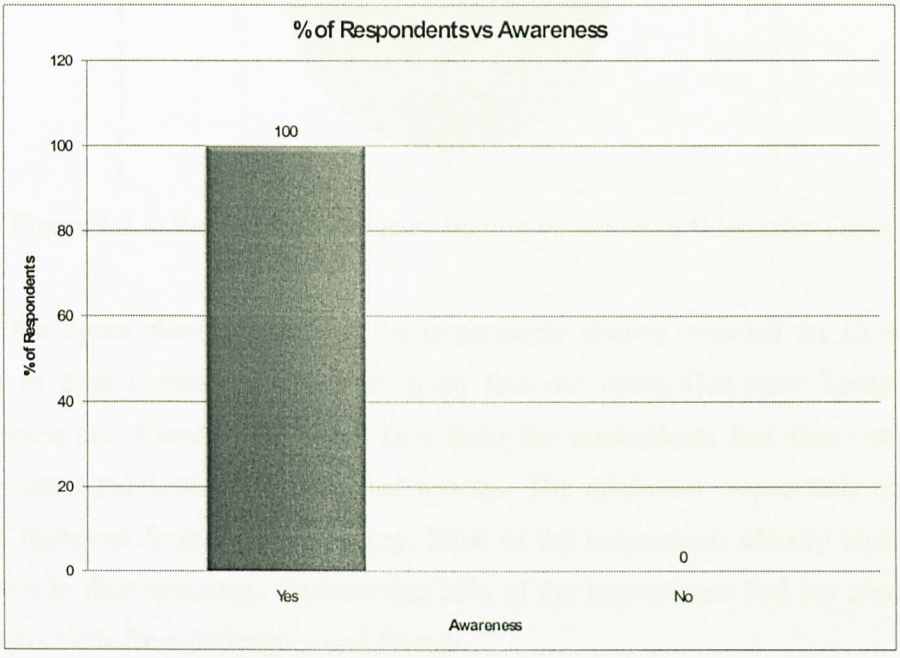

Figure 4.2.1: Respondent awareness of the availability of Computer Tools

4.2.2 Sources of finding out about the Computer Tools:

Table 4.2.2: Sources of finding out about the Computer Tools

Sources of Computer Tools	No of Respondents
Already installed in company	17
Colleagues and friends	16
Professional publication, journals and articles	8
Others	3
Total	44

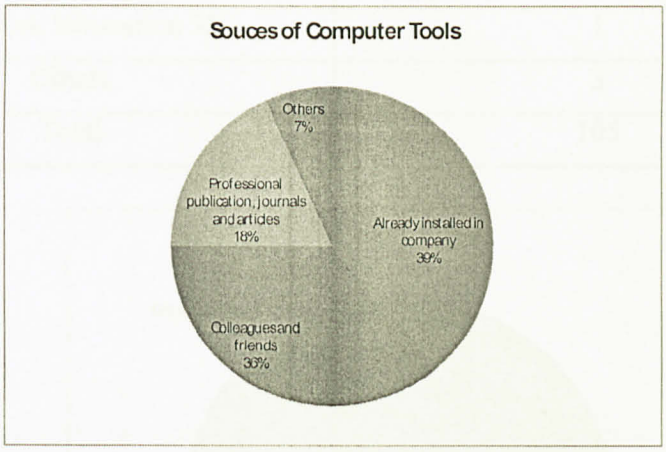

Figure 4.2.2: Respondent source of finding out about of Computer Tools

From the figure above, 39% from the respondents already installed the Computer Tools in their company. 36% from them find out about Computer Tools from colleagues and friends. There are 18% from the respondents that find out from professional publication, journals and articles. The minimum respondents are 7% which represent from Others category. Most of the respondents already install the software in their company. Besides that 38% of the respondents find out about the computer tools from colleagues and friends.

4.2.3 Computer Tools that available in the company:

Table 4.2.3: Computer Tools that available in the company

Computer Tools	No of Respondents
Microsoft Project	35
Microsoft Office	35
A CAD Drawing	24
Crane Simulation 3D	1
Primavera	6
Bid4Build	0
VirtualBoss	0
Earthwork Estimation 3D	1
Others	3
Total	105

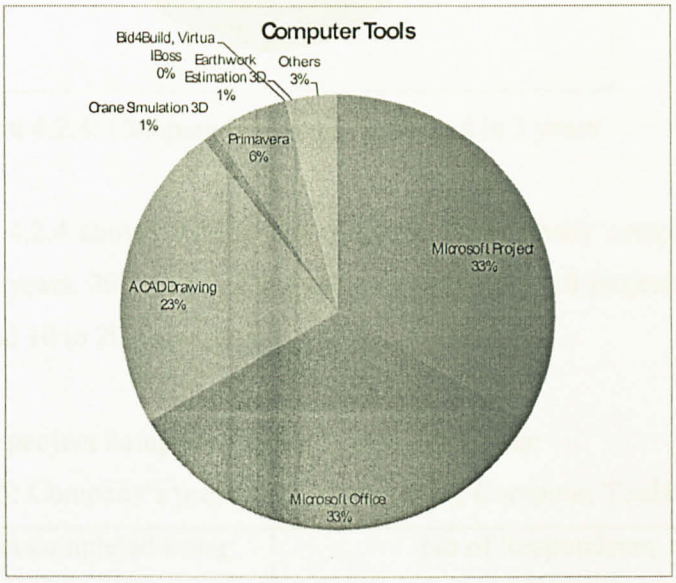

Figure 4.2.3: Computer Tools that available in respondent company

Microsoft Project and Microsoft Office are the major Computer Tools available in respondent company. The second highest popular Computer Tool is ACAD Drawing, 23% follow up by the Primavera, 6%. There are no respondent using Build4Build and VirtualBoss in their projects.

4.2.4 Company's project completed in 3 years:

Table 4.2.4: Company's project completed in 3 years

Company's project completed (Years)	No of Respondents
Less than 5	26
5-10	7
10-20	2

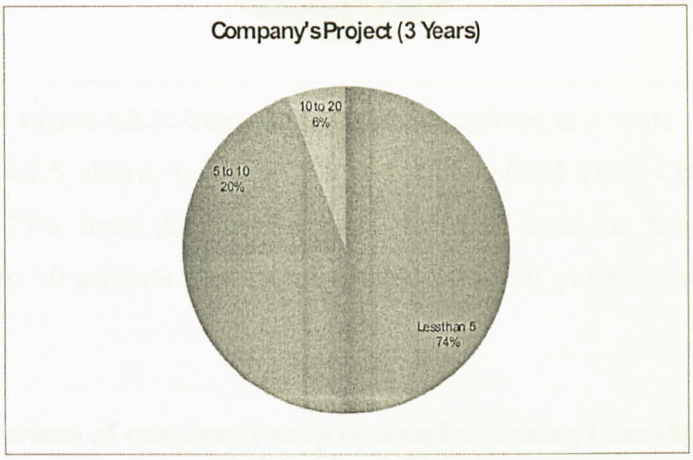

Figure 4.2.4: Company's project completed in 3 years

Referring to Figure 4.2.4 above, 74% of the respondent's company completed less than 5 projects in 3 years. 20% of the company completed 5 to 10 projects and 6% from them completed 10 to 20 projects in 3 years.

4.2.5 Company's project completed using Computer Tools:

Table 4.2.5: Company's project completed using Computer Tools

Company's project completed using Computer Tools (Years)	No of Respondents
Less than 5	25
5-10	9
10-20	1

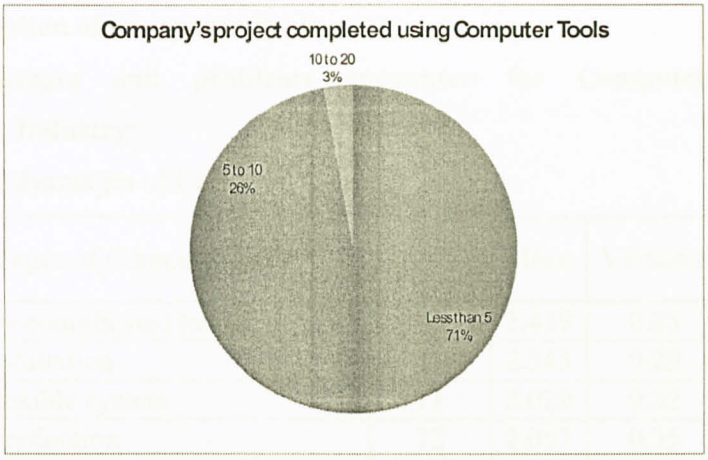

Figure 4.2.5: Company's project completed in 3 years

From Figure 4.2.5 above, less than 5 projects completed using Computer Tools represent by 71% from the total respondents. 26% from the total respondents completed 5 to 10 projects and 3% completed 10 to 20 projects using Computer Tools.

4.2.6 Comparison of company's project completed using Computer Tools

Table 4.2.6: Comparison of company's project completed using Computer Tools

No of Project completed	No of Project completed using Computer Tools	Percentage of Project completed using Computer Tools
153	122	80 %

From table 4.2.6 above, 122 projects were completed from 153 projects using Computer Tools in 3 years, which shows that 80% from the total aware and knows on how to use the Computer Tools. It is a good indicator of the application of Computer Tools in construction industry in Malaysia.

4.3 Perception of Computer Tools

4.3.1 Advantages and problems encounter for Computer Tools in Construction Industry:

Table 4.3.1: Advantages of Computer Tools

	Advantages of Computer Tools	Total, Σ	Mean	Variance	Ranking
1	Simplify complicated tasks	85	2.429	0.25	1
2	Easy Installation	82	2.343	0.29	2
3	Open/flexible system	71	2.029	0.32	4
4	Labour reduction	72	2.057	0.35	3
5	Time Saving	82	2.343	0.29	2
6	Reduce risk	70	2.000	0.41	5
7	Lowering total construction cost	71	2.029	0.38	4

Table 4.3.2: Problems of Computer Tools in Construction Industry

	Problems of Computer Tools in Construction Industry	Total, Σ	Mean	Variance	Ranking
1	Insufficient personnel concerning knowledge of Computer Tools in industry	75	2.14	0.30252	1
2	Insufficient Computer Tools manufacturer in industry	62	1.77	0.29916	2
3	Expensive	75	2.14	0.42017	1
4	Resistance to change (prefer conventional system)	62	1.77	0.35798	2
5	Failure of technology transfer (i.e. no standard,guidelines etc.)	65	1.86	0.42017	3

The perception of Computer Tools can be divide into two major groups that is advantages, Table 4.3.1 and disadvantages or problems, Table 4.3.2. Using statistical analysis, its shows that the variance is very small which is less than 1.00, therefore the result or the analysis is acceptable. The most popular factor that respondents choose towards advantages of Computer Tools is simplifying complicated tasks. Expensive and insufficient personnel concerning knowledge of Computer Tools in industry are the most popular factors that respondents choose.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

I. As a conclusion, the objectives to investigate the awareness of the availability of Computer Tools, to investigate the level of usage of Computer Tools and to investigate the perception of Computer Tools in constructions field is achieved with good response of the survey respondents.

II. The result from the analysis shows that all the respondents aware of the availability of the Computer Tools.

III. 80% from the respondents use Computer Tools in completing their projects in 3 years which shows good indication of the level of usage of Computer Tools.

IV. The respondents also shows that simplify complicated task is the most popular perception for the advantages of Computer Tools and the most popular perception of problems chosen by the respondents are expensive and insufficient personnel concerning knowledge of Computer Tools in industry.

V. 39% of the respondents already installed Computer Tools in their company.

5.2 RECOMMENDATION

Below are some recommendation to improve the awareness and application of Computer Tools in construction industry:

I. Responsible parties in construction industry like CIDB, PKK and government should promote the effectiveness of the Computer Tools in helping contractors simplify their routine task.

II. Conduct seminar or briefing to all Director or General Manager for Construction Company in Malaysia in order to introduce and guide them to implement Computer Tools in their company.

III. Government should give discount on the taxes charged to the Computer Tools in Malaysia.

IV. Establish stand alone society for Computer Tools in order to enhanced the skills and provide a medium for contractors to learn and discuss about Computer Tools.

REFERENCES

M. Al-Hussein, M. Athar Niaz, Haitao Yu, Hyoungkwan Kim *Integrating 3D visualization and simulation for tower crane operations on construction sites,* July 2005.

Y.H.Chiang, Michael Anson, John Raftery *The Construction Sector in Asian Economies* , 2004.

Frank Harris, Ronald McCaffer *Modern Construction Mangement*,2006

Angus Stevension 2002, *The Little Oxford English Dictionary,* UK, Oxford UniversityPress.

Ming Sun, Robert Howard, Rob Howard 2004, *Understanding I.T. in construction,* Taylor & Francis

Neil Scott, David Ponniah and Ben Saud, Vol. 12 No. 4 1993/4 *Computing and the Construction Industry*

Al Hammad, AM (2000) Common Interface Problems Among Various Construction Facilities wl 14 Issue 2 PP 71-74

APPENDIX

	Advantages of Computer Tools	Respondent																																		Total,?	Mean	Variance	Ranking
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35				
1	Question 1 Yes	3	2	2	2	2	3	3	2	3	3	3	2	2	2	3	2	2	3	2	2	2	2	3	3	2	3	3	2	2	2	2	3	3	3	2	85	2.429	0.252101	1
2	Easy Installation	3	2	2	3	2	3	3	2	2	2	3	2	2	2	1	2	2	3	2	2	2	2	3	3	2	3	3	2	2	2	2	3	3	2	3	82	2.343	0.290756	2
3	Open/flexible system	1	2	1	2	2	3	3	2	2	1	2	2	2	2	1	2	2	3	2	2	2	2	3	2	2	3	3	2	2	2	2	1	2	2	2	71	2.029	0.322689	4
4	Labour reduction	2	2	2	2	2	1	3	1	2	3	3	2	2	3	2	2	2	3	1	2	1	2	3	2	1	2	3	2	2	2	2	2	2	2	2	72	2.057	0.34958	3
5	Time Saving	3	2	2	3	2	2	3	2	3	2	3	2	2	2	3	2	2	3	2	2	2	3	3	2	1	2	3	2	2	2	2	3	3	3	2	82	2.343	0.290756	2
6	Reduce risk	1	2	1	3	1	1	3	1	2	1	3	2	2	2	3	2	2	3	2	2	2	2	3	2	1	2	2	2	2	2	2	2	2	3	2	70	2	0.411765	5
7	Lowering total construction cost	2	2	1	3	2	1	3	1	3	2	3	2	2	2	2	2	2	3	1	2	2	2	3	2	1	2	1	2	2	2	2	3	2	2	2	71	2.029	0.381513	4

	Problems of Computer Tools in Construction Industry	Respondent																																			Total, Σ	Mean	Variance	Ranking
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35				
1	Insufficient personnel concerning knowledge of Computer Tools in industry	2	2	2	2	1	3	1	2	2	2	1	2	2	2	2	2	2	2	2	3	2	2	2	3	2	3	3	3	3	2	2	2	2	2	3	75	2.143	0.302521	1
2	Insufficient Computer Tools manufacturer in industry	2	2	2	2	1	2	2	1	3	1	1	2	2	1	2	2	2	1	2	2	2	1	2	2	2	2	1	3	1	2	2	2	2	2	1	62	1.771	0.29916	2
3	Expensive	2	2	3	2	2	1	2	2	2	2	1	1	2	2	3	2	2	1	3	2	3	2	2	3	3	2	3	2	2	3	2	3	1	2	3	75	2.143	0.420168	1
4	Resistance to change (prefer conventional system)	2	2	2	2	2	1	2	2	2	3	1	2	3	2	2	2	2	1	1	2	1	1	2	3	2	1	2	2	1	1	2	1	1	2	2	62	1.771	0.357983	2
5	Failure of technology transfer (i.e. no standard,guidelines etc.)	2	2	3	2	1	1	3	2	2	2	1	2	3	1	2	2	2	1	2	3	1	1	2	2	2	1	2	2	1	2	3	2	1	2	2	65	1.857	0.420168	3

Perception of Computer Tools : Detail for Table 4.31 and Table 4.32

Perceptions of Computer Tools in Construction Site in Malaysia

Computer Tools are software that have been widely used in various civil engineering applications such as for project planning, design and maintenance activities. Its have been proven to be able to help engineers in performing tedious or complicated calculations or smoothen their routine work, thereby saving the time and cost. Over the years, quite a numbers of computer tools for use during construction stage have been developed and available in Malaysian market such as given in Section A of this questionnaire. However it has been observed that in construction site computer tools are not being used widely as in other civil engineering activities such as design. The main objective of this study is to investigate the awareness of the availability of computer tools for construction stage, level of usage of computer tools and perception of computer tools in helping constructions work in Malaysia.

The questionnaire is divided into 3 sections which are A, B and C. Please answer the questionnaire by referring to every section's instructions.

Section A: General / Background Information

Please fill in the blanks and tick in [ ] provided.

1. Name of Company: _____

2. What is the nature of your business?

[✓] Contractor [ ] Consultant

[ ] Developer

[ ] Other: _____

3. Class (if applicable, for contractor):

a. PKK A[✓] B[ ] B[ ] C[ ] D[ ] E[ ] F[ ]

b. CIDB G1[ ] G2[ ] G3[ ] G4[ ] G5[ ] G6[ ] G7[✓]

4. Company's experience in construction project? (Years)

<5 [ ] 5-10 [ ] 10-20 [ ] >20 [✓]

5. What is your designation with the company?

[ ] Project Manager [ ] Construction Manager

[ ] Project Engineer

[ ] Other: Project Director.

6. Your experience in construction project? 20 Years

Section B: Awareness and level of usage of Computer Tools for construction activities

Please fill in the blanks and tick in [ ] provided.

1. Are you aware of the availability of Computer Tools for construction activities?

[✓] Yes [ ] No

2. Where do you heard or learned about computer tools for construction before?

[✓] Already installed in company

[✓] From colleagues and friends

[ ] Professional publications, journal and articles

[ ] Other, please state_____

3. Computer Tools available in your company:

(Please write and / tick according to the availability)

[✓]	Microsoft Project	[ ]	Primavera
[✓]	Microsoft Office	[ ]	Bid4Build
[ ]	A CAD Drawing	[ ]	Virtualboss
[ ]	Crane Simulation 3D	[ ]	Earthwork Estimation 3D

[ ] Other: a) _____

b) _____

c) _____

d) _____

e) _____

4. How many projects have your company completed in 3 years? 8

5. How many of those projects were completed which included the use of Computer Tools in construction? 8

Section C: Perception of Computer Tools.

Please give your comments by ticking the appropriate number according to scale given:
[1] Don't Agree [2] Agree [3] Very Much Agree

1. Advantages of Computer Tools

i)	Simplify complicated tasks	[ ] 1	[✓] 2	[ ] 3
ii)	Easy installation	[ ] 1	[✓] 2	[ ] 3
iii)	Open / flexible system	[ ] 1	[✓] 2	[ ] 3
iv)	Labour reduction	[ ] 1	[✓] 2	[ ] 3
v)	Time Saving	[ ] 1	[✓] 2	[ ] 3
vi)	Reduce Risk	[ ] 1	[✓] 2	[ ] 3
vii)	Lowering total construction cost	[ ] 1	[✓] 2	[ ] 3

Other advantages, if any: _____

_____

2. Problems of Computer Tools in Construction Industry

i)	Insufficient personnel concerning knowledge of Computer Tools in industry	[ ] 1	[ ] 2	[✓] 3
ii)	Insufficient Computer Tools manufacturer in industry	[ ] 1	[ ] 2	[✓] 3
iii)	Expensive	[ ] 1	[✓] 2	[ ] 3
iv)	Resistance to change (prefer conventional system)	[ ] 1	[✓] 2	[ ] 3
v)	Failure of technology transfer (i.e. no standards, guidelines etc.)	[ ] 1	[✓] 2	[ ] 3

Other problems, if any: _____

_____

_____

Section D: Feedback

1) Please indicate whether you wish to receive a copy of the result of this study

[ ] Please send me a copy of the result
[ ] Please do not send me the copy of the result.

2) If you need further information, please contact Ikmal Hisyam Bin Mubarak at 012-7729284 or email to ir_ikmal@yahoo.com

Thank you for your time and cooperation in completing the questionnaire.