

A STUDY ON THE CAUSES AND METHODS TO PREVENT CONSTRUCTION  
DELAY IN SELANGOR STATE AND KUALA LUMPUR

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UNIVERSITI MALAYSIA PAHANG

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**JUDUL:** A STUDY ON THE CAUSES AND METHODS TO PREVENT CONSTRUCTION DELAY IN SELANGOR AND KUALA LUMPUR

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A STUDY ON THE CAUSES AND METHODS TO PREVENT CONSTRUCTION  
DELAY IN SELANGOR STATE AND KUALA LUMPUR

YAP QING FU

A thesis submitted in partial fulfilment  
of the requirement for the award of the degree of  
Bachelor of Civil Engineering

Faculty of Civil Engineering & Earth Resources  
Universiti Malaysia Pahang

JUNE 2013

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“I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Bachelor of Civil Engineering.”

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I declare that this thesis entitled “*A Study on the causes and methods to prevent construction delay in Selangor State and Kuala Lumpur*” 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 concurrently submitted in candidature of any other degree.

Signature : .....

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## **ABSTRACT**

Construction delays are one of the biggest problems construction industries face, it will directly affect the parties involved in the contract, contribute to cost and time overruns, litigation and late in project transfer to owner. Therefore, in order to reduce and prevent delay in construction, it is important to determine the real causes of construction delay. The main objectives of this study are to identify the causes and methods to prevent construction delay in Selangor state and Kuala Lumpur. This study was carried out by conducting literature review and questionnaire survey. There are 29 causes and 15 methods to prevent construction delays have been identified in literature review state and the causes of construction delays have been grouped into eight major groups. The survey questionnaires were distributed to the developer, consultant and contractor in Selangor state and Kuala Lumpur. The main objectives in this research have been achieved. The major group of delays which contributes the most in the construction delays is contractor related delays. The top five causes of delays are unforeseen site condition, finance and payments of completed work, site management, delays caused by subcontractor, improper planning and errors during construction. While the top five methods to prevent construction delays are frequent progress meeting, effective strategic planning, frequent coordination between the parties involved, proper project planning and scheduling and collaborative working in construction.

## **ABSTRAK**

Kelewatan pembinaan adalah salah satu masalah terbesar dalam industri pembinaan, ia secara langsung akan memberi kesan kepada pihak yang terlibat dalam kontrak, menyumbang kepada penggunaan kos dan masa yang berlebihan, litigasi dan lewat dalam pemindahan projek kepada pemilik. Oleh itu, dalam usaha mengurangkan dan mengelakkan kelewatan pembinaan, ia adalah penting untuk menentukan punca sebenar kelewatan pembinaan. Objektif utama kajian ini adalah untuk mengenal pasti punca dan kaedah untuk mengelakkan kelewatan pembinaan di negeri Selangor dan Kuala Lumpur. Kajian ini telah dijalankan dengan menjalankan kajian literatur dan kajian soal selidik. Terdapat 29 punca dan 15 kaedah untuk mencegah kelewatan pembinaan telah dikenal pasti dalam peringkat kajian literatur, 29 punca kelewatan pembinaan diatas telah dikumpulkan ke dalam lapan kumpulan utama. Kajian soal selidik telah diedarkan kepada pemaju, perunding dan kontraktor yang bertapak di negeri Selangor dan Kuala Lumpur. Objektif utama dalam kajian ini telah tercapai. Kumpulan utama yang menyumbang paling banyak dalam kelewatan pembinaan adalah kelewatan berkaitan dengan kontraktor. Lima punca utama yang menyebabkan kelewatan pembinaan adalah keadaan tapak yang tidak diduga, kewangan dan pembayaran terhadap kerja yang telah diselesaikan, pengurusan tapak, kelewatan yang disebabkan oleh subkontraktor serta perancangan yang tidak betul dan kesilapan semasa pembinaan. Di samping itu, lima kaedah utama untuk mencegah kelewatan pembinaan adalah mengadakan mesyuarat kemajuan yang kerap, perancangan strategik yang berkesan, penyelarasan yang kerap antara pihak-pihak yang terlibat dalam pembinaan, perancangan dan penjadualan projek yang betul serta kerjasama dalam pembinaan.



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**LIST OF SYMBOLS**

I	-	Relative Importance Index
$W_i$	-	Weight assigned to $i$ th response
$X_i$	-	Frequency of the $i$ th response given as percentage of the total responses for each factors
$i$	-	Response category index = 1, 2, 3, 4, 5

## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

Delay as an act or event that extends the time required to perform the tasks under a contract. It usually shows up as additional days of work or as a delayed start of an activity.<sup>1</sup> Moreover, as Assaf and Al-Hejji<sup>2</sup> state:

In construction, delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases.<sup>2</sup>

In addition, delay in construction project is considered one of the most common problems causing a multitude a negative effect on the project and its participating parties.<sup>3</sup> Therefore, in order to reduce and prevent delay in construction, it is important to determine the real causes of construction delay.



## 1.2 Background of Proposed Study

Assaf and Al-Hejji<sup>2</sup> state:

Completing construction projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it is rarely happen that a project is completed within the specified time.<sup>2</sup>

Delays are one of the biggest problems construction firms face. Delays can lead to many negative effects such as lawsuits between owners and contractors, increased costs, loss of productivity and revenue, and contract termination.<sup>4</sup> In addition, the time required to complete construction of public projects is frequently greater than the time specified in the contract.<sup>5</sup> Other than that, many projects experience extensive delays and thereby exceed initial time and cost estimates. In addition to imparting the economic feasibility of capital projects, extensive delays provide a fertile ground for costly disputes and claims.<sup>6</sup>

Doloi, Sawhney, Iyer and Rentala<sup>7</sup> state that :

Construction projects in India are experiencing widespread delays. Due to a dramatic shift in the capacity and volume of the Indian construction sector over the last decade, the need of a systematic analysis of the reasons of delays and developing a clear understanding among the industry professionals are highly crucial.<sup>7</sup>

Delay is a global phenomenon since decades ago, only 30% of construction projects were completed within the scheduled completion dates and that the average time overrun was between 10% and 30% in Saudi Arabia.<sup>2</sup> While the performance of the construction industry in terms of time was poor in Nigeria.<sup>8</sup> Furthermore, seven out of ten projects surveyed in Nigeria suffered delays in their execution.<sup>9</sup>

Therefore a lot of research around the world carried out research in construction delays, Ogunlana and Promkuntong<sup>10</sup> shown that Thailand facing the construction delay problem. While Al-Momani<sup>5</sup> had analyzed on construction delays in Jordan. Next, Frimpong, Oluwoye and Crawford<sup>11</sup> had identified and evaluated the significant factors contributing to delay and cost overruns in Ghana groundwater construction projects. Other than that, Chan and Kumaraswamy<sup>12</sup> had carried out survey in Hong Kong construction industry in term of delay.

Construction delay will directly affect the parties involved in the contract, contribute to cost and time overruns, litigation, and late in project transfer to owner.

### **1.3 Problem Statement**

As mentioned before, construction delays is a global phenomenon, Malaysia is included. The latest big construction project which is delays in Malaysia is the Penang Second Bridge. It was started construction on November 2007 and scheduled to complete on 2011, but it was delayed and expected to completion on May 2012 and however it was again rescheduled the completion date to November 2013.<sup>13</sup> Furthermore, the estimated price for the Penang Second Bridge is initially RM 3.6 billion but after delays occurs the price increases to RM 4.3 billion.<sup>14</sup> Delays in construction project not only increases the cost of the project, but it is also arise the dispute among the contractor and owner due to late handling over completed project and increased cost of project.

In order to improve the construction delays in Malaysia, lastly Sambasivan and Yau<sup>15</sup> studied the causes and effects of delays in Malaysian Construction Industry. Next Naha<sup>16</sup> carried out study the reason and impact of construction delay in Johor Bahru. Furthermore, Kang<sup>17</sup> studied causes, effect and methods of minimizing delay in construction projects. Next, Othman, Torrance and Hamid<sup>18</sup> studied factors influencing the construction time of civil engineering projects in Malaysia.

## **1.4 Research Objectives**

The main objectives of this study are as follows :

- 1.4.1 To identify the causes of construction delay in Selangor state and Kuala Lumpur.
- 1.4.2 To identify the methods to prevent construction delay in Selangor state and Kuala Lumpur.

## **1.5 Scope of Proposed Study**

The information and data of delay study is collected through literature review and questionnaire. Questionnaires serve as the primary data for analysis purposes in order to achieve the objectives of the study. The respondents to questionnaire are contractors, architects and civil engineer in Selangor state and Kuala Lumpur. The questions is designed mainly focus on the causes of construction delays and methods to prevent construction delay in Selangor state and Kuala Lumpur. The limitation of the study has to do with the extent to which the findings can be generalized. Furthermore, the study does not able to be more specified in term of size of project, because the domains of respondents are too limited for broad generalizations.

## **1.6 Expected Outcome**

This research is expected to give the following outcomes :

- 1.6.1 The causes contribute construction delay in Selangor state and Kuala Lumpur.
- 1.6.2 The methods or solution to prevent construction delay according to respondents' experiences.

## **1.7 Significance of Proposed Study**

This study was conducted for parties involving in construction in Selangor state and Kuala Lumpur. The average units where building plan approval obtained

from the local authority within review years 2006 to 2012, Selangor is the highest and Kuala Lumpur is the fourth high in Malaysia with 29,997 units and 9,127 units respectively<sup>19</sup>. So the demands of studies on construction delay in Selangor state and Kuala Lumpur are high with respect to the number of building plan approval obtained from the local authority. Furthermore, this study is specified in Selangor state and Kuala Lumpur as there is limited latest study focused in there. Sambasivan and Yau<sup>15</sup> were conducted a survey on the causes and effects of delays in Malaysian Construction Industry. The survey was focus on the reasons and impacts to construction project delays in whole Malaysia. In addition, Naha<sup>16</sup> carried out study the reason and impact of construction delay in Johor Bahru. Furthermore, Kang<sup>17</sup> studied causes, effect and methods of minimizing delay in construction projects. Next, Othman et al.<sup>18</sup> studied factors influencing the construction time of civil engineering projects in Malaysia.

## **1.8 Conclusion**

Delay can be defined as the construction projects which need extra time to complete than defined date. Construction delay happens around the world, Malaysia has no exception for this. This research aim to identify the major cause of delay and methods to prevent construction delay by collecting survey from parties involves. Next, the research focuses in Selangor state and Kuala Lumpur. In the other hand, the research may as a reference and guidance to all parties involves in construction industry in Malaysia especially parties involves from Selangor state and Kuala Lumpur.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

According to Assaf and Al-Hejji<sup>2</sup> :

Construction delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as a common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation due to labor cost increases.<sup>2</sup>

Delay can be further classified into critical and non-critical delays, excusable and non-excusable delays, compensable and non-compensable delays and concurrent delays and non-concurrent delays.<sup>20</sup> A contractor may provide an extension of time when excusable delay, for example occurrences beyond his control, occurred. Other than that, causes of delay can be categorized into causes of delay by owner, causes of delay by consultant, causes of delay by contractor, causes of delay by material, causes of delay by equipment, causes of delay by worker, causes of delay by contract and causes of delay by external factors.<sup>6</sup>

In summary, construction delay means the time to complete a project is later than defined project completion time and delay will cause the construction costs arise from scheduled costs. While construction delay can be divided into four types, they are critical and non-critical delays, excusable and non-excusable delays, compensable and non-compensable delays and concurrent delays and non-concurrent delays. Other than that, causes of delay are further classify into eight causes, they are causes by owner, consultant, contractor, material, equipment, worker, contract and external factors.

## **2.2 Types of delay**

As mentioned, there are four principal types of delays: (1) critical and non-critical delays, (2) excusable and non-excusable delays, (3) compensable and non-compensable delays and (4) concurrent delays and non-concurrent delays.<sup>20</sup> In order to determine the delay of a construction project, first determine is the delay is critical or non-critical, second determine the delay is excusable or non-excusable, third determine the delay is compensable or non-compensable and fourth determine is the delay is concurrent or non-concurrent.

### **2.2.1 Critical Delays versus Non-Critical Delays**

A critical delay can be defined as a delay which causes a project late completion or causes a project progress late behind a defined milestone date. While a non-critical delay refers to delay which does not affect the project in terms of late completion or does not achieve project milestone date. In other words, a delay which does not affect a critical path is not a critical delay. Below are some activities which directly contribute to project completion date<sup>17</sup>:

- a) The construction schedule and critical path
- b) The sequences of works
- c) The experience in carry out construction activities in practical ways
- d) The complexity of project

### 2.2.2 Excusable Delays versus Non-Excusable Delays

An excusable delay can be defined as a delay which is caused by unforeseeable activities and activities out of construction project contractor's control. On the other hand, a non-excusable delay can be defined as a delay which is caused by the activities which is in the contractor's control. According to normal practices in public agency, delay which is caused by the following activities can be considered as excusable delay<sup>17,21</sup>:

- a) Shortage of worker in market
- b) Natural disaster
- c) Owner-directed changes
- d) Unforeseeable site conditions
- e) Abnormal weather
- f) Late approved from local authority
- g) Shortage of material in market
- h) Improper design
- i) Discrepancy in plans and specifications
- j) Late site possession

Delay which is caused by following activities can be considered as non-excusable delay<sup>17,21</sup>:

- a) Improper sequences of workmanship by contractor
- b) Improper coordination between subcontractors and main contractor
- c) Late delivery of material by suppliers in defined date
- d) Insufficient placement of workers

### 2.2.3 Compensable Delays versus Non-Compensable Delays

As Kang<sup>17</sup> states :

A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation. Relating back to the excusable and non-excusable delays, only excusable delays can be compensable. Non-compensable delays mean that although an

excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of whether a delay is compensable must be answered. Additionally, a non-excusable delay warrants neither additional compensation nor a time extension.<sup>17</sup>

In summary, in order to determine the compensability of a delay, at first a contract shall be refer. Normally a contract may be specific types of non-compensable delay. In addition, a non-compensable delay may not allow any additional money to the contractor but may allow an extension of time.

#### **2.2.4 Concurrent Delays**

According to Kang<sup>17</sup>:

The concept of concurrent delay has become a very common presentation as part of some analysis of construction delays. The concurrency argument is not just from the standpoint of determining the project's critical delays but from the standpoint of assigning responsibility for damages associated with delays to the critical path. Owners will often cite concurrent delays by the contractor as a reason for issuing a time extension without additional compensation. Contractors will often cite concurrent delays by the owner as a reason why liquidated damages should not be assessed for its delays. Unfortunately, few contract specifications include a definition of concurrent delay and how concurrent delays affect a contractor's entitlement to additional compensation for time extension or responsibility for liquidated damages.<sup>17</sup>

Concurrent delay can be further classified, for example contractor only permit with a time extension if excusable and non-excusable delays occur concurrently<sup>17</sup>. Furthermore, the contractor will only grant a time extension but not to liquidated damages if excusable delays with compensation delays and excusable delays without compensation delays occur concurrently. Next, the contractor will only permit a time



extension and liquidated damages if both excusable delays with compensation delays and excusable delays with compensation delays occur concurrently.

Although above further classifications may be good for classify delays analysis, but it is work only with conditions, at the early stage the definitions and types of classifications are agree by the parties involved in the construction project and are transforms into contract with proper contract language. Other than this, the types of classifications may not work.

In summary, concurrent delay is use to determine the critical delay of a construction project and assign responsibility to the delay. Next, the definitions of concurrent delay in contract directly affect whether a contractor is entitle with an extension of time or both extension of time and liquidated damages. The concurrent delay is only useful when the definitions of concurrent delay are clearly stated in the contract.

### 2.3 Causes of Delay

Causes of construction delay come from different factors, for example, the technology and method of construction, project management, weather, dispute among parties involves and so on. 29 well-recognized construction delay factors<sup>6</sup> was identified and these causes were categorized into the following eight major groups which are in Table 2.1 :

Table 2.1: List of causes of delay categorized into 8 groups :

#### Group 1: Client related factors:

No.	Factors of delay
1	Finance and payments of completed work
2	Owner interference
3	Slow decision making
4	Unrealistic contract duration imposed by owners

## Group 2 : Contractor related factors:

No.	Factors of delay
1	Delays caused by subcontractor
2	Site management
3	Improper construction methods
4	Improper planning and errors during construction
5	Inadequate contractor experience

## Group 3: Consultant related factors:

No.	Factors of delay
1	Contract management
2	Preparation and approval of drawings
3	Quality assurance
4	Waiting time for approval of test and inspection

## Group 4 : Material related factors:

No.	Factors of delay
1	Quality of material
2	Shortage in material
3	Price fluctuation of material

## Group 5: Labor and equipment related factors:

No.	Factors of delay
1	Labor supply
2	Labor productivity
3	Equipment availability
4	Equipment failure

## Group 6: Contract related factors:

No.	Factors of delay
1	Change orders
2	Mistakes or discrepancies in contract document

## Group 7: Contract relationship related factors:

No.	Factors of delay
1	major disputes and negotiations
2	inappropriate overall organizational structure linking to the project
3	lack of communication between the parties

## Group 8: External factors:

No.	Factors of delay
1	weather condition
2	regulatory changes
3	problem with neighbors
4	unforeseen site condition

## 2.4 Extension of Time (EOT)

A contractor is granted time extension when delay out of his ability occurs<sup>18</sup>. Furthermore, in the Government of Malaysia P.W.D. Form 203A (Rev. 10/83)<sup>21</sup> form of contract provides 11 clauses which allowed the contractor for an extension of time.<sup>17</sup> Those clauses are:

- (a) Extension of time (EOT) due to clause 43a, force majeure;
- (b) EOT due to clause 43b, exceptionally inclement weather;
- (c) EOT due to clause 43c, direction given by Superintending Officer (SO) consequential upon disputes with neighboring owner;
- (d) EOT due to clause 43d, loss or damage occasioned by allowable contingencies;
- (e) EOT due to clause 43e, Superintending Officer's instructions;
- (f) EOT due to clause 43f, contractor not having received in due time necessary instructions, drawings, levels or instructions in regard to the nomination of subcontractors and/or suppliers;
- (g) EOT due to clause 43 g, delays in giving possession of site;
- (h) EOT due to clause 43 h, any action due to local combination of workmen strike, or lockout affecting any of the trades employed upon the works;
- (i) EOT due to clause 43i, delay on the part of artists, tradesmen or others engaged by Government in executing work not forming part of the contract;
- (j) EOT due to clause 43j, contractor's inability, for reasons beyond his control, which he could not reasonably have foreseen at the date of closing tenders;
- (k) EOT due to clause 43k, delays on the part of nominated suppliers.

In summary, a contractor is entitled with an extension of time only when construction delay which is out of contractor's ability occurs. Other than that, in public sector projects, the contractor is entitled with an extension of time only when

the construction delay obeys the eleven clauses provided in P.W.D Form 203A<sup>21</sup> as mentioned.

## **2.5 Liquidated Damage**

As to Kang<sup>17</sup> states :

Liquidated damages clauses have the virtue of informing both parties to a contract in advance what the damages payable for an identified breach will be at the time of entering the contract. This can be equal advantage to the party who must pay the damages as it is to the party receiving the damages. The upper limit of the damages payable is fixed and a party can take this into account in the initial negotiations. It is not uncommon for a contractor who knows he or she cannot complete within the required time to add the liquidated damages equivalent of the time overrun to the tendered price.<sup>17</sup>

In summary, liquidated damage is a clause which is used when the contractor does not complete the work with extended time given after contractor did not completed the work within scheduled date. According to the clause, the contractor will be charged with a daily rate after the provided extended date end until the day which the delayed works completed. The definitions and upper limit of liquidated damages must be clearly stated in the contract at early stage.

## **2.6 Methods to Reduce Construction Delays**

In order to prevent construction delays to be occurred, precautions steps are needed for the owner and contractor in order to minimize the loss of income caused by delays. 15 methods for reduce construction delays<sup>2, 22, 23, 24</sup> has been identified as cited in Kang<sup>17</sup>. Below are the methods. Refer to Table 2.2.

Table 2.2 : Methods to reduce construction delays as cited in Kang<sup>17</sup>.

No.	Methods
1	Frequent progress meeting
2	Use up-to-date technology utilization
3	Use proper and modern construction equipment
4	Use appropriate construction methods
5	Effective strategic planning
6	Proper material procurement
7	Accurate initial cost estimates
8	Clear information and communication channels
9	Frequent coordination between the parties involved
10	Proper emphasis on past experience
11	Proper project planning and scheduling
12	Complete and proper design at the right time
13	Site management and supervision
14	Collaborative working in construction
15	Compressing construction durations

## 2.7 Conclusion

Delays in construction is normal, in some cases delay are just few days later than defined completion date but in some cases the delays are longer than a year. Delays may be cause by different factors, hence causes of delay are further classified into eight groups which are mentioned. Since delays directly contribute to loss of income in both owner and contractor, therefore in order to solve and minimize delay problems, actual causes of delay must be identified first, than only a proper method in reducing and preventing delays can be applied. Managing a project within the schedule and budget is a must and important for a success construction project. Therefore, this study aim to identify the cause of construction delay and the methods to prevent construction delays in Selangor state and Kuala Lumpur because the

average units where building plan approval obtained from the local authority within review years 2006 to 2012, Selangor is the highest and Kuala Lumpur is the fourth high in Malaysia with 29,997 units and 9,127 units respectively.<sup>19</sup> This mean the demands of studies on construction delay in Selangor state and Kuala Lumpur are high with respect to the number of building plan approval obtained from the local authority. So, this study aim to fill the gap as there is limited latest study is focused in Selangor state and Kuala Lumpur.

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter aim to describe the process of conducting this study in detail. The details are cover the research design, research instrument, research setting, study population and sample, data collection and data analysis. The raw data will be collected by using the online questionnaire and the questionnaire is design according to the research objectives. Furthermore, the link of the online questionnaire will be sent to respondents through email. Then, the raw data will be analyzed using statistical method. Further discussion will be carried on in below chapters.

#### **3.2 Research Design**

This study is generally an opinion based study, therefore quantitative research design is used with the advantage :

Quantitative research design is an excellent way of finalizing results and proving or disproving a hypothesis. The structure has not changed for centuries, so is standard across many scientific fields and disciplines. After statistical analysis of the results, a comprehensive answer is reached, and the results can be legitimately discussed and published. Quantitative experiments also filter out external factors, if properly designed, and so the results gained can be seen as real and



unbiased. Quantitative experiments are useful for testing the results gained by a series of qualitative experiments, leading to a final answer, and a narrowing down of possible directions for follow up research to take.<sup>25</sup>

The research design is the structure of any scientific work, it gives direction and systematizes the research.<sup>26</sup> The research design of our study is including a few of steps in ascending order. First step is the problems identification, it is the causes of construction delay and the methods to prevent construction delays in Selangor state and Kuala Lumpur. Second step is identify resources, it is to identify the resource use in the study for example literature review which is related to the causes of construction delay and methods to prevent construction delay. Third and fourth steps are the study of population and sampling, the population of respondents is the owners, civil and structures consultants and contractors in Selangor state and Kuala Lumpur while the sampling method is probability samplings. Fifth step is develops the online questionnaire, it is developed according to the research objectives with refers to literature review, in order to collect relevant data from respondents. Sixth step is email the link of the online questionnaire to the respondents. Seventh and eighth steps are collect the online data and analysis them using statistical methods. The last step which is tenth step is to discuss and conclude the whole study. Below is the flow chart, refer to Figure 3.1.

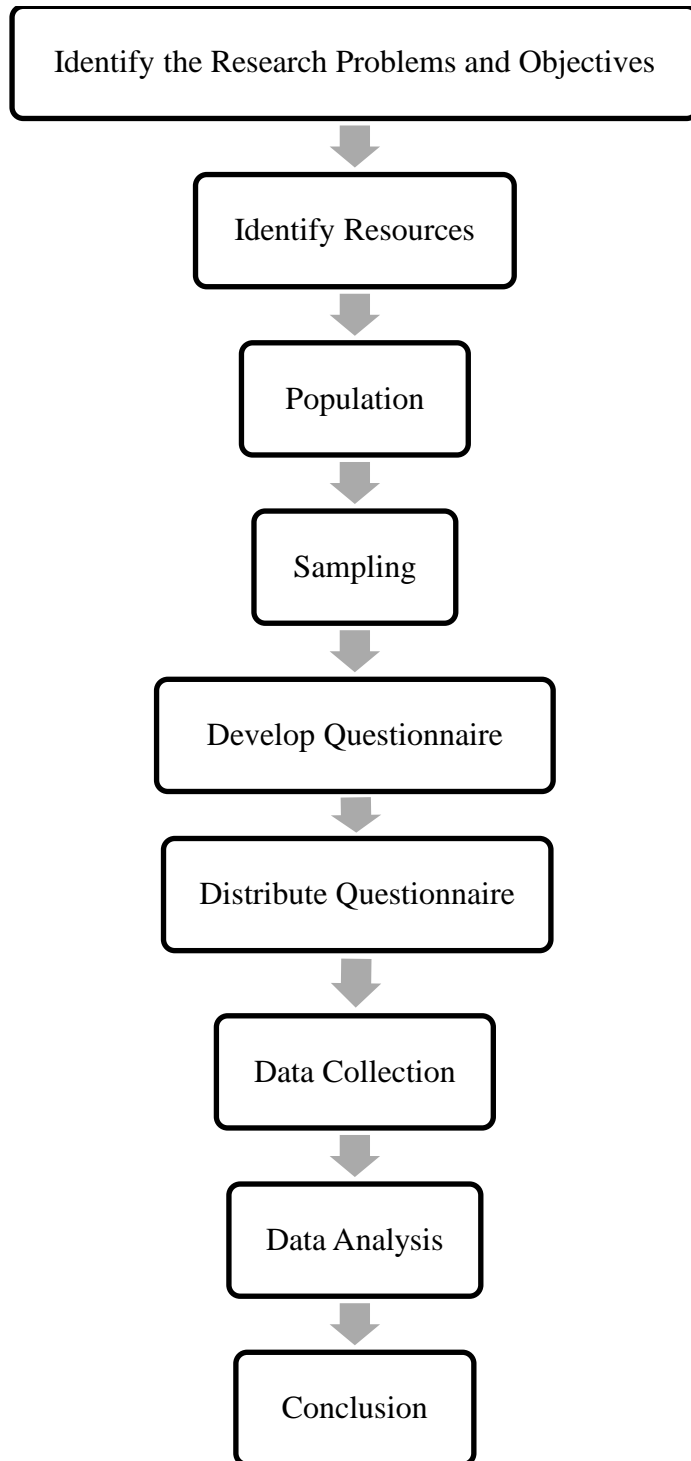


Figure 3.1 : Research flow chart

### **3.3 Research Instrument**

Since this study is generally an opinion based study, therefore a questionnaire is used as a research instrument to collect opinion from the respondents. Shuttleworth<sup>27</sup> states :

Questionnaires are an effective way of quantifying data from a sample group, and testing emotions or preferences. This method is very cheap and easy, where budget is a problem, and gives an element of scale to opinion and emotion. These figures are arbitrary, but at least give a directional method of measuring intensity.<sup>27</sup>

### **3.4 Research Setting**

The research is conducted in the Selangor State and Kuala Lumpur.

### **3.5 Population and Sample**

The population of respondents for the questionnaire is the owners, civil and structures consultants and contractors involved in construction projects in Selangor state and Kuala Lumpur. The sampling method is probability sampling, the simple random sampling method is chosen because it has the advantage of no bias in sampling, all the subjects in the population have an equal chance to be selected as respondents.

### **3.6 Data Collection**

The data collection method of this study is an online questionnaire because an online survey is the systematic gathering of data from the target audience characterized by the invitation of the respondents and the completion of the questionnaire over the World Wide Web.<sup>28</sup> Furthermore, the advantages of an online questionnaire are its ease of data gathering, minimum costs, automation in data input and handling, increase in response rates and flexibility of design.<sup>28</sup> The Google Forms is selected as a web survey tool for this study because:

Google offers a variety of ways to present your Internet questionnaire with its Google Forms. With this free survey service, you can create unlimited number of surveys and acquire more than 1,000 responses. Google Forms also provides various survey themes that may boost the interest of the respondents. Google Forms can be accessed by creating a new form at your Google Docs account.<sup>29</sup>

Furthermore, the other reason google form is selected is because it is free of charge and user friendly.

### 3.7 Data Analysis

The data will be analyzed by using the Relative Importance index (RI) as using by Kang<sup>17</sup>. The Relative Importance index (RI) is uses to indicate rank of causes of construction delays in various factors and also the methods to prevent construction delays in Selangor state and Kuala Lumpur. The procedures in data analysis are computes the relative importance index and ranks the causes of construction delays in various factors and methods to prevent construction delays in Selangor state and Kuala Lumpur.

#### 3.7.1 Relative Importance Index

The Relative Importance Index (RI)<sup>17,18</sup> is computes as below :

$$I = \frac{\sum W_i X_i}{\sum x_i}$$

Where :

I = response category index

W<sub>i</sub> = the weight assigned to ith response = 1, 2, 3, 4, 5, respectively.

X<sub>i</sub> = frequency of the ith response given as percentage of the total responses for each factors.

### **3.8 Conclusion**

In summary, this chapter has describes the research design, research instrument, research setting, study population and sample, data collection and data analysis in detail. The research instrument is important as a guide on how the study carried out, if it is not correct, than the research will be out of the right path. The research instrument is questionnaire because it is effective in collecting data from respondents. The research setting is Selangor state and Kuala Lumpur as mentioned in chapter one. The population of the respondents to questionnaire is the owners, civil and structures consultants and contractors involve in construction project in Selangor state and Kuala Lumpur, while the sampling method is simple random sampling method because it has the advantage of no bias in sampling. Online questionnaire is used in data collection and the google form is uses as data collection instrument because they are economical, efficiency, convenience and save time. The Relative Importance index is uses as the data analysis tool because it is most suitable to rank the importance of causes of construction delays in various factors and methods to prevent construction delays in Selangor state and Kuala Lumpur.

## **CHAPTER 4**

### **ANALYSIS AND DISCUSSIONS**

#### **4.1 Introduction**

Chapter Four shows the data analysis and the discussion based on the collected data from the questionnaire survey. The collected data was analyzed by using the relative important index mentioned in Chapter Three.

#### **4.2 Data Collection**

The survey questionnaires were distributed to the developer, consultant and contractor in Selangor state and Kuala Lumpur in order to identify the causes of construction delay and methods to prevent construction delays in Selangor state and Kuala Lumpur. The questionnaire was completed by respondents which are in different position, they are directors, project managers, site managers, engineers and designers. The number of respondent has been analyzed and shown in table 4.1 and figure 4.1 while the position of respondents in company has been analyzed and shown in table 4.2 and figure 4.2. Besides, the grade of project most frequent involved in delays has been analyzed and shown in table 4.3 and figure 4.3.

According to Table 4.1 and Figure 4.1, there are total of 100 respondents, 41 from developers, 18 from consultants and 41 from contractors. These mean 41% feed backs from developers, 18% feedback from consultants and 41% feed backs from contractors.

Table 4.1 : Group of respondents

Description	Number of respondents	Percentage, %
Developer	41	41
Consultant	18	18
Contractor	41	41
Total	100	100

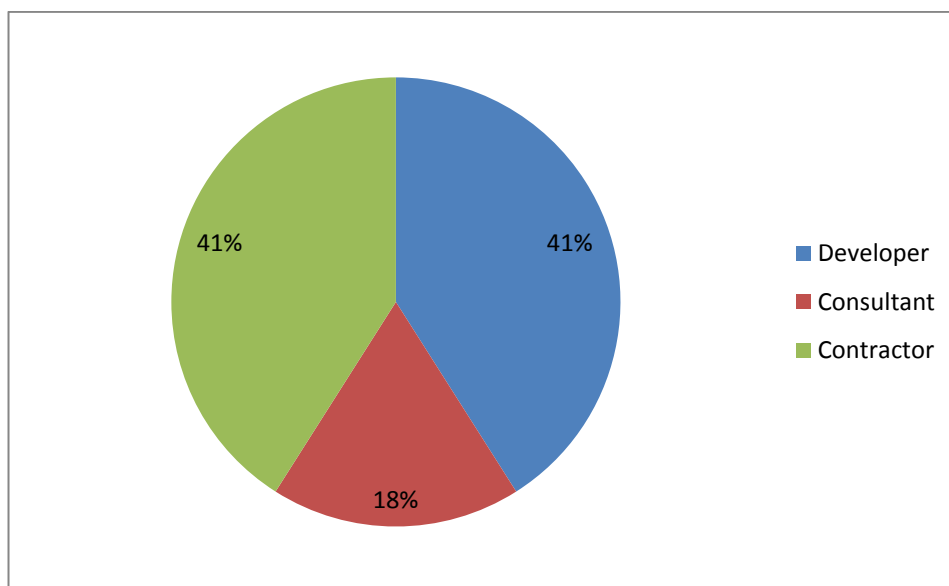


Figure 4.1 : Group of respondents

According to Table 4.2 and Figure 4.2, there are total of 100 respondents, 18 are director, 20 are project manager, 29 are site manager and 33 are engineer and designer. In other word, a total of 100 respondents, 18% are director, 20% are project manager, 29% are site manager and 33% are engineer or designer.

Table 4.2 : Position of respondents in company

Description	number of respondents	Percentage, %
Director	18	18
Project manager	20	20
Site manager	29	29
Engineer and designer	33	33
Total	100	100

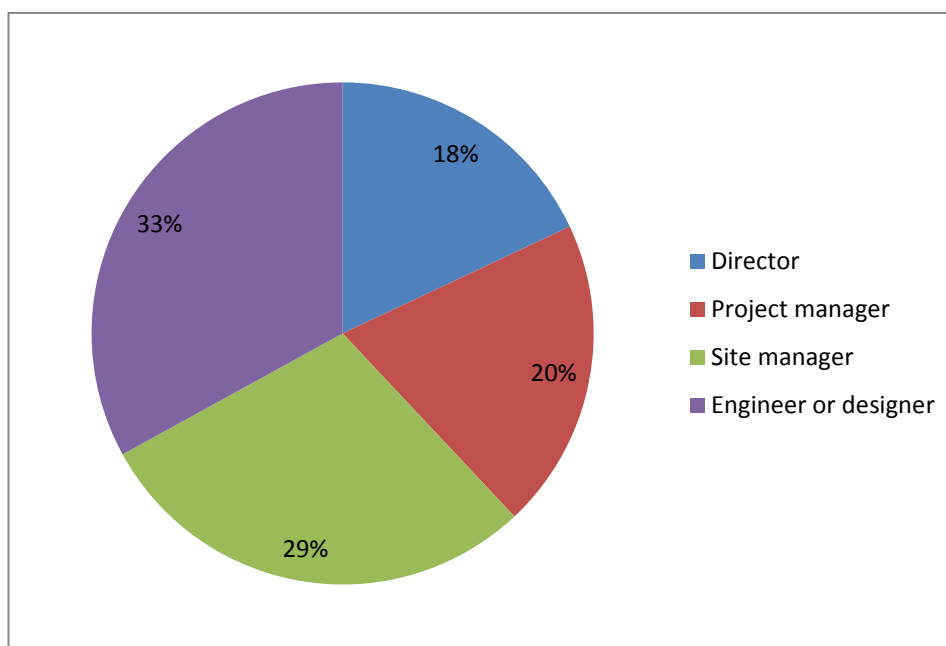


Figure 4.2 : Position of respondents in company



According to Table 4.3 and Figure 4.3, there are total of 100 responses for grade of project most frequent involved in delays according to respondents' experiences. Among the responses, zero response for G1(not more than RM 200,000) and G2(not more than RM 500,000) will be grades of project most frequent involved in delays, while one response for G3(not more than 1,000,000), 11 responses for G4(not more than 3,000,000), 25 responses for G5(not more than 5,000,000), 43 responses for G6(not more than 10,000,000) and 20 responses for G7(no limit). In other word, G1(not more than RM 200,000) and G2(not more than RM 500,000) have zero percent response for grade of project most frequent involved in delays, while G3(not more than 1,000,000) has one percent , G4(not more than 3,000,000) has 11%, G5(not more than 5,000,000) has 25%, G6(not more than 10,000,000) has 43% and G7(no limit) has 20%.

Table 4.3 : Grade of project most frequent involved in delays

Description	Frequency	Percentage, %
G1 – Not more than RM 200,000	0	0
G2 – Not more than RM 500,000	0	0
G3 – Not more than RM 1,000,000	1	1
G4 – Not more than RM 3,000,000	11	11
G5 – Not more than RM 5,000,000	25	25
G6 – Not more than RM 10,000,000	43	43
G7 – No Limit	20	20
Total	100	100

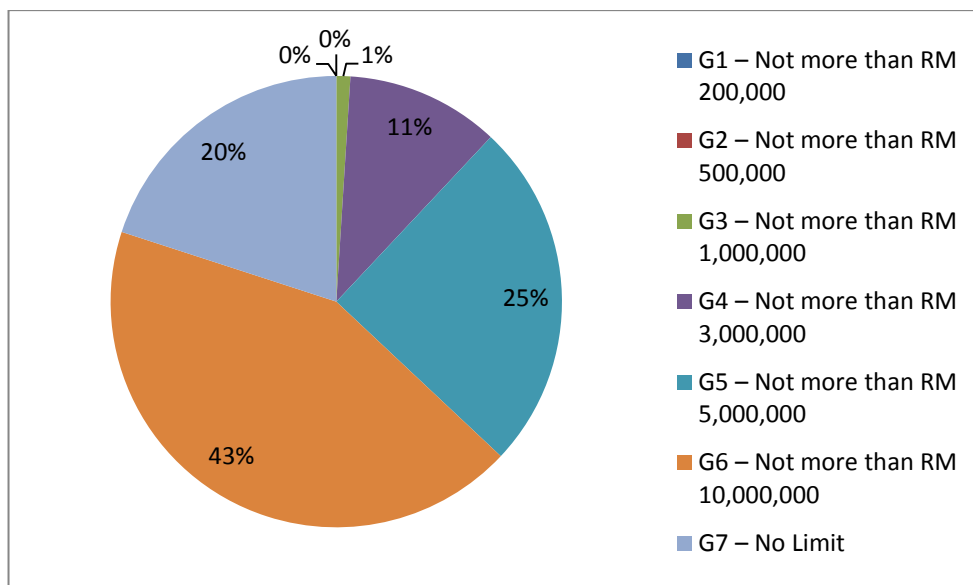


Figure 4.3 : Grade of project most frequent involved in delays

### 4.3 Analysis of Results

The purpose of analyzing result aims to identify the causes of construction delay and methods to prevent construction delays in Selangor state and Kuala Lumpur by using relative importance index. With this, the ranking of the causes contribute to construction delay and the methods of prevent construction delays can be easily establish according to the three group of respondents..

#### 4.3.1 Causes of Construction Delays

The causes of construction delays have been identified in literature review state and grouped into eight major groups. The causes in each group were analyzed and ranked by using relative important index. Below are the discussions on the factors cause construction delays for each group.

##### 4.3.1.1 Causes of Client Related Delays

Table 4.4 shows the ranked causes of client related delays based on relative important index between developers, consultants, contractors and overall for the

three group of respondents. According to Table 4.4 and Figure 4.4, in overall, finance and payments of completed work was ranked first, slow decision making was ranked second and owner interference was ranked third. Finance and payments of completed work is the most important things in construction, in order to continue construction activities, contractor need to pay for the construction material cost, labor cost, equipment rental cost and the finance loan monthly payments. If the developer faces cash flow problem, directly may causes late payment of completed work to contractor and without payment from developer, contractor may failed to pay to labors, materials and equipment suppliers, directly no construction activities can carry on smoothly.

Slow decision making of client also contribute more towards delays, for example in a housing project, the designed staircases has to redesign because the staircases had been obstructed by a primary beam. When the staircases had been redesigned and showed to the owner, the slow decision making by the owner weather to accept the redesign staircases causes pending for consultant to issues design, therefore directly consultant late in issues the design to contractor and directly causes contractor late to continue construction works.

Owner interference causes both the consultant and contractor do not carried out their work professionally and smoothly according to their planning. For example in a housing project with blocks of terrace houses, the contractor planned to start construction for two block at the same time, hence contractor orders materials and supplies labors for the two blocks of terrace houses and start construction work, during the construction of the two blocks terrace houses the owner interferes the contractor by asking the contractor not to construct two blocks terrace houses at once but construct block by block with reason that the owner's company cash flow in difficult, therefore contractor has to reduce the supply of labor and rearrange the planning, directly time wasted and time taken to finish construction works are longer than contractor's schedule.

Table 4.4 : Result of causes of client related delays

Causes of delay	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Finance and payments of completed work	3.73	1	4.22	1	4.44	1	4.11	1
Slow decision making	3.41	3	4	2	4.02	3	3.77	2
Owner interference	3.41	3	3.89	4	4.05	2	3.76	3
Unrealistic contract duration imposed by owners	3.46	2	3.94	3	3.85	4	3.71	4

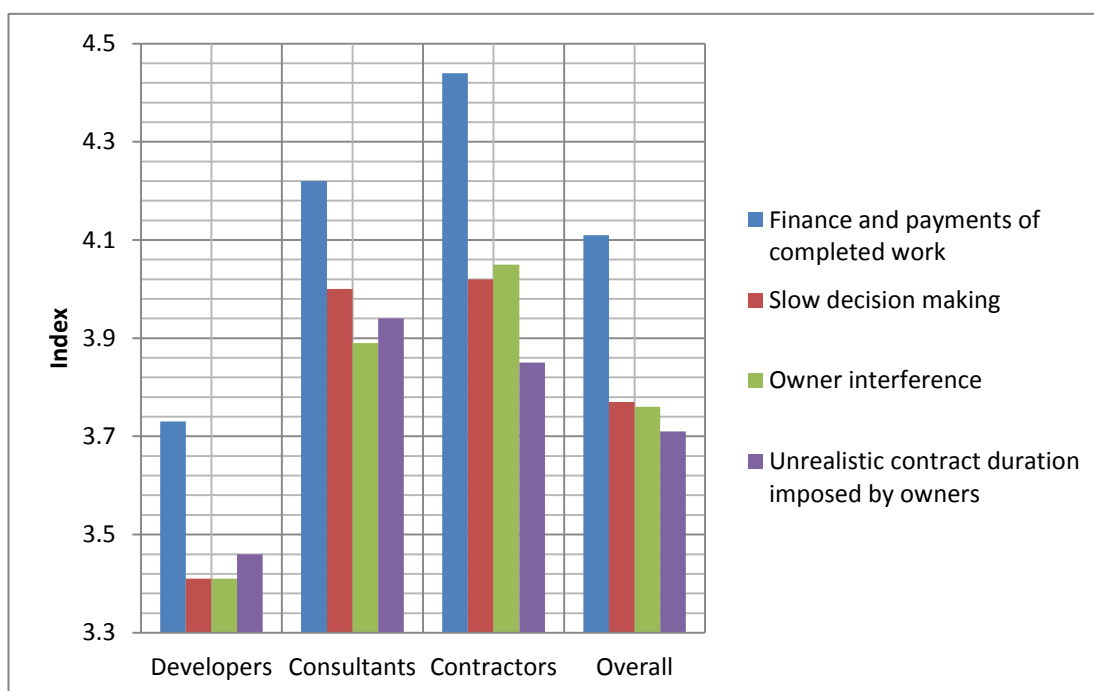


Figure 4.4 : Result of causes of client related delays

#### **4.3.1.2 Causes of Contractor Related Delays**

According to Table 4.5 and Figure 4.5, in overall, site management ranked first among causes of contractor related delays while delays caused by subcontractor ranked second and improper planning and errors during construction ranked third. Site management is the key point in construction activities, improper management of site causes the delays in material delivery to the work site and waste time for subcontractor to wait the other subcontractor leave the work site for them to start their works. Furthermore, improper site management cause the critical task failed to start on time, directly delays occur due to delays on critical path. Delays caused by subcontractor are beginning with poor quality work of subcontractor. A poor quality work cause the subcontractor need to demolish and redo the work, directly causes late completion of subcontractor work, than causes following works delays and it affect the completion date of the project.

Improper planning and errors during construction by contractor was ranked third for the group of developers and contractors also but was ranked first by consultants. Improper planning and errors during construction occur due to the improper sequences of works, under estimate the time taken for particular task that is not familiar by contractor, misreading of the design. Improper planning and errors during construction not only cause the overrun time but also cause the overrun cost.

Table 4.5 : Result of causes of contractor related delays

Causes of delay	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Site management	4.13	1	4.28	2	3.9	1	4.06	1
Delays caused by subcontractor	4.02	2	4	4	3.83	2	3.94	2
Improper planning and errors during construction	4	3	4.33	1	3.68	3	3.93	3
Improper construction methods	3.95	4	4.28	2	3.68	3	3.9	4
Inadequate contractor experience	3.71	5	3.89	5	3.45	5	3.64	5

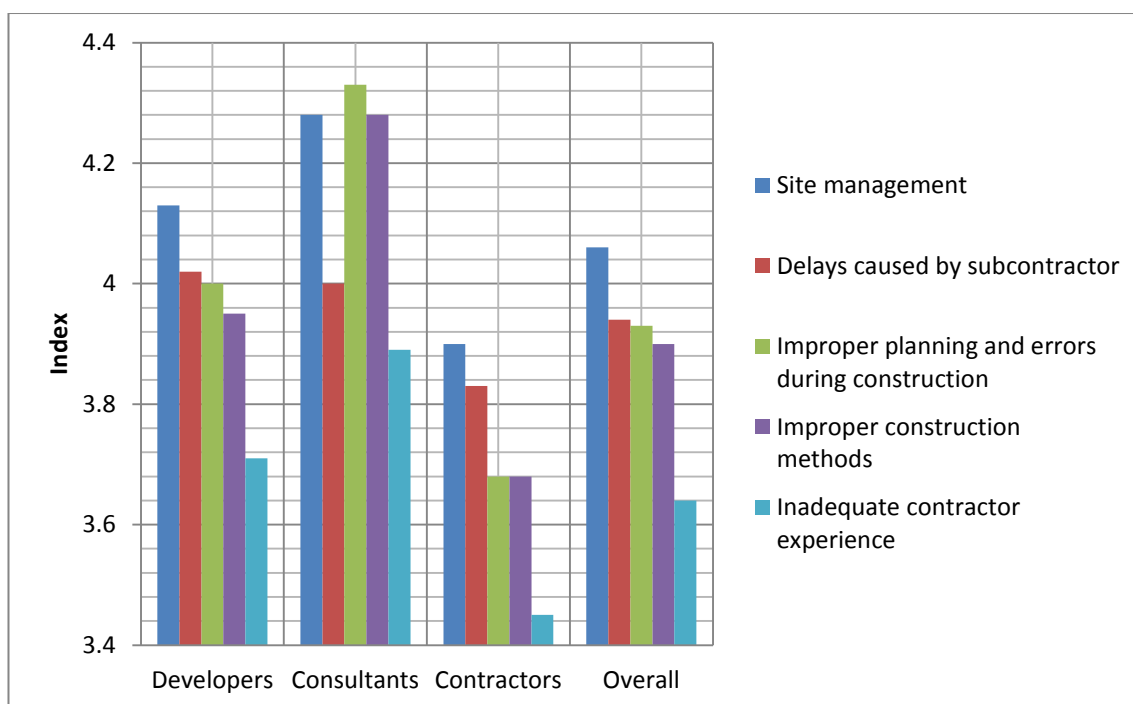


Figure 4.5 : Result of causes of contractor related delays

#### **4.3.1.3 Causes of Consultant Related Delays**

According to Table 4.6 and Figure 4.6, in overall, waiting time for approval of test and inspection ranked first among causes of consultant related delays, while preparation and approval of drawings ranked second and quality assurance ranked third. Test and inspection are the necessary parts during the construction time, every minor task for example concrete casting, firewall and water proof test have to approve by consultant before contractor can proceed to the next task. Without inspection on the steel bar size and arrangement for concrete structure, contractor is not allowed to start concrete casting. Hence, when the time taking for waiting approval of test and inspection is longer, therefore the time taken for the tasks to complete is longer. Preparation and approval of drawing are complicated process, consultant takes time to prepare the detail construction drawing first then they have to submit the design drawing to local authority for approval, after approval of drawing, then only issue construction drawing to contractor for construction. Hence, the longer time taken in preparation and approval of drawing, the longer time taken for construction activities to start. Quality assurance is responsible of consultant, a consultant have to ensure the quality of construction work is same as stated in the contract document. Consultant may only issue for the construction stage completion, when the quality of work reached the standard as stated in contract document. Repairing defect of works causes time and cost overrun.

Table 4.6 : Result of causes of consultant related delays

Causes of delay	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Waiting time for approval of test and inspection	3.63	1	3.78	2	3.68	1	3.68	1
Preparation and approval of drawings	3.44	4	3.83	1	3.61	2	3.58	2
Quality assurance	3.54	2	3.61	3	3.53	4	3.55	3
Contract management	3.51	3	3.56	4	3.56	3	3.54	4

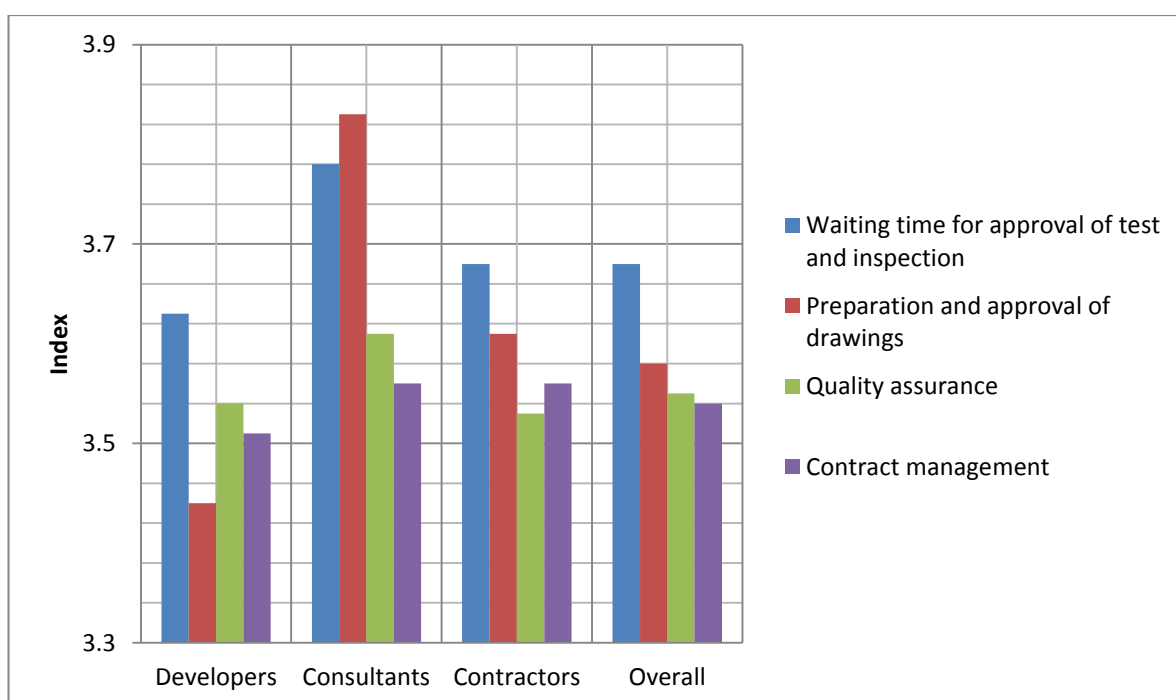


Figure 4.6 : Result of causes of consultant related delays



#### **4.3.1.4 Causes of Material Related Delays**

According to Table 4.7 and Figure 4.7, in overall, price fluctuation of material ranked first among causes of material related delays while shortage of material ranked second and quality of material ranked third. Price fluctuation means during the purchasing time, the price of material has big increase compare to tendering time. In this situation, the material cost is much higher than the contractor expected during tendering process, therefore this cause contractor decreases in profit and cause contractor loss. Hence, contractor do not purchases the material on time and causes late start on the construction work. Shortage in material means the supply of material in market not enough to fulfill the demand of market. Shortage of material causes the contractor do not able to get the material on time, hence construction do start late. Normally, price fluctuation comes together with shortage of material. When the supply is less than demand in market, market price will increase, but price fluctuation may also come with other factors for example increase of labor cost, increase in raw material cost or increase in import taxes. Quality of material is another cause of construction delays. When the quality material is not fulfill as stated in contract document, the contractor has to reject the delivery material and wait for supplier to resend the right material as stated in contract document. The process of reject and waiting for resend material cause extension time of construction works to continue.

Table 4.7 : Result of causes of material related delays

Causes of delay	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Price fluctuation of material	3.56	2	3.89	1	3.54	2	3.61	1
Shortage in material	3.44	3	3.67	2	3.68	1	3.58	2
Quality of material	3.59	1	3.61	3	3.49	3	3.55	3

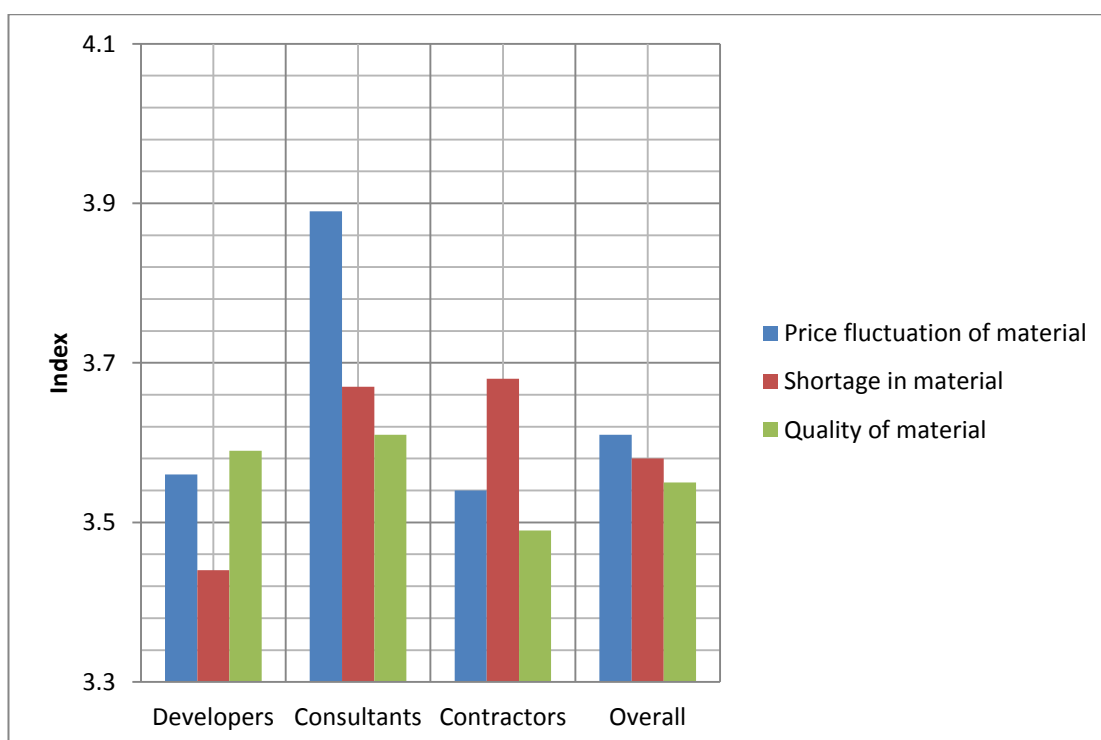


Figure 4.7 : Result of causes of material related delays

#### **4.3.1.5 Causes of Labor and Equipment Related Delays**

According to Table 4.8 and Figure 4.8, in overall, labor supply ranked first among causes of labor and equipment related delays while labor productivity ranked second and equipment available ranked third. There is no robot can replace human in construction industry, hence the labor become the main power in execution the project. With sufficient labor supply ensures the construction carried out with optimum speed while shortage of labor supply causes the construction far behind the schedule date. Labor is classified into skilled worker and unskilled worker, skilled worker is worker with experience on the particular work while unskilled worker is worker who is newly explore and work in construction industry. The productivity of the labors are directly influent by their skill and experience, therefore if a contractor did not able to hired sufficient skilled workers in the particular project, the rate of the execution of the project might not be optimum. Besides that, equipment is necessary in carry out particular task for example, crane use for concrete casting and compactor use for soil compaction. When contractor do not manage to borrow, rent or buy the equipment, the particular construction work which need the help of equipment has to stop from execution and wait until the equipment is available, hence the particular work need extra time to complete.

Table 4.8 : Result of causes of labor and equipment related delays

Causes of delay	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Labor supply	3.75	1	4.11	1	3.61	1	3.76	1
Labor productivity	3.63	2	3.89	2	3.46	2	3.61	2
Equipment availability	3.34	3	3.83	3	3.12	3	3.34	3
Equipment failure	3.02	4	3	4	2.85	4	2.95	4

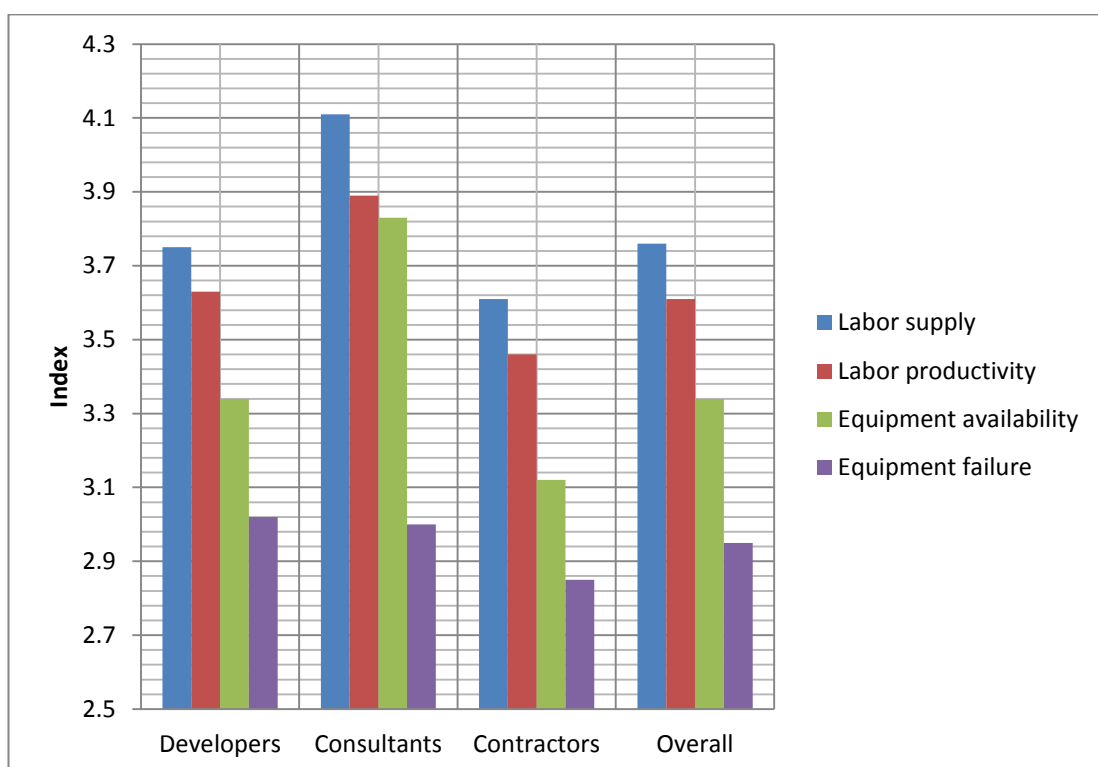


Figure 4.8 : Result of causes of labor and equipment related delays

#### **4.3.1.6 Causes of Contract Related Delays**

According to Table 4.9 and Figure 4.9, in overall, change orders and mistakes or discrepancies in contract document both ranked first in causes of contract related delays. Change orders mean during the construction process, the design, material or detail of project have changes make by the owner. Since there is change during the construction process, therefore the arrangement of material and working schedule for the construction have to change and waiting time for issues detailing of the changed order, so this directly causes the construction duration longer than schedule. Mistakes or discrepancies in contract document mean the design drawing are not suit with the architectural drawing or it can also mean there is two or more part in between the contract documents are not suit with each other. Next, the mistake and discrepancies in between the drawings cause the construction work have to stop and wait until the mistake and discrepancies are corrected. This is because construction work done according to the mistake and discrepancies have to demolish and redo. Therefore, the more mistakes or discrepancies in the contract documents, the more time have to waste and the longer time need for construction project completion.

Table 4.9 : Result of causes of contract related delays

Causes of delay	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Change orders	3.68	1	4.33	1	3.9	2	3.89	1
Mistakes or discrepancies in contract document	3.68	1	4.11	2	4	1	3.89	1

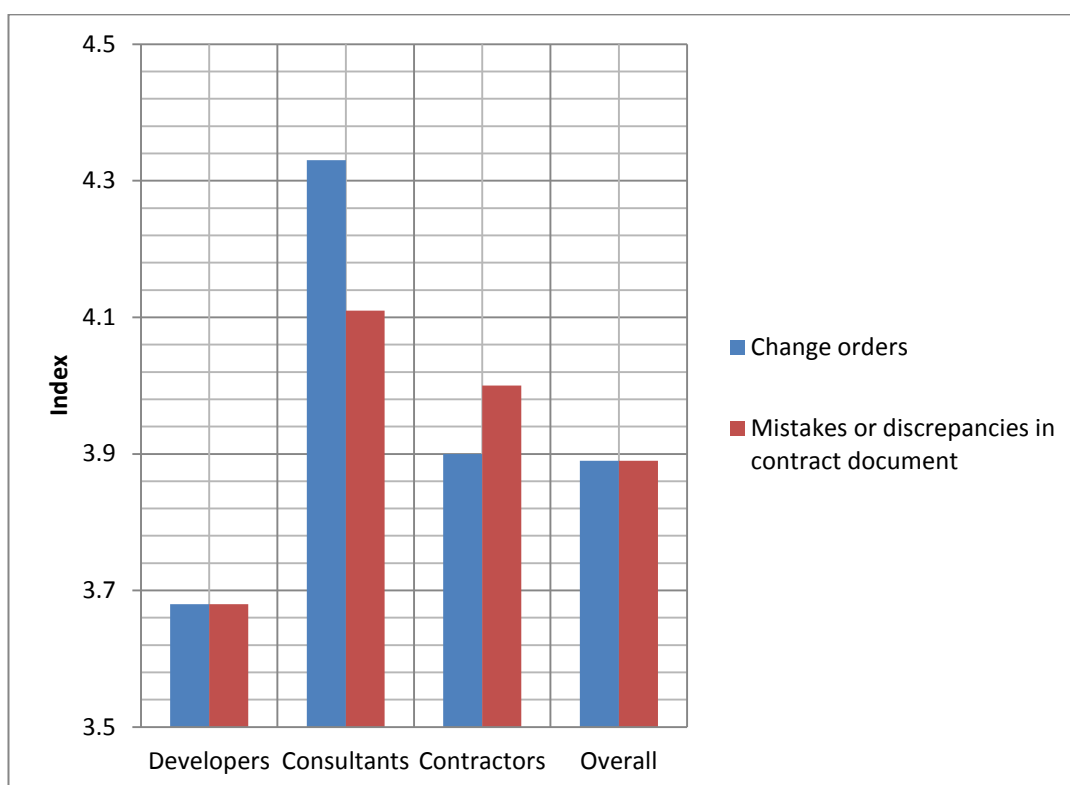


Figure 4.9 : Result of causes of contract related delays

#### **4.3.1.7 Causes of Contract Relationship Related Delays**

According to Table 4.10 and Figure 4.10, in overall, lack of communication between the parties ranked first among causes of contract relationship related delays while major disputes and negotiations ranked second and inappropriate overall organizational structure linking to the project ranked third. In order to well manage a project, the good communication among the parties are important, lack of communication between parties causes the coordination of tasks failed and delay occur due to pass down task. The major disputes and negotiations most occur among the consultant and contractor, the contractor who tend to take short cut in doing works without according to the consultant's order try to negotiate and dispute with consultant and lastly time wasting due to negotiation and disputes. Dispute and negotiation take time for solving, disputes normally has to solve by third party and it is time consuming. Next, projects with different project delivery method have different contracts among the parties and different organization structure. Inappropriate organizational structure linking to the project causes difficulties in project coordination and decision making. For example a design and build project, the consultants and contractors are under the organization and coordination of main contractor, therefore the communication among the consultant and contractor is efficient and fast, but in case of the organization structure is inappropriate, the coordination among consultant and contractor will be difficult and the time taken for decisions making will be longer. Therefore the appropriate organizational structure to the project is very important.

Table 4.10 : Result of causes of contract relationship related delays

Causes of delay	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Lack of communication between the parties	3.78	1	3.83	1	3.55	1	3.69	1
Major disputes and negotiations	3.49	2	3.56	3	3.15	3	3.36	2
Inappropriate overall organizational structure linking to the project	3.24	3	3.72	2	3.24	2	3.33	3

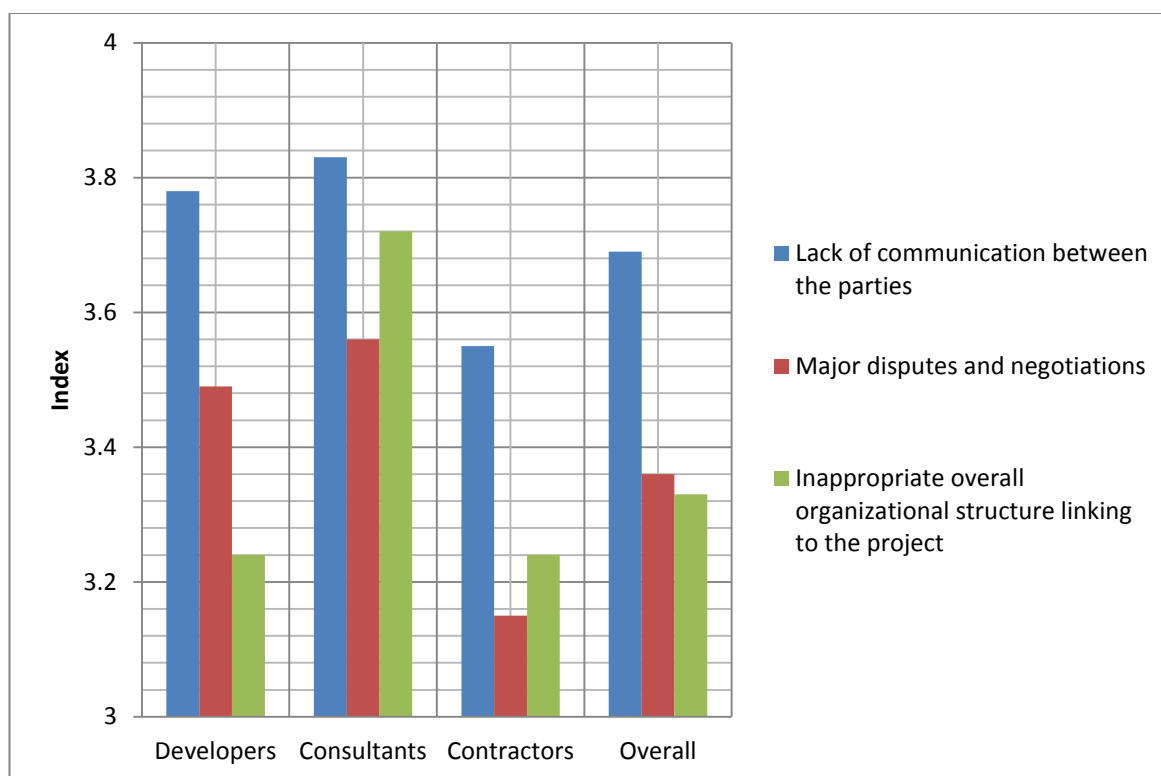


Figure 4.10 : Result of causes of contract relationship related delays



#### **4.3.1.8 Causes of External Related Delays**

According to Table 4.11 and Figure 4.11, in overall, unforeseen site condition ranked first among causes of external related delays while weather condition ranked second and regulatory changes and problem with neighbors ranked third. Unforeseen site conditions refer to the site conditions which are not discovered although proper site investigation had been carried out. The subsurface condition of site is the factor that difficult to foreseen since everything are in the ground. The unforeseen condition of site are not including during the design, therefore during the construction, once there are any unforeseen conditions discovered, the construction have to stop and report to consultant for investigation and redesign solution to the problems, hence causes delay on construction.

Weather condition is the factor which that out of human control, during the raining days construction have to stop due to the safety of workers and the quality of construction work especially works involving with concrete, hence construction delays seriously during the raining season. The raining days is factor that unpredictable, therefore it is difficult to estimate raining days when scheduling the project completion. Regulatory changes refer to the changes in regular for design or construction work, it is directly affects the design process and construction process, consultants and contractors take time to understand and practices the new regular. The problem with neighbors is the common issues, the serious complaint of neighbors for example the issues on land boundary cause the construction site have to stop and wait for resolve, hence delay occurs.

Table 4.11 : Result of causes of external related delays

Causes of delay	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
unforeseen site condition	4.1	1	4.22	1	4.2	1	4.16	1
weather condition	3.8	2	3.83	2	3.9	2	3.85	2
regulatory changes	2.98	3	3.28	4	2.95	3	3.02	3
problem with neighbors	2.98	3	3.39	3	2.9	4	3.02	3

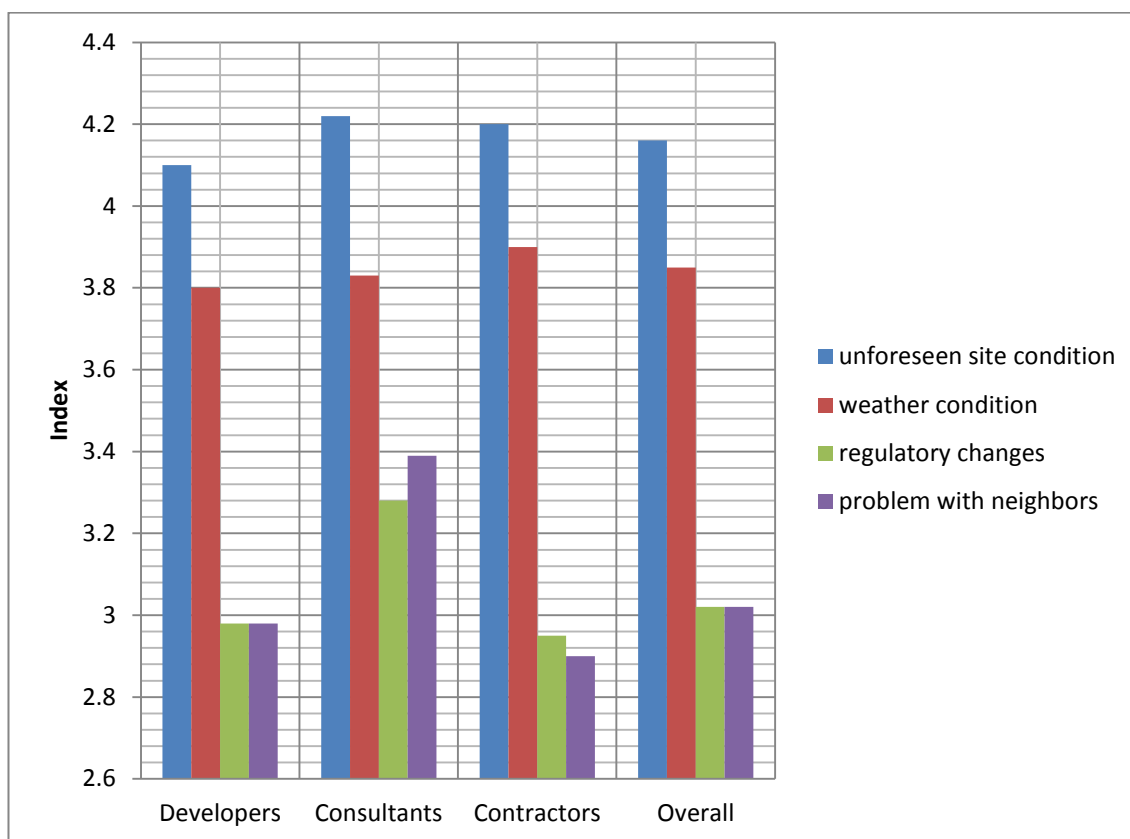


Figure 4.11 : Result of causes of external related delays

### 4.3.1.9 Ranking of All Factors that Causes Delays

According to the result of analysis and discussion on factors that causes delays in each group, the ranking of the overall factors that causes delays have been shown as in Table 4.12. According to Table 4.12, there are total 29 causes of delays had been identified, ranked and analyzed. The top five causes of delays are unforeseen site condition, finance and payments of completed work, site management, delays caused by subcontractor and improper planning and errors during the construction. Furthermore, the following five causes of delays in top ten are improper construction methods, change orders, mistake and discrepancies in contract document, weather condition and slow decision making.

Based on Figure 4.12, from the top 20 causes of delays, four are from client related delays, five from contractor related delays, one from contract relationship related delays while the rest of ten are from consultant, material, labor and equipment, contract and external related delays, each factors contributed two causes out of the ten causes. Among the top twenty causes of delays, contractor contributed a largest of 25%.

Table 4.12 : Ranking of all causes of delays

Causes of delay	Developers	Consultants	Contractors	Overall	
	Index	Index	Index	Index	Rank
unforeseen site condition	4.1	4.22	4.2	4.2	1
Finance and payments of completed work	3.73	4.22	4.44	4.1	2
Site management	4.13	4.28	3.9	4.1	3
Delays caused by subcontractor	4.02	4	3.83	3.9	4
Improper planning and errors during construction	4	4.33	3.68	3.9	5

Improper construction methods	3.95	4.28	3.68	3.9	6
Change orders	3.68	4.33	3.9	3.9	7
Mistakes or discrepancies in contract document	3.68	4.11	4	3.9	7
Weather condition	3.8	3.83	3.9	3.9	9
Slow decision making	3.41	4	4.02	3.8	10
Owner interference	3.41	3.89	4.05	3.8	11
Labor supply	3.75	4.11	3.61	3.8	11
Unrealistic contract duration imposed by owners	3.46	3.94	3.85	3.7	13
Lack of communication between the parties	3.78	3.83	3.55	3.7	14
Waiting time for approval of test and inspection	3.63	3.78	3.68	3.7	15
Inadequate contractor experience	3.71	3.89	3.45	3.6	16
Price fluctuation of material	3.56	3.89	3.54	3.6	17
Labor productivity	3.63	3.89	3.46	3.6	17
Preparation and approval of drawings	3.44	3.83	3.61	3.6	19
Shortage in material	3.44	3.67	3.68	3.6	19
Quality assurance	3.54	3.61	3.53	3.6	21
Quality of material	3.59	3.61	3.49	3.6	21
Contract management	3.51	3.56	3.56	3.5	23
Major disputes and negotiations	3.49	3.56	3.15	3.4	24
Equipment availability	3.34	3.83	3.12	3.3	25
Inappropriate overall organizational structure linking to the project	3.24	3.72	3.24	3.3	26

Regulatory changes	2.98	3.28	2.95	3	27
Problem with neighbors	2.98	3.39	2.9	3	27
Equipment failure	3.02	3	2.85	3	29

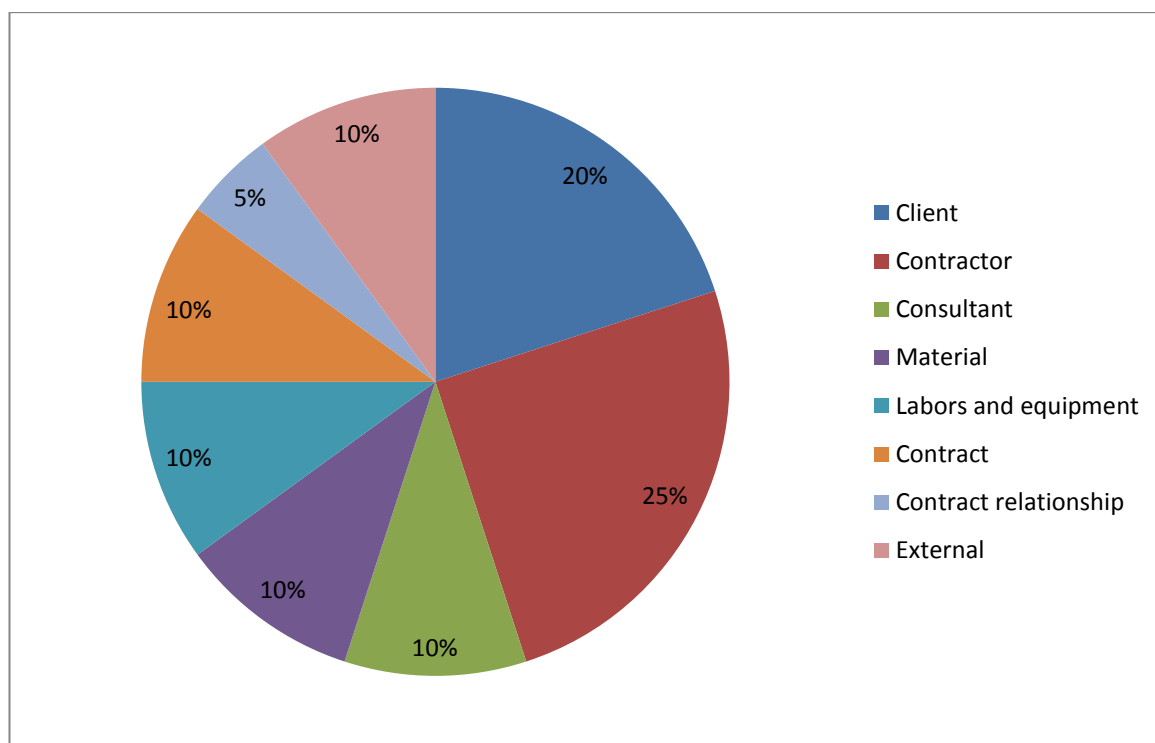


Figure 4.12 : Percentage of groups of factor that contributed to the top twenty causes of delays.

### **4.3.2 Methods to Prevent Construction Delays**

According to Table 4.13, frequent progress meeting ranked first among the methods to prevent construction delays while effective strategic planning ranked second and the three of frequent coordination between the parties involved, collaborative working in construction and proper project planning and scheduling ranked third. Frequent progress meeting are important in construction management, all the parties involved are involving in the meeting and every problems facing by them are discussing in the meeting, hence all problems are share and solve together during the meeting. Effective strategic planning is important in the construction project, it guilds and give directions for all the staffs in the construction. An effective strategic planning may reduce the major mistake in the construction. Furthermore, frequent coordination between the parties involved is necessary, with this, all the problems faces among the parties involved can be raise up early without waiting for the progress meeting. The earlier the problem raise up, the earlier the problems solve and the shorter time delays. Proper project planning and scheduling contribute to the good sequent of works, good time management and clear picture of critical path of the project activities. With good sequent of work, all activities can be go on smoothly while with clear critical path, the activities which are in the critical path can be prevent from delays by paying more attention on them.

Other than that, collaborative working in construction is key point to success in construction. A collaborative construction team contributes to the good communication among each other, experience sharing among team, problem solving, team work and good construction culture, hence problem that causes delays can be solved and avoided easily.

Table 4.13 : Result of methods to prevent construction delays

Methods	Developers		Consultants		Contractors		Overall	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
Frequent progress meeting	4.15	1	4.22	5	4.12	2	4.15	1
Effective strategic planning	4.07	2	4.39	2	4.1	3	4.14	2
Frequent coordination between the parties involved	3.98	4	4.39	2	4.05	4	4.08	3
Proper project planning and scheduling	3.98	4	4.67	1	3.93	10	4.08	3
Collaborative working in construction	3.9	9	4.22	5	4.2	1	4.08	3
Site management and supervision	4	3	4.33	4	4	7	4.06	6
Clear information and communication channels	3.95	7	4.17	7	4.05	4	4.03	7
Use appropriate construction methods	3.93	8	4.11	10	4.05	4	4.01	8
Use proper and modern construction equipment	3.98	4	4.06	11	3.98	8	3.99	9
Complete and proper design at the right time	3.85	10	4	13	3.98	8	3.93	10
Use up-to-date technology utilization	3.76	14	4.17	7	3.85	11	3.87	11
Proper material procurement	3.8	12	4.17	7	3.71	12	3.83	12
Accurate initial cost estimates	3.85	10	4.06	11	3.71	12	3.83	12
Proper emphasis on past experience	3.78	13	3.89	14	3.56	14	3.71	14
Compressing construction durations	3.05	15	3.78	15	2.85	15	3.1	15

#### **4.4 Summary**

In conclusion, the major group of factor which contributes the most in the construction delays is contractor related factors. The top five causes of delays are unforeseen site condition, finance and payments of completed work, site management and delays caused by subcontractor. While the top five methods to prevent construction delays are frequent progress meeting, effective strategic planning, frequent coordination between the parties involved, proper project planning and scheduling and collaborative working in construction. Therefore in order to minimize construction delays, more attention have to focus on the top five causes of delays at the same time implement the top five methods to prevent construction delays.



## **CHAPTER 5**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1 Introduction**

Chapter five concludes on the data collected from questionnaire survey which was analyzed and discussed in chapter four.

#### **5.2 Conclusions**

The main objectives in this research have been achieved by identified the causes of construction delay and methods to prevent construction delay in Selangor state and Kuala Lumpur.

##### **5.2.1 Major Causes of Delays**

A total of 29 causes of delays was identified, the top ten causes that contribute to construction delays are unforeseen site condition, finance and payments of completed work, site management, delays caused by subcontractor, improper planning and errors during the construction, improper construction methods, change orders, mistakes or discrepancies in contract document, weather condition and slow decision making. All the 29 causes of delays were grouped into eight groups, the contractor related group ranked first in contribute towards construction delays followed by group of client related, consultant related, material related, labors and

equipment related, contract related, external related and contract relationship related. The first objective of this research achieved.

### **5.2.2 Methods to Prevent Construction Delays**

A total of 15 methods to prevent construction delays were identified, the top ten effective methods to prevent construction delays are frequent progress meeting, effective strategic planning, frequent coordination between parties involved, proper project planning and scheduling, collaborative working in construction, site management and supervision, clear information and communication channels, use appropriate construction methods, use proper and modern construction equipment, complete and proper design at the right time.

### **5.3 Recommendation**

There are few recommendations are draw from this research, there are as follows :

1. A construction project involves with thousands of tasks, the management in construction activities are very important. Improper planning and management of time, material, labor, equipment, subcontractor and site may cause the construction activities delay. In case any activity on the critical path delay, the following activities may delay. Therefore, contractor has to pay more effort on the management stated above by having frequent progress meeting with subcontractor, effective strategic planning, frequent coordination between the parties involved and site supervision.
2. During the construction phase, a lot of unpredicted factor during planning state may be occur, for examples unforeseen site condition, change orders, dispute with neighbors, shortage in material, mistakes or discrepancies in contract document and regulatory changes. Therefore clear information channel and collaborative in working are very important, contractor has to

share the problem face with the client and consultant as fast as possible, in order to solve the problems in a shorter time. Other than that, client has to do quick decisions while consultant has to work collaborative in finding the solutions for the problems.

3. Financial management is the key to run construction activities, improper management in cash flows may cause the contractor do not able to get the labor, material, equipment, subcontractor to operate construction. Without any one of the above, the construction activity may not operate. Hence, the contractor has to proper planning on the cash flow while the client has to pay the contractor on the completed work on time, because this can ensure the good cash flow of contractor.
4. Labor's productivity and equipment efficiency play important role in project execution rates. A skilled worker use shorter time to complete a task with higher quality of works compare to an unskilled worker. At the same time, a high efficiency equipment may shorten the time for complete a task. Therefore, contractor has to provide internal training for the construction workers to upgrade their skills and provide high efficient equipment for the construction site.

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**APPENDIX A**  
**QUESTIONNAIRE FORM**



**SECTION A****Background of respondent**

Please circle the answer.

1. What type of company you are working at ?

( Developer / Consultant / Contractor )

2. What are your position in the company ?

( Director / Project Manager / Site Manager / Engineer or Designer )

3. From your experiences, what grade of project most frequent involved in delays.

G1 – Not more than RM 200,000

G2 – Not more than RM 500,000

G3 – Not more than RM 1,000,000

G4 – Not more than RM 3,000,000

G5 – Not more than RM 5,000,000

G6 – Not more than RM 10,000,000

G7 – No Limit

## SECTION B

### Causes of Construction Delays

Objective of this study : To identify the causes of construction delay in Selangor and Kuala Lumpur.

Please tick the blanks :

1 = Strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = Strongly agree

Question : Please rank the causes of construction delay in Selangor and Kuala Lumpur.

Factors	Causes of delay		1	2	3	4	5
Client related	1	Finance and payments of completed work					
	2	Owner interference					
	3	Slow decision making					
	4	Unrealistic contract duration imposed by owners					
Contractor related	1	Delays caused by subcontractor					
	2	Site management					
	3	Improper construction methods					
	4	Improper planning and errors during construction					
	5	Inadequate contractor experience					
Consultant related	1	Contract management					
	2	Preparation and approval of drawings					
	3	Quality assurance					
	4	Waiting time for approval of test and inspection					

Factors	Causes of delay		1	2	3	4	5
Material related	1	Quality of material					
	2	Shortage in material					
	3	Price fluctuation of material					
Labor and equipment related	1	Labor supply					
	2	Labor productivity					
	3	Equipment availability					
	4	Equipment failure					
Contract related	1	Change orders					
	2	Mistakes or discrepancies in contract document					
Contract relationship related	1	Major disputes and negotiations					
	2	Inappropriate overall organizational structure linking to the project					
	3	Lack of communication between the parties					
External	1	weather condition					
	2	regulatory changes					
	3	problem with neighbors					
	4	unforeseen site condition					

## SECTION C

### Methods to prevent Construction Delays

Objective of this study : To identify the methods to prevent construction delays in Selangor and Kuala Lumpur.

Please tick the blanks :

1 = Strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = Strongly agree

Question : Please rank the methods to prevent construction delays in Selangor and Kuala Lumpur.

No.	Methods	1	2	3	4	5
1	Frequent progress meeting					
2	Use up-to-date technology utilization					
3	Use proper and modern construction equipment					
4	Use appropriate construction methods					
5	Effective strategic planning					
6	Proper material procurement					
7	Accurate initial cost estimates					
8	Clear information and communication channels					
9	Frequent coordination between the parties involved					
10	Proper emphasis on past experience					
11	Proper project planning and scheduling					
12	Complete and proper design at the right time					
13	Site management and supervision					
14	Collaborative working in construction					
15	Compressing construction durations					