

Risk Allocation Model For Cisumdawu Toll Road Projects

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Abstract. In the Cisumdawu Toll Road project there are some complex problems, including the first tunnel structure in Indonesia that functions as a toll road. This complex construction project is currently experiencing delays which creates risks for project delays. In this study the aim is to identify risks and create an optimal risk allocation model between the project owner and the contractor. The allocation of risk between project owner and contractor in a contract plays an important role for the success of the project. It should be based on a proper assessment of the involved risks and choosing the party best able to manage them. This research was obtained about risks that can be impacted by the project in each phase. The scope of non-excusable factors often is considered a contractor's fault which results in project construction. Based on the results of descriptive test of the 5 main risks include the most important risk in the Cisumdawu Toll Road Construction Phase II (STA 9+750 – STA 27+100) is soil work. The results show that the soil work risk should bear by the contractors by lump sum fixed price contract.

1. Introduction

All construction projects are unique and carry their own risks. Such projects involve a number of parties concerned, starting with the owner, contractor, designer, suppliers, and others. All parties involved in a project inevitably carry certain risks. Risk can be defined as a hazard, a probability of it to occur and the potential of losses and resulting gains [1]. Risk can be defined as a difference of actual and expected results [1]. Risks can be managed, reduced, transferred or accepted, but it cannot be ignored [2]. Risk management process usually consists of four stages: risk identification, risk analysis, selection and monitoring of risk management techniques to the consequences of risk. The implementation phase of construction started after the owner and the contractor sign a construction contract. The purpose of construction contract agreement is to allocate the rights, responsibilities and risks between the parties. Construction business is a business with high risks, such as financial risks, political risk, security risk and risk at the time of execution was to be managed and handled by contractors. From the moment that the decision to begin design is taken until the new facility is in use, the owner is uncertain about the outcome of the project.

There are three uncertainties in construction project: time, cost and quality. These uncertainties are the three types of risk that are present in every project and that affect the owner [3]. Risks are usually considered as uncertain future events, which, if they happen, will cause significant extra cost or delay. Generally, the project owner usually prefers to allocate most of the risk to the contractor. The impact of "must" bear a lot of risks, the contractor will perform a "trade off" to the offer price as a consequence to accept the risks that are beyond the control of the contractor [4].



2. Research Method

In this research, data collection was done as a basis for the theory of submission of the questionnaire. Second, the data will be accumulated. Third, an analytic hierarchy process is carried out to determine the main work that is the highest risk in the Cisumdawu toll project. Research method diagram showed in the Figure 1. Justification one main work for testing in the Analytical Hierarchy Process (AHP) [5] within the stage show in Figure 2.

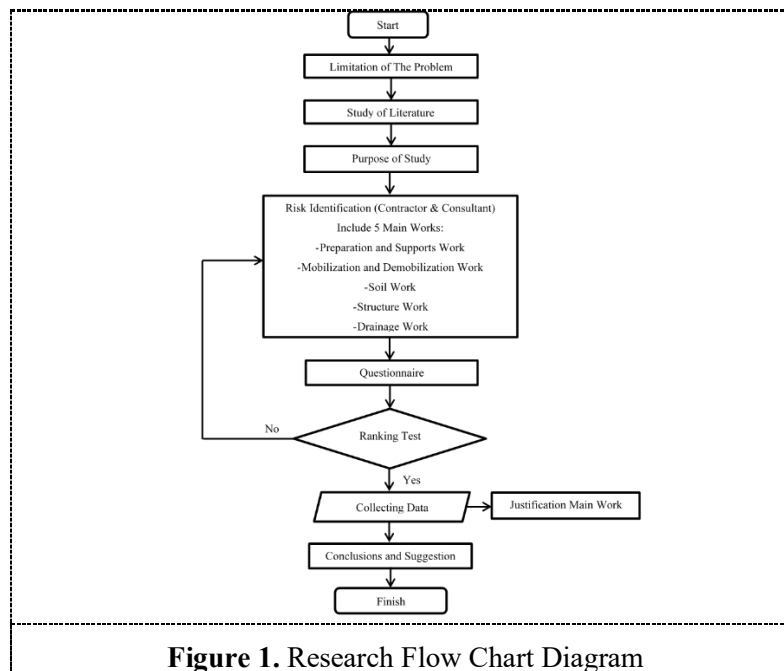


Figure 1. Research Flow Chart Diagram

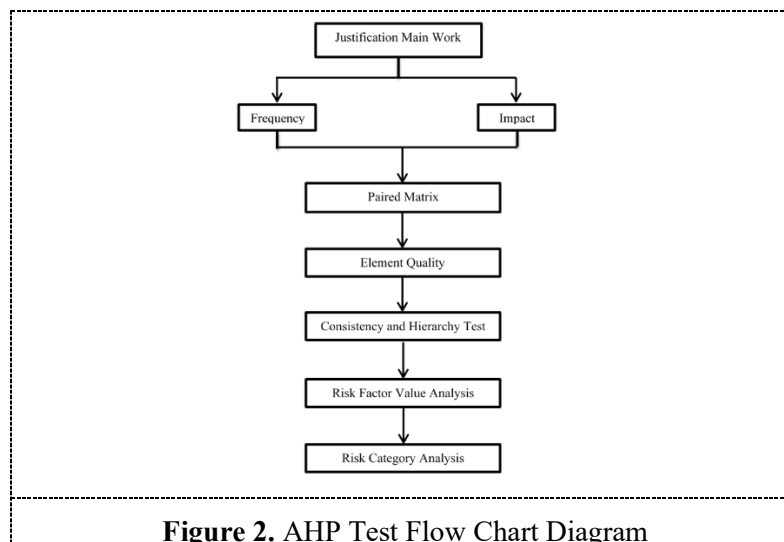


Figure 2. AHP Test Flow Chart Diagram

This research uses a survey method in the form of a questionnaire, where carried out by analyzing the research and final project that has been done in the field of transportation especially in highway project. Then, the next step is to look for factual information about the conditions that indeed occur in the project that is focused on the cisumdawu phase 2 toll road project.

3. Analysis Result

The result that can be classified all risks in each job into a high level that must be considered when the highway project was installed. Cisumdawu toll road phase II project respondents have a different perception; they assume the main work that should be considered is soil work. Furthermore, after interviewing the employees in Cisumdawu Toll Road Project Phase II and they are trying to explain about most common obstacles that occur in soil work. This can be led to differences of opinion due to different places, equipment, and workers due to the time of implementation highway project. Then, the focus of the analytical hierarchy process (AHP) test is the soil work.

3.1. Risk Analysis

After obtaining the average of the impact and frequency risk value, risk factor value is then performed, which can be calculated with the following equation [5]:

$$FR=L+I-(L \times I) \quad (1)$$

FR = Risk Factor, scale 0 -1

L = Risk Probability

I = Risk Impact

Table 1 shown recapitulation value results from aggregate variable/ risk occasion:

Table 1. Risk Factor Value

Sub Indicator C	Frequency Average Value	Impact Average Value	Risk Factor (FR)
Unpredictable of weather.	0,441	0,421	0,676
Land that has not been cleared.	0,444	0,504	0,724
Hence, the project obstructed.			
Obstacles on mobilization and demobilization for aggregate is not on time.	0,148	0,168	0,291
Productivity of employees	0,180	0,180	0,327
Working methods are less precise.	0,200	0,193	0,354
Lack of policy application in OSH (Occupational Safety and Health) aspects.	0,160	0,160	0,295
Damage residential area during the project construction.	0,215	0,602	0,687
Respiratory problems due to material dust for workers and local residents.	0,180	0,122	0,280
The land that cannot be used after being cleared.	0,179	0,147	0,299
Risk of soil/site existing conditions.	0,122	0,135	0,240

Sub Indicator C	Frequency Average Value	Impact Average Value	Risk Factor (FR)
Obstruction of public transportation access	0,140	0,109	0,234
Limitation of workspace and co-working space construction	0,115	0,122	0,223

A qualitative risk assessment can also help to determine if there are any specific types or categories of risks that would require special attention or any risk events that need to be handled in the near-term. Then, I tried to make the qualitative risk analysis matrix on the Figure 3.

Frequency	Impacts				
	Very Low	Low	Average	High	Very High
Very High					
High					
Average			R3.1; R3.2		
Low	R3.8; R3.11	R3.3 : R3.4; R3.5; R3.6; R3.8; R3.9		R3.7	
Very Low	R3.12	R3.10			

Figure 3. Qualitative Risk Analysis

Risks (R) information:

R3.1 Unpredictable of weather.

R3.2 There is land that has not been cleared. Hence, the project obstructed.

R3.3 Obstacles on mobilization and demobilization for aggregate is not on time.

R3.4 Productivity of employees

R3.5 Working methods are less precise.

R3.6 Lack of policy application in OSH (Occupational Safety and Health) aspects.

R3.7 There is damage residential area during the project construction.

R3.8 Respiratory problems due to material dust for workers and local residents.

R3.9 There is the land that cannot be used after being cleared.

R3.10 Risk of soil/site existing conditions.

R3.11 Obstruction of public transportation access

R3.12 Limitation of work space and co-working space construction

Table 2 shown results of risk category in soil work by AHP method.

Table 2. Results of Risk Category in Soil Work by AHP

Sub Indicator C	Risk Factor (FR)	Risk Level
3.1 Unpredictable of weather.	0,676	Average
3.2 Land that has not been cleared. Hence, the project obstructed.	0,724	High

Sub Indicator C	Risk Factor (FR)	Risk Level
3.3 Obstacles on mobilization and demobilization for aggregate is not on time.	0,291	Low
3.4 Productivity of employees	0,327	Low
3.5 Working methods are less precise.	0,354	Low
3.6 Lack of policy application in OSH (Occupational Safety and Health) aspects.	0,295	Low
3.7 Damage residential area during the project construction.	0,687	Average
3.8 Respiratory problems due to material dust for workers and local residents.	0,280	Low
3.9 The land that cannot be used after being cleared.	0,299	Low
3.10 Risk of soil/site existing conditions.	0,240	Low
3.11 Obstruction of public transportation access	0,234	Low
3.12 Limitation of workspace and co-working space construction	0,223	Low

The results of Risk category in soil work shows that is categorized as high risk is 3.2, and data which categorized as average risk is 3.1; 3.7. Then, for variable that categorized as low risk is 3.3; 3.4; 3.5; 3.6; 3.8; 3.9; 3.10; 3.11; 3.12.

3.2. Risk Allocation

The most important risk in the Cisumdawu Toll Road Construction Phase II (STA 9+750 – STA 27+100) is soil work. The origin of risk factors was then analyzed and discussed based on Indonesia's Risk Allocation Guidelines from PT. Penjaminan Infrastruktur Indonesia, all technical risks should be borne by the contractors. So, soil work risk must bear with contractor party.

4. Conclusion

The result of this study shows that contractors bear important risks that impact to delay in construction phase. All risk factor in soil work allocate to contractor party by lump sum fixed price contract mechanism. The result at this study will contribute to provide the lesson learned to develop a risk management for toll road project in Indonesia.

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