Analysis Of Risk Management In Development SMK Stikes Rajawali Bandung (Case Study: Well Foundation)

Firda Aulia Khairin¹, Annisa¹, Ilham¹

¹. Civil Engineering, Faculty of Engineering and Design, Institut Teknologi Sains Bandung, Central Cikarang, Indonesia
E-mail: firdaaulia22@gmail.com

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Abstract

The SMK STIKES Rajawali Bandung project is a unique project because it has a steep terrain location that creates various risks, so a risk analysis is needed. The identification in this study was 32 risks. This research uses qualitative and quantitative methods with the stages of identifying possible risks, assessing risks, knowing the causes, and ways of dealing with dominant risks if they occur. The results of the study of the 32 risks consisted of 3 very high risks, 2 high risks, 23 medium risks and 4 low risks. The biggest risk comes from the external risk that can be detected, namely the risk of rain with a score of 20. Therefore, the risk of rain requires ideal treatment using a dewatering pump.

Keywords: risk identification, assessment, mitigation

1. INTRODUCTION

Over time, the development of the construction industry has become increasingly diverse, complex and sophisticated. The construction consists of different stages, where the determining stage is the construction stage because the overall quality of the project depends on construction and construction management²⁾. During the construction phase, the contractor must plan, plan, schedule, plan and control the project carefully and achieve the project objectives.

Project management is the application of 10 areas of knowledge, skills, tools and techniques in project activities to achieve project goals. Construction projects cannot be separated from three aspects, namely time, cost and implementation¹⁾. Therefore, every construction project implementation requires good project management to be able to

manage and minimize various project risks that can occur. The success of a project is determined if at the right time, the costs do not exceed the budget, the quality meets the requirements, at least a change in the scope of work, the results can be carried out properly by the owner⁹).

Problems in project implementation are caused by many internal and external factors starting from the initial stages of project implementation, namely the design stage, the procurement process, implementation to handover¹⁹). This problem causes delays in project goals and objectives that have been planned. Therefore, risks must be managed properly. Risk is an uncertain condition that has a positive or negative impact on project results¹⁴). The extent to which the impact caused by these risks can be known through Project Risk Management Project risk management is the application of risk management elements, namely risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response, risk response implementation and risk monitoring¹⁴). Construction project risk management must be managed adequately so that the benefits to be obtained are in accordance with the risks faced.

One of the project conditions that affect development is the project location. The project location affects the risk management of work in the field, including foundation work, structural works, finishing and complementary works⁵). Foundation work is the most important part of a building construction project, because foundation work is a load transmitter from the building above the structure to the soil layer below²⁰). This study analyzes foundation risk management. Working on a case study of a 5-story building with steep and varied boundary conditions at SMK STIKES Rajawali Bandung.

The construction project of SMK STIKES Rajawali Bandung is located in West Bandung Regency and was built from January 9, 2018, to November 7, 2019. The construction of the project is built on steep terrain that creates various project risks that can hinder project progress. And it affects project achievement. One of the jobs that is hampered is foundation work, where this work is delayed. The delay in foundation work affects subsequent work items (such as structural, finishing, and additional work). Work planning started on March 2, 2018, to March 22, 2018, but when the field started on March 2, 2018, to April 12, 2018, there was a delay in the implementation time for 21 days (The initial plan was 34 days, but the implementation in the field was 55 days). Delays in implementation time due to steep ground location resulting in mobilization, weather, and lack of material storage and project control. Based on the above background, the purpose of this study is to identify risks, risk analysis and risk mitigation the construction of SMK STIKES Rajawali Bandung.

1.1 Project Risk Management

Risk management is generally the process of identifying, measuring, ascertaining risks and strategies, which work to create and protect value⁸). The risks are viewed negatively, such as losses, dangers and other consequences¹⁸). Risk is an uncertain situation that has a

positive or negative impact on project results and objectives¹⁴⁾. This risk has three main elements, namely: events, frequency, impact⁹⁾.

1.2 Risk Identification

Risk identification is the initial stage in risk management which aims to reduce sources of risk and events that hinder the achievement of project objectives¹⁴⁾. Sources of risk are divided into two parts, namely external and internal causes, because the causes of risk do not have a universal standard in their distribution¹⁹⁾.

1.3 Risk Assessment

Risk analysis to measure risk based on the calculation or assessment of its frequency and impact. Risk assessments can be mapped into a risk matrix. This risk matrix shows where the risk is based on the level of risk. The risk matrix will be used at a later stage to identify existing risks. The following is a risk matrix¹⁶⁾

Table 1. Risk Matrix

		Impact				
		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Extreme
Frequency	1	Very unlikely	Low	Low	Low	Medium
	2	unlikely	Low	Medium	Medium	High
	3	Possible	Low	Medium	Medium	High
	4	Likely	Medium	Medium	High	Very High
	5	Almost Certain	Medium	High	High	Very High

Risk level is formulated as follows:

$$\text{Risk} = \text{Frequency} \times \text{Impact} \quad (1)$$

The scale used in assessing risk to frequency and impact is the likert scale⁴⁾. The Likert scale serves to provide a score in this research questionnaire. The scale of the frequency and impact can be seen in Table 2.

Table 2. Frequency Level Scale and Impact Level Scale

Level	Frequency	Impact
1	Very Low	Very Small
2	Low	Small
3	Moderate	Moderate
4	High	Large
5	Very High	Very Large

1.4 Risk Acceptability

The level of risk is a very important tool in making decisions because through risk ratings, management can determine priorities and treatments at the construction stage³⁾. The level of risk acceptance depends on the result of multiplying the frequency with the impact. The level of risk acceptance can be seen in Tabel 3.

Table 3. Risk Acceptability

Assessment	Acceptance Scale
Unacceptable	$x \geq 15$
Undesirable	$5 \leq x < 15$
Acceptable	$3 \leq x < 5$
Negligible	$x < 3$

1.5 Risk Mitigation

Risk mitigation is a strategy carried out to reduce the impact of identified risks. Sometimes there are risks that cannot be eliminated, sometimes they can only be reduced so that the result is residual risks. So 4 risk management strategies are needed, namely: avoid, reduce, receive, overcome, and take a turn¹⁵⁾.

2. METHODS

This research is taken from a case study in the SMK STIKES Rajawali Bandung project with qualitative and quantitative methods, which aim to make a systematic description of the risk events under study. The descriptive method used was a questionnaire and interviews that took place in the field. And aims to get opinions from respondents about events that pose risks in foundation work.

2.1 Variables

Based on the results of previous research assessments there are variables and risks that generally occur in construction projects which will then be used as identification for the questionnaire. From previous research there are 4 variables and 32 indicators which will be grouped in Table 4 of the following variables and indicators:.

Table 4. Variable and Indicators

No.	Variable	Indicators	Reference
1	External cannot be detected	<ul style="list-style-type: none"> • Avalanche • Flood • Earthquake 	Magna, et al (2017) Subiyanto (2010)
2	External can be detected	<ul style="list-style-type: none"> • Inflation or an increase in prices and a decrease in purchasing power • Rain • Project locations that are difficult to reach 	Magna, et al (2017) Subiyanto (2010) Nugraheni, et al (2012)
3	Internal technical	<ul style="list-style-type: none"> • Inaccurate soil data • Sting errors of the soil are excavated • Excavation has not yet reached the elevation plan • Errors in determining drilling points and on the foundation • Non-alignment of foundation drilling • The ground collapses were found around the borehole 	Magna, et al (2017) Subiyanto (2010) Ismael, et al (2014) Messah, et al. (2013) Hartono (2015)

		<ul style="list-style-type: none"> • Concrete pouring error • Low labor productivity • Low equipment productivity • Tool damage • If there is no provision of construction equipment at the project site • The quality and quantity of the material do not match the specifications • Delays in delivery of materials to locations • Lack of material storage space • Delay in ordering material • Material fabrication failure • Material breakdown • There are design changes • Incomplete planning (drawing) • Delay in the process of requesting and approving work spaces by the owner 	
4	Internal non technical	<ul style="list-style-type: none"> • Time and cost control systems are weak • Late payment owner • There is work that is not recognized as a bill • Lack of time control information to monitor and analyze schedule estimation errors that affect project performance • Sequencing that is not good enough • The other job that goes before is too late 	Magna, et al (2017) Subiyanto (2010) Ismael, et al (2014) Messah, et al. (2013)

3. RESULT AND DISCUSSION

The results of distributing questionnaires totaled 42 respondents, consisting of 43.2% of respondents as workers, 7.14% of respondents as surveyors, logistics, 4.7% of respondents as quantity surveyors, quality control, supervisor, drafter, administration, project manager, engineering, administration, executors and 2.38% of respondents as project managers, project heads, technical heads, technical managers, operational managers, administrative managers, chief supervisors, project operational control. In this study, they had quite a long project experience, about 5 to 9 years, and the majority of respondents had a bachelor's degree of 53.36%, while vocational and high school education were 40.5% and 7.14%, to get an assessment of the frequency and impact of risks on work foundation in the SMK STIKES Rajawali construction project.

3.1 Risk Analysis

The results of the questionnaire were obtained as an analysis of risk, namely: there are 3 very high risks, 2 high risks, 23 medium risks, and 4 low risks. The biggest risk comes

from external risk that can be detected, namely very high with a rain risk value of 20. Risk analysis can be seen in the Table 5.

Table 5. Risk Analisyis

No.	Indicators	Risk Score	Risk Matrix Grouping
1	Avalanche	4	Medium
2	Flood	4	Medium
3	Earthquake	3	Low
4	Inflation or an increase in prices and a decrease in purchasing power	15	High
5	Rain	20	Very High
6	Project locations that are difficult to reach	16	Medium
7	Inaccurate soil data	4	Low
8	Sting errors of the soil are excavated	2	Medium
9	Excavation has not yet reached the elevation plan	4	Medium
10	Errors in determining drilling points and on the foundation	4	Medium
11	Non-alignment of foundation drilling	4	Medium
12	The ground collapses were found around the borehole	5	Medium
13	Concrete pouring error	4	Medium
14	Low labor productivity	4	Medium
15	Low equipment productivity	4	Medium
16	Tool damage	4	Medium
17	If there is no provision of construction equipment at the project site	3	Low
18	The quality and quantity of the material do not match the specifications	4	Medium
19	Delays in delivery of materials to locations	9	Medium
20	Lack of material storage space	12	High
21	Delay in ordering material	5	Medium
22	Material fabrication failure	4	Medium
23	Material breakdow	5	Medium
24	There are design changes	3	Low
25	Incomplete planning (drawing)	4	Medium
26	Delay in the process of requesting and approving work spaces by the owner	4	Medium
27	Time and cost control systems are weak	16	Very High
28	Late payment owner	4	Medium
29	There is work that is not recognized as a bill	4	Medium
30	Lack of time control information to monitor and analyze schedule estimation errors that affect project performance	4	Medium
31	Sequencing that is not good enough	4	Medium
32	The other job that goes before is too late	9	Medium

3.2 Risk Acceptability

From the risk analysis there are 4 types of risk acceptance, namely: unacceptable amounting to 3 risk (9,375%), undesirable amounting to 4 risk (12,5%), acceptable amounting to 24 risk (75%), and negligible amounting to 4 risk (12,5%). The results of this study show that acceptance of risk that falls into the category requires treatment, namely unacceptable and undesirable risks.

3.3 Risk Mitigation

Risk mitigation that falls into the risk category is unacceptable and undesirable. Risk treatment can be seen in Table 6.

Table 6. Risk Mitigation

No.	Risk Identification	Causes of Risk	Risk Mitigation
1	Inflation or an increase in prices and a decrease in purchasing power	The increase in the price of iron due to the game on the market price reached 30-50% of the estimated price or iron	<ul style="list-style-type: none"> • Make an estimate of the increase in raw material prices • Making contracts with suppliers with an umbrella contract system • Looking for a material supplier that offers lower prices
2	Rain	The groundwater level becomes high because it often rains during foundation work	<ul style="list-style-type: none"> • Prepare for dewatering • Provide a drainage system
3	Project locations that are difficult to reach	When it rains, access to the project entrance becomes difficult for material delivery to the project site	<ul style="list-style-type: none"> • Prepare alternative access roads to facilitate mobilization
4	Delays in delivery of materials to locations	The supplier did not send iron material according to schedule, so this project had to wait a long time for iron supply	<ul style="list-style-type: none"> • Make schedule, evaluate the arrival and the amount of material • Contact the supplier to negotiate the material ordered, speed up immediately • Speed up the work of the upper structure
5	Lack of material storage space	The difficulty of determining the desired material due to the accumulation of material in the warehouse	<ul style="list-style-type: none"> • Schedule delivery periodically • Renting a material storage area
6	Time and cost control systems are weak	The foundation work was delayed, so the casting was too late	<ul style="list-style-type: none"> • The cost and time control system is kept simple but quite up to date • Monitoring and reviewing the implementation schedule

			periodically
			<ul style="list-style-type: none"> • If there is a deviation from the implementation schedule, a recovery is carried out which is discussed in the meeting to plan follow-up
7	The other job that goes before is too late	Rain conditions become difficult when removing the sludge from the foundation work, so that the dump truck cannot enter and exit the project because it is muddy. In addition, when drilling is not cast immediately, the foundation hole that has been drilled will collapse and the next work will be delayed	<ul style="list-style-type: none"> • Doing project crashing • Do fast tracking • Cover additional time with contingency time

Based on the risk analysis, the biggest risk in SMK Stikes Rajawali Bandung is the risk of rain. Thus, a risk handler is required for foundation work. Risk handlers for rain variables use a dewatering pump or drainage¹¹⁾. The following is a comparison of alternatives to dewatering pump and drainage based on the parameters in table 7.

Table 7. Comparison of Dewatering Pump and Drainage

Parameter	Dewatering Pump	Drainage
Material	-	Concrete
Tools	Electric pump and generator	Hoe and Roskam
Principles of Action	Ground water is pumped out, so that the ground water level around the excavation will flow into the pump hole by gravity, and cause a decrease in the ground water level around the pump area	Flow water that comes from the rain to another channel to the disposal place, namely a river or temporary water reservoir
Advantage	<ul style="list-style-type: none"> • The groundwater level drops • Improve soil stability • Landslides are down • Removing water in the excavation due to rain 	<ul style="list-style-type: none"> • Land use can be optimized • Freeing standing water in the project area due to rain
Joy	<ul style="list-style-type: none"> • The surrounding land springs into down • The suction of fine particles from the ground by the pipe • Consolidation of silt, clay or loss due to increased effective stress 	<ul style="list-style-type: none"> • Minimizes the project work area • Often seen as shabby and smelly

Based on the comparison between the two alternatives above, the ideal for handling the risk of rain at SMK STIKES Rajawali Bandung is to use a dewatering pump. This is because the dewatering pump is able to release groundwater in the foundation hole due to rain, reducing the risk of landslides due to rain, and the groundwater level decreases.

4. CONCLUSIONS

The results of research analysis at SMK STIKES Rajawali Project can be concluded that based on the results of the risk analysis identified 32 risks, namely: 3 very high risks, 2 high risks, 23 medium risks, and 4 low risks. The biggest risk comes from the external risk that can be detected, namely the risk of rain with a risk score of 20. Therefore, the risk of rain requires ideal treatment using a dewatering pump. In fact, the dewatering pump is able to discharge groundwater in the foundation hole due to rain, reducing the risk of landslides due to rain and lower the groundwater table.

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