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RISK POTENTIAL ANALYSIS USING HAZARD IDENTICATION, RISK ASSESSMENT AND DETERMINE CONTROL (HIRADC) AND JOB SAFETY ANALYSIS (JSA) METHODS

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ABSTRACT:
Lake Tondano Revitalization Project Phase I located in Minahasa Regency, North Sulawesi Province which is a program of the North Sulawesi Provincial Government, namely the Ministry of Public Works and Public Housing in the field of Water Resources (SDA). Lake Tondano Revitalization Project Phase I is a semi-automated project, where the tools used are still controlled by humans who have a high level of potential danger and risk. So it requires very careful supervision to prevent hazards that might cause potential hazards that have an adverse impact during and after construction to reduce the impact caused by the risk. The methods used in this study are Hazard Identification, Risk Assessment and Determaine Control (HIRADC) and Job Safety Analysis (JSA) methods. Data collection is carried out by observation, interviews and questionnaire distribution. The results showed that at the stage of identifying potential risks there were 233 potential risks from 9 works in the Lake Tondano Revitalization Project Phase I. In an effort to create zero accident division K3 or HSE (health, safety and environment) in order to conduct strict supervision and discipline on occupational safety and health supervision in order to avoid potential risks that will occur in the project to be worked on.

Keywords : K3, Potential Risk, HIRADC, JSA

INTRODUCTION

Occupational safety and health are activities to ensure, maintain and protect the safety and health of workers through efforts to prevent accidents and occupational diseases according to Government Regulation no. 50 of 2012, concerning the implementation of SMK3 in 1 paragraph 2 (Pingle, 2012). Occupational safety and health is an important issue that is of concern to the world today because it covers various aspects. Therefore, every development project must have good K3 implementation (Ahmad, 2022).

There are several dangers and risks involved in building construction projects that can lead to work accidents and the level of risk that exists in the technology, industry and control measures used (Haslam et al., 2005). Work-related accidents are incidents that occur while carrying out work within the company. In general, work accidents are caused by two factors, namely human actions that do not comply with work safety *(unsafe act)* and dangerous environmental conditions *(unsafe condition)* (Lan et al., 2022).

The Tondano Lake Revitalization Project Phase I is located in Minahasa Regency, North Sulawesi Province, which is a program of the North Sulawesi Provincial Government, namely the Ministry of Public Works and Public Housing in the Water Resources (SDA) sector (Borkenhagen, 2003). Revitalization of Lake Tondano Phase I is a project to build an embankment dividing the lake's water body along 18 km. Apart from building a lake revitalization embankment, this project aims to organize the lake's watershed area, dredging it, removing water hyacinth, and providing the lake with a natural function as a water reservoir.

The Tondano Lake Revitalization Project Phase I is a project carried out semi-automatically, where the tools used are still controlled by humans which has a high level of potential danger and risk. So it requires very careful supervision to prevent dangers that might cause potential hazards that have an adverse impact during and after construction to reduce the impact caused by the risks.

RESEARCH METHODS

The research method used in this research is qualitative methods. The focus of the research is to describe the potential safety and health hazards of workers associated with the Tondano Lake Revitalization Phase I project, Minahasa Regency, North Sulawesi Province which are controlled by identifying project work activities and descriptions of field conditions that have the opportunity or potential to cause subsequent work accidents. The Hazard Identification, Risk Assessment and Risk Control (HIRADC) method is carried out which produces a HIRADC document to reduce the level of risk, which will then be continued with risk control using the Job Safety Analysis (JSA) method.

The type and design of this research is descriptive and qualitative, describing risk assessments for occupational safety and health as well as potential hazards. Qualitative research methods are approaches in which descriptive data is generated from the words spoken or written by people and actions that can be seen. Qualitative research is research that uses open interviews to investigate and understand the opinions, feelings and behavior of individuals or groups.

RESULTS AND DISCUSSION

Data analysis

Data analysis was carried out after obtaining the results of the questionnaire. Data analysis in this research includes validity and reliability tests of the questionnaire, and probability and impact analysis using the severity index.

A. Validity test

For this research, a validity test was carried out using SPSS version 25. The validity test was carried out based on each risk category to determine whether the risk items were valid or not. Based on calculations using SPSS version 25 using Bivariate Pearson correlation (Pearson Product Moment), the correlation coefficient value for each risk category was obtained above the r-product moment value (0.632, 2-tailed sig 0.05) with a total of 15 respondents (Holgado–Tello et al., 2010).

This research shows the results of validity testing using the SPSS ver. 25 based on respondents' answers to likelihood and consequences. It can be seen in appendices 3 and 4 that this question item is valid because it has reached the requirement, namely the P value is less than α (alpha) (Bisson et al., 2016). So it can be concluded that at the probability or likelihood category there are 233 risk variables and at the impact or consequences category level there are 233 valid variables.

B. Reliability Test

Reliability testing can be used as a measuring tool for a questionnaire whose indicators are variables. A questionnaire is said to be reliable if a person's answers to the questions are consistent or stable (Bisson et al., 2016).

Measuring reliability can be tested using the Cronbach's Alpha statistical test. A variable is said to be reliable if it provides a Cronbach's Alpha value of more than 0.60 (Taber, 2018). The results of reliability testing can be seen in table 1 as follows:

Table 1
Reliability Test Recapitulation Results

No	Variable Risk	Mark*Aplha Cronbach* (Possibility)	Mark*Aplha Cronbach* (Impact)
1.	Preparatory work	0,992	0,992
2.	Bamboo Piling Jobs	0,954	0,944
3.	2 Layer Bamboo Mattress Work	0,911	0,902
4.	Boulder Embankment Work	0,948	0,941
5.	Gabion Work	0,938	0,880
6.	Compacted Soil Piling Jobs	0,952	0,951
7.	Geotextile Work	0,960	0,931
8.	Settlement Plate Work	0,949	0,944
9.	State of Emergency	0,898	0.905

Based on the results of table 1, the reliability test results show that Cronbach's Alpha results for all research variables have a Cronbach's Alpha value > 0.60, therefore it can be concluded that the instrument in this research is reliable and suitable for use and the test results.

C. Probability and Risk Impact Analysis

From the data obtained from the questionnaire, a probability and impact assessment analysis is then carried out which influences the risk assessment aspect using the Severity Index (SI) calculation method (Suseno et al., 2015). The Severity Index value issued is in the form of a percentage. The aim is to obtain a value that represents the answers of all respondents regarding the assessment of the possibility and impact of risks that influence the risk assessment (Akintoye & MacLeod, 1997). Respondents' answers to the impact option were very small for 2-layer mattress work, namely 38%. Meanwhile, for the answer that the risk impact is very large, the respondent's answer chose the bamboo cerucuk job, namely 11% and the results of the respondent's answer were then compared with the risk analysis table using a risk matrix which shows the level of risk.

D. Risk Assessment

Risk assessment (risk assessment) in HIRADC (Hazard Identification, risk assessment and determine control) is defined as a risk assessment based on the

occurrence or possibility (likehood) and the impact or severity (saverity) resulting from each potential risk (Iqbal et al., 2021). This research carries out a risk assessment using the AS/NZS 4360: 2004 approach (Sari et al., 2017). After obtaining the savings index results, the values will be processed into a risk level classification, then the results will be plotted into a risk matrix using the probability and impact multiplication formula. The plot will produce risk levels from low to extreme. After getting a risk assessment, you will get a value that corresponds to the actual risk conditions. From this value, it can be seen how big the risk is caused by the hazard. Based on data analysis carried out using a matrix before carrying out risk control, the following data was obtained:

There are no potential risks that have a very high level of risk (extreme risk). The identification of risks with a high level of risk (high risk) was obtained, namely 51 potential risks. Identification of risks with a medium risk level (medium risk), namely 64 potential risks. Identify risks by having a low risk level, namely 118 potential risks. Based on the results above, it shows that the average job is at a low risk level. Where the number of jobs is 9 jobs with a total potential risk of 233. So from the 233 potential risks that have been analyzed using the HIRADC method if converted into percent units as follows:

$$\text{Extreme risk} = \frac{0 \text{ potensi risiko}}{233 \text{ potensi risiko}} \text{ x } 100\% = 0\ \%$$

$$\text{High risk} = \frac{51 \text{ potensi risiko}}{233 \text{ potensi risiko}} \text{ x } 100\% = 21{,}9\ \%$$

$$\text{Medium risk} = \frac{64 \text{ potensi risiko}}{233 \text{ potensi risiko}} \text{ x } 100\% = 27{,}5\ \%$$

$$\text{Low risk} = \frac{118 \text{ potensi risiko}}{233 \text{ potensi risiko}} \text{ x } 100\% = 50{,}6\ \%$$

Risk control

A. Risk Control using the HIRADC Method

This control is the final stage of the HIRADC method which aims to improve the process structure and reduce the risk of existing dangers and minimize the potential risk of work accidents (Kabul & Yafi, 2022). In determining the control efforts that will be carried out, the considerations are based on the basic hierarchy of the control process, namely elimination, substitution, technical engineering, administration to personal protective equipment (PPE) but still considering field conditions in the Phase I Lake Tondano Revitalization project (Akbar-Khanzadeh et al., 1995).

From the results of risk control using HIRADC, there are still residual risks in the high risk category, namely traffic accidents identified during site survey and measurement work, traffic accidents identified during heavy equipment mobilization/demobilization work, traffic accidents identified during material and equipment preparation work and delays. work identified as a result of the riot.

After controlling the potential risks, there is a reduction in the risk level for each potential risk. There is no potential risk with a very high risk level. It was found that there

were still potential risks with a high risk level of 4 potential risks. Jobs with a moderate level of potential risk (moderate risk) have 73 potential risks. Jobs with a low level of risk (low risk) have 156 potential risks.

Based on the results above, it shows that the average job is at a low risk level. Where the number of jobs is 9 jobs with a total potential risk of 233. So from the 233 potential risks that have been analyzed using the HIRADC method if converted into percent units as follows:

$$\textit{Extreme risk} = \frac{0\ potensi\ risiko}{233\ potensi\ risiko}\ x\ 100\% = 0\ \%$$

$$\textit{High risk} = \frac{4\ potensi\ risiko}{233\ potensi\ risiko}\ x\ 100\% = 1{,}7\ \%$$

$$\textit{Medium risk} = \frac{73\ potensi\ risiko}{233\ potensi\ risiko}\ x\ 100\% = 31{,}3\ \%$$

$$\textit{Low risk} = \frac{156\ potensi\ risiko}{233\ potensi\ risiko}\ x\ 100\% = 67{,}0\ \%$$

After obtaining data obtained from risk identification, risk assessment and risk control using the HIRADC approach, the next step is to prepare a HIRADC table which is used to calculate the level of risk occurrence and reduction in risk level in work at the Tondano Lake Revitalization Project Phase I.

B. Risk Control Using the Job Safety Analysis Method

Job safety analysis is an identification of risks that may arise every time a worker does it or a method used to check or find dangers before designing a workplace, work facilities, equipment, machines or heavy equipment used in work (Albrechtsen et al., 2019). The job safety analysis method also makes it easier for workers to read and implement actions or mitigation of a risk (Zhang et al., 2015). The job safety analysis method contains the sequence of work steps, sources of danger or potential risks of accidents and recommendations to eliminate or reduce potential risks.

From the results of risk control using HIRADC, there are 4 potential risks with the highest potential risks, namely preparatory work in the location survey and measurement sub-work, heavy equipment mobilization/demobilization work, material and equipment preparation work and in emergency situations in the riot sub-section.

CONCLUSION

Based on this research that has been carried out, the following conclusions are obtained. Results of analysis of potential risks in work at the HIRADC Phase I Tondano Lake Revitalization Project. Based on the results of identifying potential risks, there are 233 potential risks from 9 works on the Phase I Lake Tondano Revitalization project. The results of the risk assessment that has been carried out using a risk matrix are that there is no very high risk level, there are 51 potential risks at a high risk level, and there are 64 risk levels. potential risks and low risks, there are 118 potential risks.

Risk control using the HIRADC method which involves a hierarchical approach to risk control, namely elimination, substitution, technical engineering,

administration and PPE (personal protective equipment) gets changes in the risk level for each type of work including no very high risk level, high risk level there are 4 potential risks, the medium risk level is 73 potential risks and the low risk is 156 potential risks and controlling the risk with the highest risk level is by planning JSA in accordance with work procedures in the field by breaking down potential risks into steps. and given overall risk control recommendations for each work in the Tondano Lake Revitalization Phase I project.

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