



Risk Identification And Cost Estimation For Occupational Safety And Health (Osh) On The Gpdi Church Construction Project In Kuta

Ariany Frederika^{1*}, A. A. Gde Agung Yana¹, Putu Audien Marchely¹

¹Civil Engineering Study Program, Udayana University

*Email: arianyfrederika@unud.ac.id

ABSTRACT

Occupational Safety and Health (K3) has been regulated in national regulations and international standards such as OSHA, however BPJS Ketenagakerjaan reported that cases of work accidents increased from 3,174 in 2022 to 5,508 by August 2024. The construction project of the Pentecostal Church Building in Kuta, with an K3 budget of only 0.25% of the project value of IDR 7,444,833,207.00, is below the standard set by the Circular of the Director General of Construction Development in 2018 of 1% to 2.5%. This study aims to identify risks using the Job Safety Analysis (JSA) method and examine the appropriate K3 cost estimates. Primary data is in the form of the number of workers, while secondary data is taken from project documents such as time schedules, planning drawings, Bill Of Quantity (BOQ), and AHSP Badung Regency. Risk analysis is carried out with JSA, identifying work, hazards, and risks using a risk matrix. The K3 cost estimate is calculated from the need for PPE, training, and other K3 facilities, then compared to the total project value. The results of the study showed that 7.27% of risks were identified as very high, 50.91% as high, 40% as medium, and 1.82% as small. The estimated K3 cost required is Rp145,082,002.07 or 1.9% of the project value.

Keywords: Occupational Safety and Health (OSH), Job Safety Analysis (JSA), Occupational Safety and Health Risk, Occupational Safety and Health Cost

1. INTRODUCTION

Occupational Safety and Health (K3) is an important element in construction projects. Law No. 11 of 2020 requires compliance with safety, health, and sustainability standards in the work environment. In addition, international standards such as OSHA require each company to prepare a safety program that is in accordance with potential work risks. Data from BPJS Ketenagakerjaan shows a spike in work accidents in the construction sector, from 3,174 cases in 2022 to 5,508 cases until August 2024. This figure confirms the need for more effective implementation of K3. Every activity in a construction project has its own risks, so companies

are required to identify and control risks systematically. The use of appropriate personal protective equipment (PPE) must also be adjusted to the type of high-risk work.

One effort to prevent work accidents is JSA [4]. JSA helps the project team identify potential risks at each stage of work, assess the level of risk, and determine appropriate control measures. This method aims to reduce the possibility of accidents or injuries in the workplace. K3 cost analysis also plays an important role in evaluating the effectiveness of the implementation of safety programs. The Circular of the Directorate General of Construction Development in May 2018 stipulates that the allocation of the K3 budget, including the provision of PPE, ranges from 1.0 to 2.5% of the total project cost. Determining the proportion of the K3 budget in the Bill of Quantity (BOQ) makes it easier for project management to assess the amount of investment for safety compared to the total project value.

The GPdI (Indonesian Pentecostal Church) Kuta construction project carried out by PT. Megatama Karya only allocated a K3 budget of IDR 18,842,694.00 or 0.25% of the total project value of IDR 7,444,833,207.60. This percentage is far below the minimum standard of 1.0–2.5% according to the Circular of the Directorate General of Construction Development in May 2018. This low budget risks increasing the number of work accidents, especially due to the minimal provision of personal protective equipment and the low level of compliance with its use. Therefore, this study aims to identify the level of risk and analyze K3 costs so that its implementation is in accordance with standards and supports the achievement of the zero accident target in the project.

2. THEORY AND METHODS

2.1 Theory

2.1.1 Occupational Safety and Health (K3) in the Construction Sector

The construction sector often experiences work accidents, such as heavy equipment incidents, falls from heights, electric shocks, and explosions. The causative factors include low work discipline, inadequate equipment, unsafe work procedures, and negligence in the use of personal protective equipment (PPE). In addition, work in this sector can also trigger work-related diseases, such as muscle, respiratory, hearing, skin disorders, and organ damage due to exposure to chemicals, vibrations, and high temperatures. Similar risks can also be experienced by office and laboratory employees if the implementation of K3 is not running properly.

OHSAS 18001:2017 and Law No. 1 of 1970 emphasize that K3 aims to protect the physical, mental, and social health of workers. K3 also functions to prevent work-related diseases and create a safe work environment. The comprehensive implementation of K3 can reduce the potential for accidents and increase productivity and work efficiency sustainably..

2.1.2 Identification of OHS Risks

Identification and evaluation of work risks consider the level of likelihood and impact (severity) according to the AS/NZS 4360 standard. Table 1 shows a risk matrix that combines the probability of an event with the severity of the consequences. Table 2 shows five levels of likelihood categories used to assess how likely a risk is to occur, while Table 3 shows five levels of severity impact that describe the level of consequence of a risk if it occurs. Formula

1 shows how to calculate the risk value based on a combination of the level of likelihood of an event occurring and the severity of its impact.

$$R = L \times S \quad (1)$$

Where:

- R = Risk Rating
- L = Likelihood
- S = Severity

Risk calculations using a predetermined formula produce risk categories in four levels, namely low, medium, high, and very high. Table 4 shows the classification of risk levels based on the calculation results, complete with descriptions and actions that need to be taken according to the level of severity. Each risk level determines the type of action that needs to be taken, ranging from routine monitoring, control efforts, to serious and immediate handling for the highest risks.

Table 1. Risk Matrix

RISK MATRIX		SEVERITY				
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Severe (5)
LIKELIHOOD	Almost Certain (5)	Medium	High	Very High	Very High	Very High
	Likely (4)	Medium	High	High	Very High	Very High
	Possible (3)	Low	Medium	High	High	Very High
	Unlikely (2)	Low	Low	Medium	Medium	High
	Rare (1)	Low	Low	Low	Low	Medium

Table 2. Likelihood of AS/NZS 4360 Standard

LIKELIHOOD OF AS/NZS 4360 STANDARD		
LEVEL	DESCRIPTION	REMARKS
5	Almost Certain	There is > 1 incident every day
4	Likely	There is > 1 incident every week
3	Possible	There is > 1 incident every month
2	Unlikely	There is > 1 incident every year
1	Rare	There is > 1 incident every 5 years

Table 3. Severity In AS/NZS 4360 Standard

SEVERITY IN AS/NZS 4360 STANDARD		
LEVEL	DESCRIPTION	REMARKS
5	Severe	Fatal > 1 person, very large losses and very wide impacts, stopping all activities
4	Major	Serious injury > 1 person, large losses and production disruption
3	Moderate	Moderate injury, requires medical treatment and large financial losses

2	Minor	Minor injury, small financial losses
1	Insignificant	No injuries, small financial losses

OHSAS standards classify workplace injuries into five main categories. Fatality refers to death due to an accident or exposure to toxic materials. Serious injury includes severe injuries such as amputations and severe burns. Recordable injury includes moderate injuries that require advanced medical care. First aid cases include minor injuries that can be treated with first aid. Near misses describe incidents that nearly caused an accident but did not result in injury. These classifications aid in the risk analysis process and strengthen accident prevention efforts in the workplace.

Table 4. *Risk Category*

RISK CATEGORY		
RISK SCORE	RISK CATEGORY	ACTION
1-4	<i>Low</i>	Acceptable, but still monitored
5-9	<i>Medium</i>	Needs control and monitoring measures
10-16	<i>High</i>	Must be controlled immediately
17-25	<i>Very High</i>	Needs immediate and serious action

2.1.3 Job Safety Analysis (JSA)

JSA aims to identify potential risks at each stage of work and establish control measures so that accidents can be prevented. The application of this method provides various benefits, such as supporting safety training, being a guide for new employees, helping to evaluate post-accident procedures, and encouraging improvements in work methods. The JSA process includes dividing work steps, identifying potential hazards, and determining appropriate control measures according to the level of risk.

2.1.4 Safety Equipment and Construction Safety Management System (SMKK) Implementation Costs

Work safety equipment plays an important role in construction projects because it functions to protect workers from various potential hazards. Every contractor is required to provide personal protective equipment (PPE), such as helmets, protective shoes, gloves, safety glasses, masks, ear protectors, safety belts, work clothes, reflective vests, and first aid kits. PUPR Ministerial Regulation Number 10 of 2021 states that the cost of implementing the Construction Safety Management System (SMKK) includes the preparation of documents such as RKK, RKPPL, and RMLLP, as well as socialization activities, promotions, training, provision of PPE, work insurance, permits, supporting facilities, and medical equipment at the project site.

2.1.5 Construction Project Safety Program Quantification

Measurement of the safety level of a construction project involves evaluating various factors that affect OHS performance. The use of personal protective equipment and the implementation of safe work procedures are analyzed to assess their contribution to reducing the risk of accidents and improving work safety. Safety induction serves as an introduction session for new workers regarding the safety procedures applicable to the project. Formula 2

explains how to calculate the number of safety inductions for new workers on a construction project based on the number of workers and the turnover rate that occurs.

$$\text{Quantity} = \text{Number of New Workers} \times \text{Turnover Factor} \quad (1)$$

Safety briefings provide information on work safety procedures before construction activities begin. Routine safety meetings are also held to discuss potential risks at the project site. Formula 3 explains the calculation of the frequency of safety briefings and routine safety meetings based on the number of new workers and the turnover factor that affects the intensity of safety socialization activities.

$$\text{Quantity} = \text{Number of New Workers} \times \text{Turnover Factor} \quad (3)$$

Safety patrols monitor the implementation of OHS in the work area to ensure that it runs according to regulations. Formula 4 shows how to calculate the number of weekly safety patrols required for the duration of the project, assuming two patrols are conducted each work week.

$$\text{Quantity} = \frac{\text{Number of Working Days}}{7} \times 2 \quad (4)$$

The calculation of safety costs considers the number of activities and the cost per unit for each activity. Formula 5 explains how to calculate the total safety cost of a project based on the quantity of activities carried out and the unit price of each safety activity.

$$\text{Total Price} = \text{Quantity} \times \text{Unit Price} \quad (5)$$

2.1.6 Bill Of Quantity (BOQ)

The PUPR Ministry stated that the BOQ presents a list of construction materials systematically based on the type of work, volume, unit, unit price, and total cost. The calculation of the proportion of the K3 budget uses a comparison of the K3 RAB value with the total BOQ value of the project. Formula 6 explains how to calculate the percentage of the occupational safety and health (K3) budget to the total BOQ value of the project by comparing the K3 RAB value to the total construction budget.

$$\text{Percentage of RAB K3 Value} = \frac{\text{RAB K3}}{\text{Bill Of Quantity Cost}} \times 100\% \quad (6)$$

2.2 METHOD

2.2.1 Research Object

This study examines the Pentecostal Church Building Construction Project in Indonesia (GPdI) Kuta located at Jl. Raya Kuta No. 18, Badung Regency, Bali. The project has a contract value of Rp7,444,833,207.00 and is funded by the APBD. The project is planned to last for 165 calendar days with a target completion in December 2024. CV. Mahantara carries out the project implementation, while CV. Adhi Utama supervises the work. The project implementation refers to the Letter of Agreement Number 25/SP/DPUPR-CK/2024 dated June 19, 2024 and SPMK Number 39/SPMK/DPUPR-CK/2024 dated July 4, 2024.

2.2.2 Preliminary Survey

A preliminary survey was conducted to understand the research context by reviewing literature related to occupational safety and health (K3). The study includes factors causing accidents, applicable regulations, impacts of accidents, project costs, and the application of the JSA method.

2.2.3 Data Collection

This study uses primary and secondary data from the Pentecostal Church Construction Project in Indonesia (GPdI) Kuta. Direct observation and interviews collected primary data from 7 contractor staff of CV. Mahantara, 4 supervisory consultant personnel of CV. Adhi Utama, and 30 field workers, so that the total workforce reached 41 people. Secondary data comes from project documents such as implementation schedules, design drawings, and BOQs. The total BOQ value of the project reached Rp7,444,833,207.60 with the main components of the cost of structural, architectural, MEP work, and SMKK allocation of Rp18,842,694.00.

2.2.4 Data Processing

Data processing identifies each type of work to understand the project activities as a whole. Risk analysis groups risks based on the level of impact and likelihood. Table 1 presents a risk matrix that connects the two. Risks with high impact and likelihood are categorized as significant and require special management. Confirmation of the identification results was carried out with the contractor CV Mahantara and consultant CV Adhi Utama to ensure the suitability of field conditions and obtain mitigation suggestions. This step is the basis for a more in-depth risk analysis using the JSA method.

2.2.5 Analysis

Analysis using JSA identifies and assesses risks in each job. Evaluation of potential risks, such as falls, slips, and contact with hazardous materials, is carried out based on likelihood and impact. This evaluation determines control measures, including the use of PPE and training. K3 needs are calculated by multiplying the volume of work and the price per unit. Percentage of K3 RAB value compared to total project BOQ to ensure the budget includes occupational safety elements.

3. RESULTS AND DISCUSSION

3.1 Job Identification with Job Safety Analysis (JSA) and K3 Equipment Needs

The work on the Pentecostal Church Building construction project in Kuta is organized according to the WBS work breakdown structure. JSA identifies and reduces risks in construction activities, such as land measurement and bowplank installation. This process involves identifying risks of slipping, falling, injury, and weather, as well as assessing their probability and impact. The project implements preventive measures by leveling the work surface, installing barriers, and requiring the use of personal protective equipment such as helmets, gloves, and safety shoes. The use of additional K3 equipment, such as fall protection, safety nets, and warning signs, ensures the safety of workers in the field.

3.2 Analysis of Risk Levels from Construction Safety Planning Results

Risk analysis on construction projects begins with hazard identification and assessment of the severity and likelihood of occurrence. For example, the risk of injury from falling from a height without PPE has a severity of “major” (4) and a probability of “likely” (4). Formula 1

calculates a risk value of 16, which is categorized as “high”. The results of this analysis determine stricter safety control measures.

Figure 1 presents a visualization of risk management priorities based on the assessment results, which illustrates the percentage distribution of risks according to their severity category. From the percentages shown in Figure 1, the largest risk is in the high category (50.91%), followed by moderate risk (40.00%), then very high risk (7.27%), and low risk (1.82%). This proportion indicates that the majority of risks are in the high to moderate category, which means that strict control, consistent implementation of safety procedures, and routine supervision are needed so that the risk does not increase to very high or cause a serious incident. The very high category, although only 7.27%, remains a major concern because it has the potential to cause fatal impacts. Therefore, risks in this category must be handled immediately with specific and effective mitigation actions.

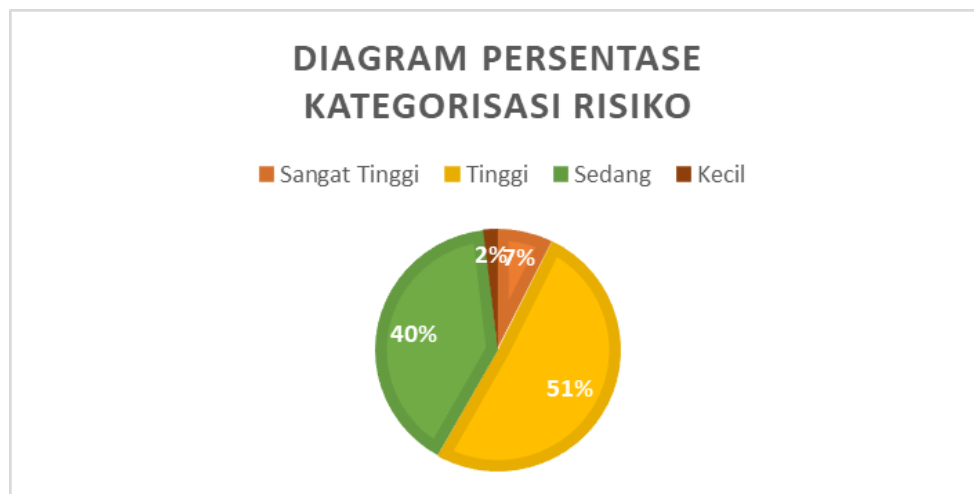


Figure 1. Risk Categorization Percentage Diagram

3.3 Calculation of K3 Implementation Cost Estimation

The cost estimate for implementing K3 in the Kuta GPDI Development Project follows the Circular of the Minister of PUPR Number 11/SE/M/2019 concerning Technical Guidelines for Construction Safety Management System Implementation Costs. The calculation uses the unit "OH" (Occurrence/Hourly) which includes several activities, such as 36 safety inductions at a cost of Rp360,000, safety briefings for 165 days at a cost of Rp1,650,000, safety meetings for 165 days at the same cost, and 47 safety patrols at a total cost of Rp471,428.57.

The total budget for the implementation of SMKKS reached Rp145,082,002.07, while the total project value was Rp7,444,833,207.00. The percentage of the occupational safety and health budget to the total project value was 1.9%.

4. CONCLUSIONS

1. The results of the risk level analysis using the JSA method on the GPDI Kuta Building Construction Project show that 7.27% of the risks are classified as very high, 50.91% are high risk, 40.00% are at medium risk, and 1.82% are in the low risk category.
2. Circular Letter of the Director General of Construction Development Number 10 of 2018 states that the estimated cost of implementing K3 on the GPDI Kuta Building Construction

Project reaches Rp145,082,002.07. The total project value is Rp7,444,833,207.00 so that the budget for implementing SMK-K reaches 1.9% of the project value.

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