Work Accident Risk at Hospital Construction Environment

Marsus Suti, Amiruddin Akbar Fisu, Ahmad Ali Hakam Dani, Apriyanto Apriyanto, Andi Dewi Angreyani and Amiul Amruh
Universitas Andi Djemma, Palopo, Indonesia
marsus.unanda301260@gmail.com, amiruddinakbarfisu07@gmail.com, ahmad.ali.hd90@gmail.com, riyadh.math06@gmail.com, andidewiangreyani1305@gmail.com, a.amruh04@gmail.com

Arifuddin Rachmat Fisu
Universitas Hasanuddin, Makassar, Indonesia
arifuddin.fisu@gmail.com

Ismail Suardi Wekke
Instutut Agama Islam Negeri (IAIN) Sorong, Indonesia
Iswekke@gmail.com

Abstract

The construction environment has the potential to cause health problems and accident, so an assessment is necessary. The most important stage in occupational health and safety is the assessment stage, where the risk point of each identified hazard is calculated, and whether the hazard level is acceptable or not. In this manuscript the writer tries to identify and provide an assessment of work accidents which is an attempt to analyze the risks that occur in a construction work. The method used is direct observation in the field as a first step to find out what variables will be included in the questionnaire which will be distributed to staff / workers in the construction project of the Stella Maris Hospital Makassar. The value of the questionnaire is then processed by the Fine method which is the reference in risk assessment. The results of this data processing show that work accidents are grouped based on their cause and occupational variables where of all the risks of work accidents, only two accident variables are categorized as substantial (has a risk value of 70-180), while the rest is in the moderate category (has a risk value of 20-70).

Keywords
Work accident risk; construction environment; fine method; occupational health and safety; project environment.

1. Introduction

The development of the construction world in Indonesia is currently experiencing intense competition. Construction projects are a work sector that has a high risk compared to other sectors (Harvey et al. 2018) and is prone to work accidents (Hoła et al. 2017). In fact, not a few work accidents that occur are classified as fatal (Shao et al 2019). Therefore, the role of occupational health and safety (OHS) is important in construction environtment projects (Niu et al. 2019). Construction companies are required to be able to increase their resources, not only in human resources but also in other supporting resources. For example, the equipment used and also the resource management system that is owned. In fact, several construction environtment projects have implemented digital engineering and sensing and warning based technology for safer construction work (Golizadeh et al. 2018, Antwi-Afari et al. 2019). With the increasing complexity of existing systems in building construction, a company is obliged to pay attention to the control aspects in construction environtment management, especially risk management in the OHS (Occupational Health and Safety) sector and improve climate safety and work safety culture (Ajslev et al. 2017). OHS aims to protect workers from a variety of potential accidents in the site project (Ilbahar et al. 2018). The number of job accidents in Indonesia is quite high and continues to increase from previous years. Data from the International Labor Organization

(ILO) notes that every day there are about six thousand work accidents resulting in fatalities in the world. In Indonesia, there are 20 cases of accidents experienced by workers for every 100,000 workers, and 30 percent of them occur in the construction sector. Meanwhile, according to Saefty Indonesia Mengajar, the number of work accidents in Indonesia from 2007 was 83,714 cases, experiencing a significant increase, namely 99,491 cases in 2011. According to data from the Ministry of Manpower and Transmigration, Indonesia until 2013 recorded work accidents that resulted in deaths as many as not less than six workers every day. This figure is relatively high compared to Europe, in European countries as many as two people die per day due to work accidents. According to data from the International Labor Organization (ILO), in Indonesia, there are an average of 99,000 cases of work accidents per year, resulting in 70% of deaths and lifelong disabilities (Wiwoho et al. 2020).

The construction project for the Stella Maris Hospital Makassar is a 7-storey building construction project with 1 basement floor and 1 ground floor located in the city of Makassar with a contract value of Rp.44,000,000,000 (Forty-four billion rupiah, Including VAT) carried out by PT. Waskita Karya as contractor with PT. Optima Mitra Konstruksi as consultant. Apart from being a health infrastructure, this development can also improve the economy because it absorbs a lot of workforces (Fisu et al. 2020), especially construction workers.

At the time of carrying out construction work, it is mandatory to implement an occupational safety and health (K3/OHS) management system at work sites where occupational safety and health issues are also part of project planning and control. Project management is one of the things that most influences occupational accidents in environment construction projects (Christina et al. 2019, Hoła et al. 2017). The most important stage in occupational health and safety is the assessment stage, where the risk point of each identified hazard is calculated, and whether the hazard level is acceptable or not (Gul et al. 2018). Therefore, the authors conducted research on occupational safety and health (K3) management, namely regarding the risk of work accidents within the project.

2. Methods

This research uses a quantitative method approach, by collecting primary and secondary data. Primary data collection in the form of occupational accident risk data, was carried out using a questionnaire to the respondents and interviews with related parties. Secondary data collection is done by collecting reference material in the form of literatures or journals related to this research. Analysis of the data was carried out in several stages, including testing the validity of primary data. The calculation of the risk value for work accidents is carried out using the Fine method. The fine method is a comprehensive risk assessment method and has been widely used to help control hazards in the workplace (Wang et al. 2018). The Fine method is used in calculating the risk score for work accidents by looking for three parameters, namely, E (Exposure), C (Consequences), and P (Probability) (Kokangül at al. 2017). Fine method provides a more detailed explanation of the concepts of exposure, consequence and probability (Yilmaz et al. 2019). Where Fine exposure is the frequency of exposure to a hazard or a source of risk (Gul et al. 2018).

In this method, the terms used are as follows: Chance is defined as the likelihood of a sequence of events leading to an accident that will occur upon exposure to the risk. Exposure is defined as the frequency of hazard events. Consequences are defined as the effects most likely to occur from a potential hazard.

Chance measures the likelihood of a hazard-related event occurring. The probability value has a range of 0.1 to 10 which can be seen in Table 1, Hazard exposure with respect to the frequency with which people may be exposed to the identified hazard (Gul et al. 2021).

The probability value has a range of 0.5 to 10 which can be seen in Table 2, Consequences which are the physical consequences of an accident which give an indication of the risk complexity associated with adverse effects on humans, property damage / loss and decreased productivity (Yalçin et al. 2018). The value adopted has a range of 1 to 100 which can be seen in table 3.

Table 1. Value of accident by chance

Factor	Description	Value
Opportunity of accidents happen	Almost often	10
	Could happen (50:50 chance)	6
	Not common but likely (1:10 chance)	3
	less likely to happen (1: 100 chance)	1
	Imaginable but possible (1: 1000 chance)	0,5
	Almost impossible (1: 1000 chance)	0,1

Table 2. Value of accident by exposure

Factor	Description	Value
Level of accident exposure	Can occur continuously or daily	10
	Often (several times a week)	6
	Once in a while (several timesa month)	3
	Not always (several times a year)	2
	Rarely (once a year)	1
	Very rarely (once in over a year)	0,5

Table 3. Value of accidents by level of consequences

Factor	Description	Value
Impact/ Consequences of Loss	Death of many people or loss> Rp. 5 Billion or stopping work or damage to the environment of role and breadth	100
	Death of more than 1 person or loss of Rp. 2-5 Billion or local environmental damage	50
	A person's death or loss of IDR250 million-2.5 billion or non-permanent environmental damage	25
	Life-long disability, or loss of IDR 25-250 million or impact on environmental damage	15
	Stopping work temporarily, loss of IDR.5-25 million.	5
	Minor injuries, or loss < IDR 2.5 million	1

The values assigned to each level of consequence, opportunity and exposure are operated by multiplying to get the level of risk value. The risk value is a risk measurement of a general value in such a way that the risk can be compared and prioritized for control. The nomogram in Figure 1 can also be used to combine these values to obtain a risk value.

$$Risk\ Value = Pp \times Pe \times Kc$$

Pp = probability of accidents occurring (probability)
Pe = accident exposure level (exposure)
Kc = consequences that can occur (consequences)

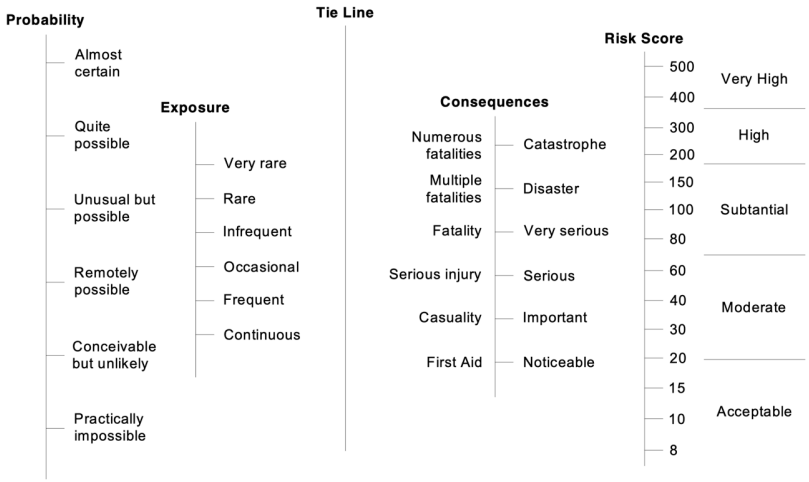


Figure 1 Nomogram for risk classification

Risk assessment commonly used in the construction industry is similar to Fine method which only applies three descriptions of action, starting from immediate action, as soon as possible and acceptable action.

Table 4 below is used to determine risk treatment priorities.

Risk Value	Risk Category	Action Description
>350	Very high	Requires immediate action to control Hazards
180-350	High	
70-180	Substantial	Requires a danger control approach as soon as possible
20-70	Moderate	
< 20	Acceptable	Acceptable risks and subsequent risk reduction should not be done

Table 4 shows that the categories of the construction. There is five conditions that allow to see about the treatment priorities.

3. Result and Discussion

From the results of studies and interviews and based on the limitations of the problems in this study, it is concluded that the main work in construction environtment projects related to work safety is Logistic Storage, which consists of storing tools, materials and materials, Structural Work, which consists of; (a) scaffholding work, (b) ironwork, (c) casting work, mechanical electrical work which consists of installation, machine operational work, and heavy equipment work which consists of; (a) welding work, (b) excavation work using heavy equipment, (c) machine operational work, (d) tower crene operational work, architectural work consisting of; (a) brickwork, plaster and painting work, (b) frame installation, and foundation work consisting of; (a) drilling work, (b) steel fixing work, (c) installation of reinforcing steel frames, (d) machine operational work, (e) casting work.

From the results of the risk identification of work accidents in these studies, the accidents analyzed were grouped into 5 categories based on their cause and 6 categories based on their occupation. Work accidents based on the causes, namely; (a) work accidents caused by transportation, heavy equipment, traffic and machinery, (b) work accidents caused by falling objects, (c) work accidents caused by falling from a high place, and (e) work accidents caused by by

sparks, electricity and explosions. Meanwhile, based on the work, namely; (a) storage work for tools, materials and materials, (b) structural work, (c) mechanical and electrical work, (d) operational work for machines and heavy equipment, (e) architectural work, and (f) foundation work.

Analysis of the effectiveness of risk control for construction workers is carried out by determining the risk of accidents in the work environment. The identification of the risk of work accidents in this study was carried out based on data obtained from a questionnaire distributed to respondents, namely the parties involved in the development of the project.

The results of the work accident risk identification obtained from the questionnaire were determined to be the research variables, so that there were several research variables. Each of these variables goes through a validity test. So from the synchronization results, it is stated that 5 variables of work accident risk categories are used in analyzing the effectiveness of occupational accident risk control.

Reliability test is used to see whether the measuring instrument used by the questionnaire shows consistency in measuring the same symptoms. The terms of the reliability test using the Cronbach's alpha coefficient are: (1) Cronbach's coefficient alpha value <0.6 indicates that the research instrument is unreliable and (2) Cronbach's value alpha coefficient> 0.6 indicates that the research instrument is reliable (Ginting and Kristiana 2020).

Table 5 shows the test results, where the Cronbach alpha output Exposure (E) value is 0.971, so the data is reliable or trustworthy. The Cronbach alpha output Consequence (C) value is 0.932, so the data is reliable or trustworthy. The Cronbach alpha output Probability (P) value is 0.927, so the data is reliable or trustworthy. Overall the test results in Table 5 show the Cronbach alpha output value> 0.6. This shows that the research instrument is reliable.

Table 5. Reability test result

	Cronbach's Alpha	*N of Items*
Reability test Exposure (E)	*0,971*	*7*
Reability test Consequence (C)	*0,932*	*7*
Reability test Probability (P)	*0,927*	*7*

The data analysis used in this study is Fine method. The data analysed was only data that passed the validation test of the SPSS program. Variables that do not pass the validation test are considered invaluable (0). From the results of the risk analysis that has been carried out, the results are as shown in Table 6 below:

The results of the analysis are presented in Table 6 where the occupational accident risk variable is dominated by the value at the risk level of 20-70 or moderate, while there are two categories of conditions where the work accident variable is at the 70-180 or substantial risk level. Meanwhile, there are 5 conditions in which the occupational accident variable is at a risk level <20 or acceptable. For the risk category of accidents based on the level of consequences can be seen in Table 7.

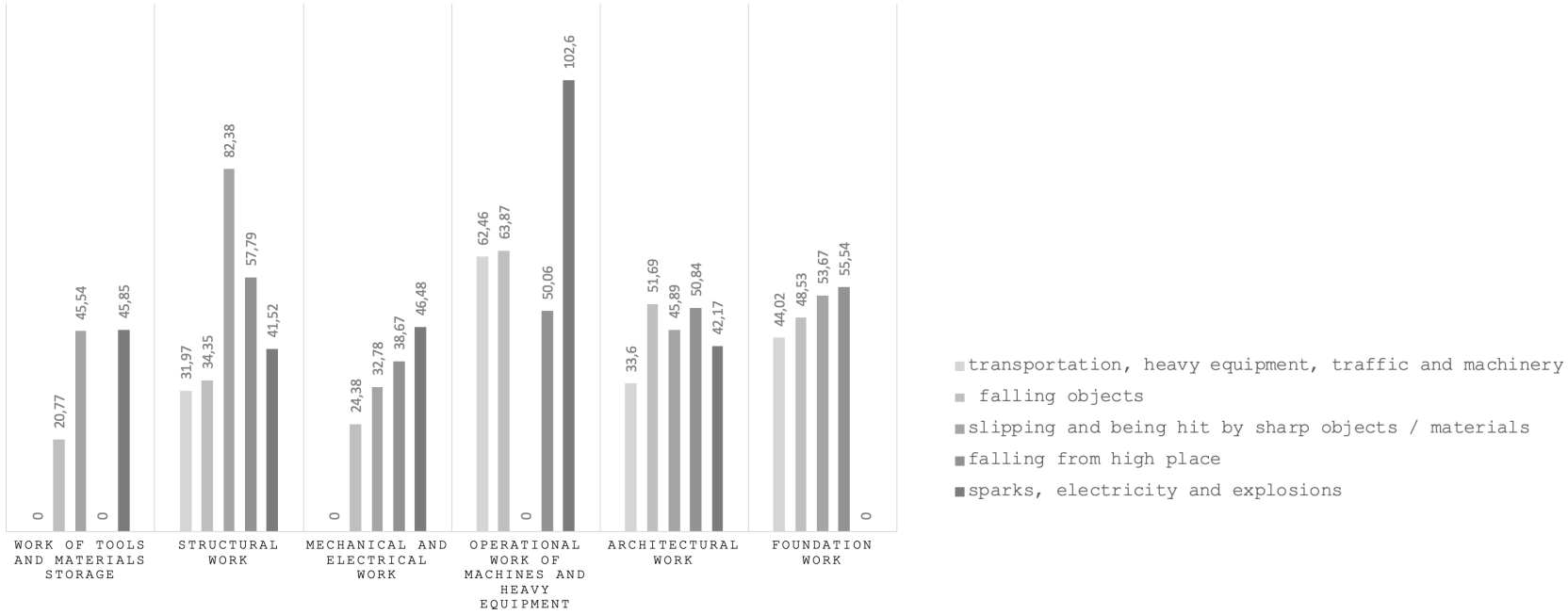
Table 6. Category of accidents based on the degree of consequence

	Work of tools and materials storage	*Structural work*	*Mechanical and electrical work*	*Operational work of machines and heavy equipment*	*Architectural work*	*Foundation work*
transportation, heavy equipment, traffic and machinery						
falling objects						
slipping and being hit by sharp objects / materials						
falling from high place						
sparks, electricity and explosions						

acceptable
moderate
substansial

Table 7 Fine Analysis Results

Accident causes category	*Work category*					
	Work of tools and materials storage	*Structural work*	*Mechanical and electrical work*	*Operational work of machines and heavy equipment*	*Architectural work*	*Foundation work*
accident risk caused by transportation, heavy equipment, traffic and machinery	0	31,97	0	62,46	33,6	44,02
accident risk caused by falling objects	20,77	34,35	24,38	63,87	51,69	48,53
accident risk caused by slipping and being hit by sharp objects / materials	45,54	82,38	32,78	0	45,89	53,67
accident risk caused by falling from high place	0	57,79	38,67	50,06	50,84	55,54
accidents caused by sparks, electricity and explosions	45,85	41,52	46,48	102,6	42,17	0



4. Conclusion

Because the risk category value is quite large, the control in project implementation in terms of work safety must receive serious attention by project managers and implementers. The risk value in the moderate category was lowered as much as possible to the acceptable level, and the substantial risk was lowered to moderate or to acceptable. To reduce the risk value, the implementation of OHS/K3, project supervision, and control is very important so that the incidence of work accidents is kept to a minimum.

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Biographies

Marsus Suti. Born in Luwu Regency, Indonesia, December 30, 1960. Served as Chancellor of Universitas Andi Djemma, Palopo, Indonesia from 2014 until now. He holds a Doctorate in Education Management, Universitas Negeri Jakarta in 2010. His areas of expertise include Occupational Safety and Health Management, Education Management and Organizational Behavior

Amiruddin Akbar Fisu. Born in Penajam, Indonesia, on March 10, 1990. He earned a Master's degree in Transportation from Institut teknologi Bandung, Indonesia, in 2015, and is currently actively teaching and researching at the Faculty of Engineering, Andi Djemma University. This assistant professor has an interest in the scientific fields of urban and regional planning, transportation, and land use.

Arifuddin Rachmat Fisu. Born in Penajam, Indonesia, on Ocktober 07, 1992. Graduated from the Department of Civil Engineering, Faculty of Engineering, Hasanuddin University in 2015, with a focus on the field of research is Occupational Health and Safety.

Ahmad Ali Hakam Dani was born in Palopo, Indonesia. He obtained his bachelor's degree in Mathematics from Hasanuddin University in 2010, and his Master's degree in Information Technology form University of Indonesia in 2014. Currently, He is a Lecturer in Informatics Engineering, Faculty of Engineering at Universitas Andi Djemma Palopo. His current research interests include Information Technology, Information System, Expert System, Augmented Reality, and IT Governance.

Apriyanto Apriyanto was born in Ujung Pandang, Indonesia. He obtained his Bachelor of Mathematics Education in 2010 from Universitas Negeri Makassar and his Magister of Science degree in 2014 from Universitas Gadjah Mada. Apriyanto is currently a lecturer at the Informatics Engineering Study Program, Andi Djemma Palopo University. Currently, he is interested in research in Actuarial, Mathematics, Statistics, and Informatics Engineering.

Andi Dewi Angreyani was born in Makassar Indonesia, Indonesia. She obtained her bachelor's degree in Economics from Andi Djemma University in 2013, and her Master's degree in Finance Management from Hasanuddin University in 2019. Currently, she is a Lecturer in Economic Department at Universitas Andi Djemma Palopo. Her current research interests include Finance, Management and Decision Making.

Ismail Surdi Wekke is a lecturer at Postgraduate Program in the Department of Islamic Education, Institut Agama Islam Negeri (IAIN) Sorong, Indonesia, where he serve as chair (2020-2021). Ismail was born in the kampung namely Camba. A village in Kabupaten Maros, South Sulawesi, Indonesia. His areas of interest and research range in various topics, include teaching and learning, sociolinguistics, and multicultural education.

Amiul Amruh was born in Palopo, Indonesia. Graduated from the Department of Informatics Engineering, Faculty of Engineering, Andi Djemma University in 2021, and currently he's focusing on research about his interest and also develop his soft skill like programming, logic, and data science.