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Occupational Health and Safety (OHS) Risk Analysis in the Villa Development Project

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risk assessment;
work accident;

Abstract

In the process of working on a construction project, there is no such thing as a work accident, therefore it is necessary to take preventive measures. One of its efforts to prevent workplace accidents is the implementation of Occupational Health and Safety (K3). K3 is a form of effort to ensure the integrity and perfection of the workforce, both physically and spiritually, to create protection and security from the risk of accidents and hazards both physically and mentally. The method used in this research is Hazzard Identification, Risk Assessment and Determining Control. The construction project of Vila House identified 82 occupational risks, therefore 42 risks are classified as low risk and 40 risks are classified as medium risk. The preventive measures that can be taken to minimize the risk of Occupational Health and Safety (K3) are Eliminate Unsafe Conditions and Unsafe action socialization/ Occupational Health and Safety (K3) training, as well as Use of proper and correct (Personal Protective Equipment) and (Work Protective Equipment).

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1 Introduction

As stated in Law No. 1 of 1970 that "every worker has the right to protection for his safety in doing work for the welfare of life and to increase national production and productivity". The purpose of implementing the Occupational Health and Safety (K3) program in the work environment is so that every worker gets occupational safety and health guarantees (Prawiro, 2018). Protection of workers from work-related hazards and diseases or the work environment is very much needed so that workers feel safe and comfortable in completing their work (Zhang et al., 2015; Bahn, 2013).

K3 in the Villa development project can be seen during the project implementation process. Implementation During the work process, in the field several workers experienced work accidents, such as being scratched by wire or iron and being pierced by nails (Dzeng et al., 2016). This can be caused by a lack of OSH implementation, namely in the form of the application of Personal Protective Equipment (PPE) and Health Protective Equipment (APK), the lack of OSH implementation and the absence of management who handles OSH in this project. Based on this, it is considered necessary to research "K3 Risk Analysis in the Villa House Development Project". Based on the description above, the problem can be formulated as follows:

a) What are the OHS risks identified in the "I D G Palguna's House" Villa Development Project on Jalan Tukad Badung Bali?
b) How is the K3 risk assessment in the "I D G Palguna's House" Villa Development Project on Jalan Tukad Badung Bali?
c) How is the control of OHS risk in the "I D G Palguna's House" Villa Development Project on Jalan Tukad Badung Bali?

The benefits of this research are:

a) To know the importance of implementing K3
b) Increasing awareness and knowledge about K3
c) Knowing OHS risks and how to control them
d) Avoid loss/loss of working hours, materials and souls due to work accidents
e) Creating an efficient and productive work environment

2 Materials and Methods

The research design used in this research is descriptive-analytic. The method used to analyze OHS risk in the Villa House (Dewi & Wardani, 2022; Tejamaya et al., 2021). This study aims to identify, assess and find out how to control the OHS risks that occur in the Villa Development Project on Jalan Tukad Badung Bali. In obtaining the data in this study, the data collection techniques used were:

a) Questionnaires were carried out through a list of questions given to management and project workers involved in the House Villa. Questionnaires were prepared to obtain data in the form of opportunities for work accident risks that might occur.
b) Interviews in research occur when researchers are chatting with informants to dig up information through questions that are still within the scope of the questionnaire submitted. In this study, the interview subjects were Project Managers, Field Executors and Workers.
c) Observation/Observation, in this study the researcher made direct observations to find facts in the field. Observation / Observation techniques are carried out by direct field observations to obtain data that can strengthen the results of data collection through interviews and distributing questionnaires.

Data collection in the study involved 17 respondents consisting of project management and project workers involved in the Villa House Development Project. The questionnaire is distributed to project management and workers via a link that will lead to Google Forms. After that, validation and reliability tests were carried out with the Statistical Program for Social Science (SPSS) software.

Table 1
Validation Test Results (Sig.) Significance Value

No	(Sig.) (Hasil)	(Sig.) (Minimal)	Notes
A	2nd floor beam questionnaire		
1	0,038	0,05	Valid
2	0,009	0,05	Valid
3	0,008	0,05	Valid
4	0,001	0,05	Valid
5	0,038	0,05	Valid
B	2nd floor plate questionnaire		
1	0,050	0,05	Valid
2	0,001	0,05	Valid
3	0,023	0,05	Valid
4	0,027	0,05	Valid
5	0,022	0,05	Valid
C	2nd floor column questionnaire		
1	0,001	0,05	Valid
2	0,048	0,05	Valid
3	0,008	0,05	Valid
4	0,001	0,05	Valid
5	0,037	0,05	Valid

Table 2
Questionnaire reliability test results

No	Kuesioner	*Cronbach's Alpha* (Hasil)	*Cronbach's Alpha* (Minimal)	Notes
1	Questionnaire on the probability of work accidents on the 2nd-floor beam work	0,611	0,6	Valid
2	Questionnaire on the probability of work accidents on the 2nd-floor plate work	0,881	0,6	Valid
3	Questionnaire on the probability of a work accident occurring on the 2nd-floor column work	0,633	0,6	Valid

3 Results and Discussions

Overview of the Denpasar City Utilities Network

A. Risk Identification (*Risk Assesment)*
In the work on the 2nd-floor beams, 2nd-floor plates and 2nd-floor columns, a total of 82 work risks were identified that could occur (Sutapa et al., 2021). The 82 risks consist of 16 types of occupational risks, namely falling/impacting scaffolding, slipping, being punctured by nails, being scratched/punctured by iron/wire, being hit by a hammer, being pinched by formwork, falling/impacting formwork, hands/finger scratches by saws, shortness of breath, fever, fell from a height, fell/hit/was caught by metal, caught by

iron, hand/finger was cut off by a grinder, the concrete pump fell and was caught by a vibrator machine (Nai'em et al., 2020).

B. Risk Assessment *(Hazzard Identification)*

Table 3
Risk Assessment on the Villa I D G Palguna's House Development Project

No	Critical Work Stage	Accident Hazard	Opportunity (P)	Consequence (A)	Risk Level (PxA)
A	**Floor Beam Work 2**				
A.1	**Scaffolding & Formwork Work**				
1	Installation of Bamboo Scaffolding	Fall/hit scaffolding	1	4	4
2	Slippery work floor	Slip	2	3	6
3	Scaffolding and formwork assembly used nails scattered on the work floor	Pierced by a nail	3	2	6
4	Pieces of iron/wire scattered on the work floor	Scratched / punctured iron/wire	3	2	6
5	Scaffolding and formwork assembly using a hammer	Hammer hit	2	2	4
6	Installation and assembly of the formwork	Wedged formwork	2	2	4
7	Formwork installation on the 1st-floor column	Fall/hit the formwork	1	4	4
8	sawing bamboo and plywood	Saw scratched hands/ fingers	1	2	2
9	Dust gets into the nose	Hard to breathe	2	3	6
10	Extreme weather	Fever	1	3	3
11	Height	Fall from a height	1	5	5
A.2	**Iron Work**				
1	Iron	Fall/bump/pinned iron	1	4	4
2	Slippery work floor	Slip	2	3	6
3	Scaffolding and formwork assembly used nails scattered on the work floor	Scratched/punctured iron/wire	3	2	6
4	Iron reinforcement assembly	Iron clamped	2	2	4
5	Cutting iron with a seated grinder	Grinding hands/ fingers	1	5	5
6	Dust gets into the nose	Hard to breathe	2	3	6
7	Extreme weather	Fever	2	3	6
8	Height	Fall from a height	1	5	5
A.3	**Foundry Work**				
1	Casting using a concrete pump	The fall of the concrete pump	1	4	4
2	Use of vibrators	clamped vibrator machine	1	4	4
3	Slippery work floor	Slip	1	3	3

4	Pieces of iron/wire scattered on the work floor	Scratched / punctured iron/wire	1	2	2
5	Pieces of iron/wire scattered on the work floor	Iron clamped	3	2	6
6	Installation and assembly of the formwork	Wedged formwork	2	2	4
7	Dust gets into the nose	Hard to breathe	2	3	6
8	Extreme weather	Fever	1	3	3
9	Height	Fall from a height	1	5	5
B	**Floor Plate Work 2**				
B.1	**Scaffolding & Formwork Work**				
1	Installation of Bamboo Scaffolding	Fall/hit scaffolding	1	4	4
2	Slippery work floor	Slip	2	3	6
3	Scaffolding and formwork assembly used nails scattered on the work floor	Pierced by a nail	2	2	4
4	Pieces of iron/wire scattered on the work floor	Scratched / punctured iron/wire	3	2	6
5	Scaffolding and formwork assembly using a hammer	Hammer hit	2	2	4
6	Installation and assembly of the formwork	Wedged formwork	1	2	2
7	Formwork installation on the 1st-floor column	Fall/hit the formwork	1	4	4
8	sawing bamboo and plywood	Saw scratched hands/ fingers	1	2	2
9	Dust gets into the nose	Hard to breathe	2	3	6
10	Extreme weather	Fever	1	3	3
11	Height	Fall from a height	1	5	5
B.2	**Iron Work**				
1	Iron	Fall/bump / pinned iron	1	4	4
2	Slippery work floor	Slip	2	3	6
3	Scaffolding and formwork assembly used nails scattered on the work floor	Scratched/punctured iron/wire	3	2	6
4	Iron reinforcement assembly	Iron clamped	2	2	4
5	Cutting iron with a seated grinder	Grinding hands/ fingers	1	5	5
6	Dust gets into the nose	Hard to breathe	1	3	3
7	Extreme weather	Fever	1	3	3
8	Height	Fall from a height	1	5	5
B.3	**Foundry Work**				
1	Casting using a concrete pump	The fall of the concrete pump	1	4	4
2	Use of vibrators	clamped vibrator machine	1	4	4
3	Slippery work floor	Slip	2	3	6
4	Pieces of iron/wire scattered on the work floor	Scratched / punctured iron/wire	2	2	4

5	Pieces of iron/wire scattered on the work floor	Iron clamped	3	2	6
6	Installation and assembly of the formwork	Wedged formwork	2	2	4
7	Dust gets into the nose	Hard to breathe	1	3	3
8	Extreme weather	Fever	1	3	3
9	Height	Fall from a height	1	5	5
C	**2nd Floor Column Work**				
C.1	**Scaffolding & Formwork Work**				
1	Installation of Bamboo Scaffolding	Fall/hit scaffolding	1	4	4
2	Slippery work floor	Slip	2	3	6
3	Scaffolding and formwork assembly used nails scattered on the work floor	Pierced by a nail	3	2	6
4	Pieces of iron/wire scattered on the work floor	Scratched / punctured iron/wire	3	2	6
5	Scaffolding and formwork assembly using a hammer	Hammer hit	2	2	4
6	Installation and assembly of the formwork	Wedged formwork	2	2	4
7	Formwork installation on the 1st-floor column	Fall/hit the formwork	1	4	4
8	sawing bamboo and plywood	Saw scratched hands/ fingers	1	2	2
9	Dust gets into the nose	Hard to breathe	1	3	3
10	Extreme weather	Fever	2	3	6
11	Height	Fall from a height	1	5	5
C.2	**Iron Work**				
1	Iron	Fall/bump / pinned iron	2	4	8
2	Slippery work floor	Slip	2	3	6
3	Scaffolding and formwork assembly used nails scattered on the work floor	Scratched/punctured iron/wire	3	2	6
4	Iron reinforcement assembly	Iron clamped	2	2	4
5	Cutting iron with a seated grinder	Grinding hands/ fingers	1	5	5
6	Dust gets into the nose	Hard to breathe	1	3	3
7	Extreme weather	Fever	2	3	6
8	Height	Fall from a height	1	5	5
C.3	**Foundry Work**				
1	Slippery work floor	Slip	2	3	6
2	Pieces of iron/wire scattered on the work floor	Scratched / punctured iron/wire	3	2	6
3	Pieces of iron/wire scattered on the work floor	Pinned/impaled iron	1	2	2
4	Installation and assembly of the formwork	Wedged formwork	1	2	2
5	Dust gets into the nose	Hard to breathe	1	3	3
6	Extreme weather	Fever	2	3	6
7	Height	Fall from a height	1	5	5

C. Risk Control *(Determining Control)*

a) Eliminate Unsafe Conditions and Unsafe actions. In this case, the role of companies and workers is needed. Companies must provide safe work facilities and infrastructure while workers must have awareness and eliminate acts of carelessness or abnormalities when working which can result in work accidents (Pinto et al., 2011).
b) Occupational Health and Safety (K3) socialization or training. Periodic OSH socialization or training must be carried out at least once a month and safety talk briefings, safety induction, safety patrols, slogans and provision of signs are held.
c) Use the right and correct PPE and APK, such as safety helmets, gloves, goggles, masks, safety shoes, safety belts or body harnesses, lifelines, guard railings and fall arresters.

4 Conclusion

Based on the results of the analysis and discussion that has been carried out, the conclusions that can be drawn are:

a) In the work of beams, slabs and columns on the 2nd floor, a total of 82 work risks were identified that could occur. The 82 risks consist of 16 types of occupational risks, namely falling/impacting scaffolding, slipping, being punctured by nails, being scratched/punctured by iron/wire, being hit by a hammer, being pinched by formwork, falling/impacting formwork, hands/fingers scratched by saws, shortness of breath, fever, fell from a height, fell/hit/was caught by metal, caught by metal, hand/finger was cut off by a grinder, the concrete pump fell and was caught by a vibrator machine (Melchior & Zanini, 2019; Feng et al., 2015; Nenonen, 2011).
b) Of the 82 identified work risks, 42 risks are classified as low risk and 40 risks are classified as medium risk.
c) The preventive actions that can be taken, to minimize Occupational Health and Safety (K3) risks are Eliminate Unsafe Conditions and Unsafe actions, Socialization or training on Occupational Health and Safety (K3) and Using PPE (Personal Protective Equipment) and APK (Protective Equipment) Work) is precise and correct.

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References

Bahn, S. (2013). Workplace hazard identification and management: The case of an underground mining operation. *Safety science*, *57*, 129-137. https://doi.org/10.1016/j.ssci.2013.01.010

Dewi, A. I., & Wardani, E. (2022). Occupational health and safety management system and work-related accidents among hospital nurses. *Enfermería Clínica*, *32*, S6-S10. https://doi.org/10.1016/j.enfcli.2022.03.008

Dzeng, R. J., Lin, C. T., & Fang, Y. C. (2016). Using eye-tracker to compare search patterns between experienced and novice workers for site hazard identification. *Safety science*, *82*, 56-67. https://doi.org/10.1016/j.ssci.2015.08.008

Feng, Y., Zhang, S., & Wu, P. (2015). Factors influencing workplace accident costs of building projects. *Safety science*, *72*, 97-104. https://doi.org/10.1016/j.ssci.2014.08.008

Ilmu Teknik Sipil. (2012). Jenis – Jenis Bekisting.

Klop Mart. (2018). K3: Keselamatan dan Kesehatan Kerja.

Melchior, C., & Zanini, R. R. (2019). Mortality per work accident: A literature mapping. *Safety Science*, *114*, 72-78. https://doi.org/10.1016/j.ssci.2019.01.001

Nai'em, F., Darwis, A. M., & Amin, F. (2020). Analysis of work accident cost on occupational safety and health risk handling at construction project of Hasanuddin University the Faculty of Engineering. *Enfermería clínica*, *30*, 312-316. https://doi.org/10.1016/j.enfcli.2020.06.070

Nenonen, S. (2011). Fatal workplace accidents in outsourced operations in the manufacturing industry. *Safety Science*, *49*(10), 1394-1403. https://doi.org/10.1016/j.ssci.2011.06.004

Pinto, A., Nunes, I. L., & Ribeiro, R. A. (2011). Occupational risk assessment in construction industry–Overview and reflection. *Safety science*, *49*(5), 616-624. https://doi.org/10.1016/j.ssci.2011.01.003

Prawiro, M. (2018). Pengertian K3 Secara Umum, Tujuan, Prinsip, Ruang Lingkup, Jenis K3.

Sugiyono, D. (2010). Metode penelitian kuantitatif dan R&D. *Bandung: Alfabeta*, 26-33.

Sugiyono. (2014). Metode Penelitian Kualitatif, Kuantitatif dan R&D. Bandung: Tarate.

Sutapa, I. K., Kader, I. M. S., Santiana, I. M. A., Wibawa, I. G. S., Yasa, I. M. T., & Suasira, I. W. (2021). Work accident risk analysis with FMEA (failure mode and effect analysis) method on steel frame bridge project. *International Journal of Physical Sciences and Engineering*, *5*(3), 52–60. https://doi.org/10.53730/ijpse.v5n3.2942

Tejamaya, M., Puspoprodjo, W., Susetyo, H., & Modjo, R. (2021). An analysis of pivotal factors in the implementation of occupational health and safety management systems in micro, small and medium enterprises (MSMEs): Literature review. *Gaceta Sanitaria*, *35*, S348-S359. https://doi.org/10.1016/j.gaceta.2021.10.050

Zhang, S., Sulankivi, K., Kiviniemi, M., Romo, I., Eastman, C. M., & Teizer, J. (2015). BIM-based fall hazard identification and prevention in construction safety planning. *Safety science*, *72*, 31-45. https://doi.org/10.1016/j.ssci.2014.08.001

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