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Occupational Health & Safety Risk Analysis with HIRADC Method in Building Construction Project X

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Abstract: Within construction projects, there is a risk of workplace accidents that can cause injury and death to workers. These risks are some of the factors that can cause project failure and affect other worker activities. If proper risk control is no carried out the incident can escalate into a fatal work accident. Therefore, good implementation of Occupational Safety and Health (OHS) is essential in every construction project. This research aims to plan work safety using Hazard Identification, Risk Assessment, and Determining Control (HIRADC) method to identify potential hazards, assess the risk of these hazards, and determine appropriate controls to minimize the risks that may occur. In the observed work, the result of hazard identification and risk assessment using the HIRADC method found 22 potential hazards, namely 3 with extreme risk level, and 5 with low risk level. Control were carried out based on the control hierarchy in the form of engineering, administrative, and personal protective equipment (PPE), which succeeded in reducing the risk level so that there were no jobs with extreme and high risk levels. Thus, it can be understood that proper risk control can prevent work accidents.

Keywords: HIRADC, Occupational Health and Safety (OHS), Risk, Work Accidents.

Introduction

Infrastructure development is currently growing rapidly along with the increasing population in Indonesia, especially in the construction sector including the development of health facility infrastructure such as hospitals that provide medical services and health care for the community. In the digital era, hospitals also need to carry out digital transformation in services to patients and improve good facilities, especially in areas where health infrastructure is till inadequate. The X Building Construction Project is one of the projects that support the inadequate infrastructure needs in Indonesia.

Nevertheless, in construction projects there is a risk of work accidents that can cause injury and even death to workers. According to records from the Ministry of Public Works and Spatial Planning's Bina Konstruksi in 2019, there were 130.923 work accidents, most of which occurred on construction projects in Indonesia. Thus, efforts to ensure Occupational Health and Safety (OHS) are very important. OHS is an important aspect that must be implemented by every company and is a form of protection for workers (Act No. 13 Year 2003).

Improving occupational safety and risk control in construction projects is essential. One effective method is HIRADC (Hazard Identification, Risk Assessment, and Determining Control). This method can identify potential hazards, risk assessment, and determination of appropriate controls to minimize the risk of work accidents. By applying HIRADC systematically, appropriate preventive measures can be taken, so that the number of work accidents in construction projects can be minimized. Thus, the implementation of OHS and the use of the HIRADC method are important steps to ensure work safety in the construction sector and support the development of safe and quality infrastructure.

Methodology

Methods used in this research are HIRADC (Hazard Identification, Risk Assessment, Determining Control) which aims to identify hazards that occur in concrete structure work, conduct a risk assessment of the observed work to find out the work that has the tightest risk level and carry out appropriate controls in order to minimize work accidents. Below is the flow chart of the research:

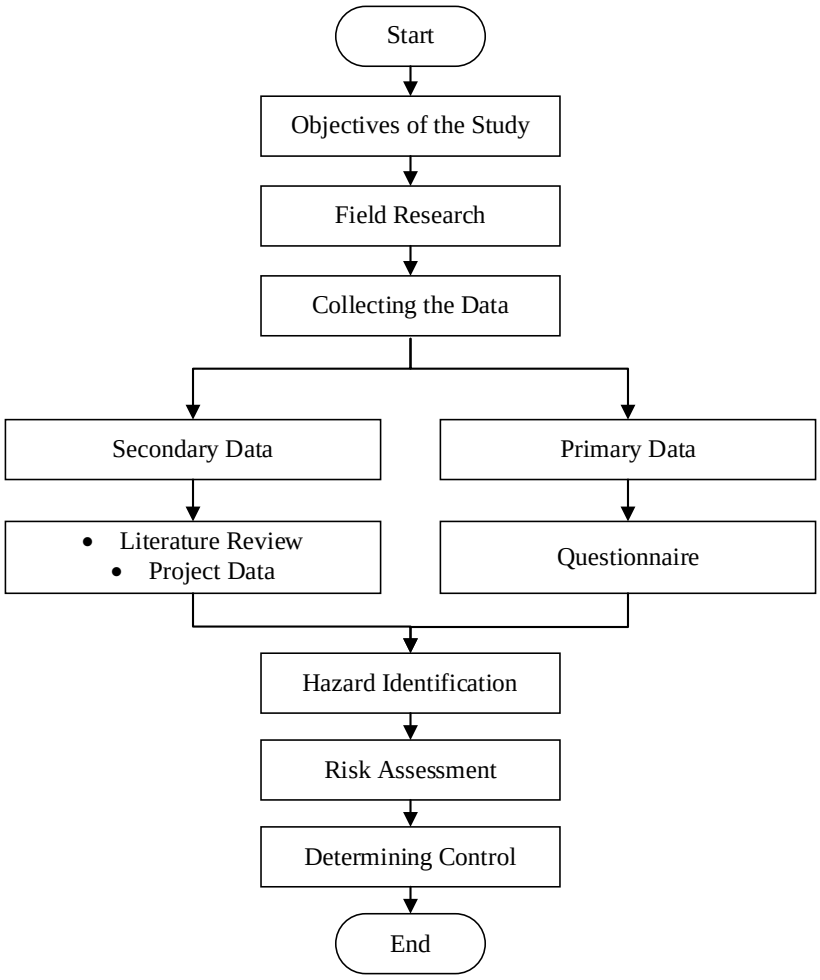

Figure 1. Flow Chart

Result and Discussion

1. Hazard Identification

Hazard identification can be done with several, namely by conducting interview, observations, and other project documents. This aims to find out how likely the hazards that can occur in the work observed. The following are the results of hazard identification in concrete structure, which can be seen in the table below

Table 1. Hazard Identification

No	Job Description	Hazard Risk
1.	Scaffolding	a. Hand caught in scaffolding lock b. Fall from collapsed scaffolding c. Hit by collapsed scaffolding frame d. Farthest from altitude e. Slipped from heights
2.	Reinforcing Works	a. Hands or feet caught in metal during material transfer b. Hand caught in cutting tools c. Crushed by materials or tools d. Hand of foot pierced by material e. Electrocution

No	Job Description	Hazard Risk
3.	Formwork	a. Collapsed by conventional formwork b. Hands or feed pinched during formwork placement c. Fall from height during formwork installation d. Hands or feet pierced by plywood fragments during formwork installation e. Hand or feet hit by a hammer f. Hand or feet caught in the formwork mold
4.	Casting	a. Bumped by casting hose b. Irritation from additives c. Vibrator-induced tremors d. Fall or slip during casting e. Electrocution f. Fall from heights

Based on the results of hazard identification in concrete structure work on Building X Construction Project, 22 potential hazards were obtained, where there were 5 hazards in scaffolding installation work, 5 hazards in concreting work, 6 hazards in formwork and 6 hazards in casting work.

2. Risk assessment

This risk assessment stage aims to determine the level of risk in terms of the results of two parameters, namely consequences and likelihood. The value determination uses the symbol (S) for consequences and the symbol (L) for likelihood, according to Ramli (2010). Then the results obtained from the risk level are evaluated to determine the risk criteria.

Table 2. Risk Assessment

No.	Job Description	Hazards	Possibilities	Impact	Risk
1.	Scaffolding	a. Hand caught in scaffolding lock	2	2	4
		b. Fall from collapsed scaffolding	3	3	9
		c. Hit by collapsed scaffolding frame	2	3	6
		d. Farthest from altitude	3	4	12
		e. Slipped from heights	2	4	8
2.	Reinforcing Works	a. Hands or feet caught in metal during material transfer	3	3	9
		b. Hand caught in cutting tools	3	3	9
		c. Crushed by materials or tools	2	3	6
		d. Hand of foot pierced by material	3	3	9

No.	Job Description	Hazards	Possibilities	Impact	Risk
		e. Electrocution	2	4	8
3.	Formwork	a. Collapsed by conventional formwork	2	4	8
		b. Hands or feed pinched during formwork placement	3	3	9
		c. Fall from height during formwork installation	3	4	12
		d. Hands or feet pierced by plywood fragments during formwork installation	2	3	6
		e. Hand or feet hit by a hammer	3	2	6
		f. Hand or feet caught in the formwork mold	2	2	4
4.	Casting	a. Bumped by casting hose	2	2	4
		b. Irritation from additives	2	2	4
		c. Vibrator-induced tremors	2	2	4
		d. Fall or slip during casting	3	3	9
		e. Electrocution	2	4	8
		f. Fall from heights	3	4	12

Table 3. Risk Assessment Level

No.	Job Description	Hazards	Risk Level
1.	*Scaffolding*	a. Hand caught in scaffolding	Low-risk
		b. Fall from collapsed scaffolding	High-risk
		c. Hit by collapsed scaffolding frame	Medium-risk
		d. Farthest from altitude	Extreme-risk
		e. Slipped from heights	High-risk
2.	Reinforcing Works	a. Hands or feet caught in metal during material transfer	High-risk
		b. Hand caught in cutting tools	High-risk
		c. Crushed by materials or tools	High-risk
		d. Hand of foot pierced by material	Medium-risk
		e. Electrocution	High-risk
3.	Formwork	a. Collapsed by conventional formwork	High-risk
		b. Hands or feed pinched during formwork placement	High-risk
		c. Fall from height during formwork installation	Extreme-risk
		d. Hands or feet pierced by plywood fragments during formwork installation	Medium-risk
		e. Hand or feet hit by a hammer	Medium-risk

No.	Job Description	Hazards	Risk Level
		f. Hand or feet caught in the formwork mold	Low-risk
4.	Casting	a. Bumped by casting hose	Low-risk
		b. Irritation from additives	Low-risk
		c. Vibrator-induced tremors	Low-risk
		d. Fall or slip during casting	High-risk
		e. Electrocution	High-risk
		f. Fall from heights	Extreme-risk

Results from the risk level assessment calculated from two parameters, namely the likelihood and consequences of the observed work, obtained as many as 3 hazards with Extreme-risk level, 10 hazards with High-risk level, 4 hazards with Medium-risk level and 5 hazards with Low-risk level.

3. Risk Control

After identifying risks, the next stage of risk assessment is to determine risk controls that aim to reduce the risk of hazards that will occur. This risk control uses a risk control hierarchy consisting of several ways, namely:

1. Elimination
2. Substitution
3. Engineering Control
4. Administrative Control
5. Personal Protective Equipment (PPE).

The following risk control can be seen in the table below:

Table 4. Risk Control

No.	Job Description	Hazards	Control
1.	Scaffolding	a. Hand caught in scaffolding	a. Use appropriate PPE and pay attention to work steps
		b. Fall from collapsed scaffolding	b. Ensure the installation of scaffolding is installed by a competent person and the use of additional PPE in the form of Body Harness and Safety Belt.
		c. Hit by collapsed scaffolding frame	c. Ensure that the installation is done properly, and that there are no workers in the vicinity of the collapsed scaffolding.
		d. Farthest from altitude	d. Use of additional PPE, such as Body Harness and Safety Belt and ensure that the place where workers stand is made free.

No.	Job Description	Hazards	Control
		e. Slipped from heights	e. Checking PPE regularly and ensuring the footing for standing is safe and strong and ensuring the environment is always clean and tidy.
			f. Conducting morning talks on safety, toolbox meetings.
2.	Reinforcing Works	a. Hands or feet caught in metal during material transfer	a. Remind workers of the risk of hazards by conducting safety morning talks.
		b. Hand caught in cutting tools	b. Use of complete PPE and pay attention to work steps.
		c. Crushed by materials or tools	c. Ensure that the hooks are strong and no workers are underneath when lifting.
		d. Hand of foot pierced by material	d. Periodic checking of PPE (vest, helmet, gloves, shoes)
		e. Electrocution	e. Ensure that every electrical device is functioning properly and that there are no loose wires.
3.	Formwork	a. Collapsed by conventional formwork	a. Conduct safety morning talk, toolbox meeting regularly
		b. Hands or feed pinched during formwork placement	b. Ensure the hooks are strong and there are no workers around the formwork area.
		c. Fall from height during formwork installation	c. Ensure that the footing for workers to stand is safe and the use of additional PPE in the form of body harnesses and safety belts.
		d. Hands or feet pierced by plywood fragments during formwork installation	d. Periodic checking of PPE (vest, helmet, gloves, shoes).
		e. Hand or feet hit by a hammer	e. Ensure that workers who perform work use complete PPE
		f. Hand or feet caught in the formwork mold	f. Complete PPE usage instructions and pay attention to work steps.
			g. Checking PPE on workers who will perform related work
4.	Casting	a. Bumped by casting hose	a. Checking the use of PPE regularly
		b. Irritation from additives	b. Using additional PPE in the form of project goggles and

No.	Job Description	Hazards	Control
			latex gloves
		c. Vibrator-induced tremors	c. Make personnel changes
		d. Fall or slip during casting	d. Use additional PPE in the form of body harness and safety belt and make sure the place or environment is always clean and tidy.
		e. Electrocution	e. Ensure that the related tools are safe and that there are no loose wires.
		f. Fall from heights	f. Make sure the footing for standing is safe and use additional PPE in the form of body harnesses and safety belts.

With the control and prevention of hazards risk, there is a decrease in the level of hazard risk in each job, namely Medium-risk hazards to 8 hazards and 14 hazards with Low-risk levels, and there are no jobs with Extreme-risk and High-risk hazard levels.

With the control and prevention of hazard risk, there is a decrease in the level of hazard risk in each job, namely Medium-risk hazards to 8 hazards and 14 hazards with Low-risk levels, and there are no jobs with Extreme-risk and High-risk levels.

Conclusion

Based on the analysis with the HIRADC (Hazard Identification Risk Assessment and Determining Control) method, 22 potential hazards were identified in the upper structure work that will be assessed for their risk level. The hazard that has the highest risk level is the fall of workers while at height, found in scaffolding installation work, formwork installation, and casting work.

Risk control carried out in this study is by controlling by means of engineering, administrative, and PPE. From the results of risk control, a decrease in the risk level of each job was obtained, including at the Extreme-risk level and High-risk level to 0 hazards, 8 hazards at the Medium-risk level, and 14 hazards at the Low-risk level.

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