Analysis of How Important Is Occupational Safety and Health (K3) In The Water Drainage Project In Mojogede Village Using The Hirarc Method

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Abstract.
The implementation of Occupational Health and Safety (OHS) in construction projects is a crucial aspect of preventing workplace accidents and ensuring smooth project execution. This study aims to analyze the importance of OHS implementation in a drainage project in Mojogede Village, Balongpanggang District, Gresik Regency, using the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method. The study employs a qualitative descriptive approach supported by semi-quantitative data obtained through field observations and risk assessments based on likelihood and severity values. The results identified five primary hazards: excavation wall collapse, slipping in muddy areas, injuries from material lifting, being struck by materials during channel installation, and dust exposure during the finishing stage. The highest risk was associated with soil excavation—with a risk score of 12, placing it in the high-risk category—while three other activities fell into the medium-risk category and one into the low-risk category. Implementing controls based on the hierarchy of controls—comprising elimination, substitution, engineering controls, administrative controls, and the use of Personal Protective Equipment (PPE)—proved effective in reducing risk levels to the low-to-medium range. The study concludes that the HIRARC method is effective for identifying potential hazards, establishing risk control priorities, and raising worker awareness regarding the importance of OHS in village-scale drainage projects with limited resources.
Keywords: *Occupational Health and Safety implementation; drainage project; Hazard Identification, Risk Assessment, and Risk Control (HIRARC).*

I. INTRODUCTION

The development of infrastructure in Indonesia is growing rapidly, marked by the increase in infrastructure projects across various sectors. Construction success is determined not only by cost efficiency and timeliness, but also by occupational safety. The absence of accidents during project implementation reflects the effective implementation of occupational safety and health (K3) in the field, a key indicator of the consistent quality and sustainability of national construction projects.(Nahak & Chandra, 2023)Drainage is a facility designed to meet the community's need to control excess surface water. This system functions to channel rainwater and wastewater to prevent pooling or flooding.(Apriliani et al., 2024)Drainage is an important element in irrigation infrastructure because it directly affects the comfort of the community. Irrigation infrastructure because it directly affects the comfort of the community.

In the implementation of occupational health and safety (K3) in drainage construction, the level of knowledge, understanding, and application of occupational health and safety prevention and management among those involved is still very low. Implementation in the workplace is still far from perfect due to worker negligence and work delays. Water channel development projects in rural areas, such as in Mojogede Village, play a strategic role in improving the quality of life of the community by providing clean water and agricultural irrigation. However, the construction sector, particularly water infrastructure projects, is known to have a high risk of workplace accidents. According to data from the Central Statistics Agency (BPS), the construction sector contributes significantly to the number of workplace accidents each year.

The main objective of implementing K3 is to create a safe, healthy, and productive work environment. According to Bakri(2022), the implementation of K3 aims to: (1) protect workers from the risk of accidents and occupational diseases, (2) ensure that every source of production can be used safely and efficiently, and (3) improve worker welfare and organizational performance.

In a waterway development project in a rural area like Mojogede, the implementation of K3 provides tangible benefits, including reducing the risk of accidents during excavation and channel installation, controlling potential hazards in the work area, and ensuring the consistent use of personal protective

equipment (PPE) (Purwanto et al., 2025). The implementation of K3 through the use of work procedures, supervision, and the use of PPE can help reduce risks that could potentially lead to workplace accidents.(Susanto et al., 2022). Evaluation of construction projects in the Mojokerto area also shows that the implementation of K3 policies and procedures and the use of PPE are important parts of implementing occupational safety on construction projects.(Jamila & Beatrix, 2024).

Effective implementation of Occupational Safety and Health (K3) in construction projects is crucial for preventing accidents and occupational diseases. Good K3 implementation not only protects workers but also improves productivity and the quality of work. A study by Riswana(2022), emphasizing the importance of implementing the Occupational Safety and Health Management System (SMK3) in construction projects in Indonesia.

Workplace accidents in construction projects are often caused by human factors, the work environment, and suboptimal management systems. Therefore, it is crucial to identify and evaluate risks using methods such as Hazard Identification and Risk Assessment (HIRA) to mitigate potential hazards. Furthermore, developing a safety culture in the construction industry is also a crucial focus. Research by(Tang, 2025)revealed that positive leadership, job competency, safety participation, and safety compliance behavior play a significant role in forming an effective safety culture.

In the context of a waterway development project in Mojogede Village, optimal implementation of OHS requires special attention to the work environment, which may present its own challenges. Therefore, this study aims to analyze the implementation of OHS, the factors influencing worker compliance, and the effectiveness of the OHS management system in the project.

The implementation of K3 in waterway construction projects covers various aspects, from planning and implementation to field supervision. The main stages include: (1) preparing a work safety plan before project implementation; (2) providing and using personal protective equipment (PPE); (3) installing safety signs in the work area; and (4) safety training for all workers.(Purwanto, 2025). According to research by Larasati(2022)The implementation of occupational safety and health (K3) in village infrastructure projects is often suboptimal due to limited resources and a lack of training for informal workers. Therefore, improving understanding and direct supervision by project management is key to reducing the number of workplace accidents in the field.

According to Widiana(2023)The implementation of OHS in construction projects not only prevents accidents but also improves work efficiency by reducing downtime due to incidents and reducing costs due to material loss or equipment damage. Therefore, OHS implementation is an integral part of overall project management.

Occupational Safety and Health (K3) is an important part of the construction project management system that aims to ensure safe, efficient working conditions, and free from the risk of accidents and occupational diseases. According to Law Number 1 of 1970 concerning Occupational Safety, K3 is all efforts to ensure the safety of workers and others in the workplace through the implementation of safe systems, procedures, and work tools. In the context of construction projects, K3 functions to protect workers, equipment, materials, and the environment so that the construction process runs according to time, quality, and cost targets.(Juliana et al., 2023).

II. RESEARCH METHODS

This study uses a qualitative descriptive approach supported by semi-quantitative data. This approach aims to systematically describe the implementation of Occupational Safety and Health (OSH) in a water drainage construction project in Mojogede Village, Balongpanggang District, Gresik Regency.

The Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method is used as the primary analytical tool to identify potential hazards, assess risk levels, and formulate risk controls appropriate to field conditions. This approach was chosen because it is effective for small- to medium-scale construction projects and is suited to the characteristics of rural drainage projects.

The Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method is a systematic approach to OHS risk management that consists of three main stages: 1). Hazard Identification. This stage

involves detecting all potential hazards associated with drainage work, including physical, biological, ergonomic, and environmental hazards. 2). Risk assessment. The assessment is carried out by estimating the likelihood (likelihood of occurrence) and severity (severity of impact) of each identified hazard to determine the level of risk. 3). Risk control. Based on the results of the assessment, control measures are established to reduce the risk to an acceptable level. Control is carried out through a hierarchy of controls such as risk elimination, substitution, administrative control, and the use of Personal Protective Equipment (PPE). The HIRARC method has been widely applied to various construction projects to assess and control work risks effectively; this demonstrates the flexibility and effectiveness of the method in real work environments.(Masri et al., 2022).

The Occupational Safety and Health Management System (SMK3) in Indonesia is regulated by Government Regulation Number 50 of 2012. SMK3 is part of the overall company management system used to control risks related to work activities in order to create a safe, efficient, and productive workplace. SMK3 has several main elements, namely: (1) OHS policies and commitments; (2) OHS planning including hazard identification and risk assessment; (3) OHS implementation and operation; (4) performance evaluation and internal audits; and (5) management review and continuous improvement (Minister of Manpower Regulation No. 5 of 1996). The implementation of this system aims to ensure that all construction project activities, including the construction of water channels, run according to safety standards and do not have a negative impact on workers and the surrounding community.(Kusuma et al., 2023).

Hazard identification and risk assessment are the initial steps in OHS management. According to ISO 45001:2018, hazard identification is conducted to identify potential events that could cause injury, illness, or property damage. Risk assessment, on the other hand, aims to determine the likelihood and severity of each hazard.

In the water channel construction project in Mojogede Village, several potential hazards were identified, including the risk of collapsing excavation walls, being swept away by water currents, exposure to chemicals from cement or waste, and electrical hazards from water pumps and heavy equipment. Based on research by Bumulo(2023), the greatest danger in rural drainage projects comes from excavation work and the use of heavy equipment without adequate supervision.

III. RESULTS AND DISCUSSION

This research was conducted during a one-month environmental drainage project in Mojogede Village, Balongpanggang District, Gresik Regency. The project was located in a residential area and on a village road, characterized by clay soil, relatively flat contours, and an open drainage system. The work was carried out manually by local workers with simple equipment and without the implementation of a formally documented occupational health and safety (K3) system.

The work environment in Mojogede Village has several characteristics that can potentially increase the risk of workplace accidents, including slippery surfaces during rain, stagnant drains, limited work space, and minimal use of Personal Protective Equipment (PPE). Therefore, the application of the HIRARC method is necessary to identify hazards, assess risk levels, and design risk controls appropriate to field conditions.

Identification of drainage worker activities based on field observations, drainage work activities in Mojogede Village can be grouped into several main stages as follows: 1). Cleaning and preparation of the work area, 2). Excavation of drainage channel soil, 3). Moving and transporting materials, 4). Installation of drainage channels, 5). Backfilling and tidying the area. Each stage of the work has different potential hazards and requires a separate risk analysis.

Hazard identification is conducted through observations of workers' activities in the field and discussions regarding the working conditions encountered. Some risks identified include collapsing excavation walls, slipping due to mud or puddles, injuries while moving materials, being struck by falling materials during duct installation, and exposure to dust during the finishing stage. The use of manual tools, hot or dirty environments, improper working posture, and inconsistent use of PPE can also increase the risk of accidents and health problems for workers.

Control measures are implemented by adjusting the hazard level and work conditions. Excavation is carried out in stages, paying attention to soil stability, while slippery areas are cleaned and provided with safer footing. Material is moved using lighter tools or materials, while the installation area is kept free of unnecessary materials. Dust is reduced through wet cleaning methods. These measures are reinforced by simple standard operating procedures (SOPs), work instructions, supervision, and the use of helmets, non-slip shoes/boots, gloves, and masks for additional protection.

Risk assessment is conducted by determining the likelihood of an accident occurring (Likelihood/L) and the severity of the impact (Severity/S). This assessment is adjusted to the actual conditions of the drainage work in Mojogede Village.

Table1Risk Assessment Results

no	Work activities	Potential hazards	impact	L	S	Risk Value	category
1	Earth Excavation	Excavation Wall Landslide	Serious Injury	3	4	12	Tall
2	Work Area	Slipped in the Mud	Minor injuries	4	2	8	Currently
3	Lift Material	Overload	Muscle Injury	3	3	9	Currently
4	Channel Installation	Fallen Material	Moderate Injury	2	3	6	Currently
5	Finishing	Dust Exposure	Respiratory disorders	2	2	4	Low

Based on Table 1 above, there are five potential hazards in production, with risk levels of 1 being high, 3 being medium, and 1 being low. This impacts worker safety, particularly in excavation work, which carries a high risk level and requires serious attention due to its potential for workplace accidents.

Risk control

Based on the risk assessment, control measures are then developed using the Risk Control Hierarchy, which includes elimination, substitution, engineering controls, administrative controls, and the use of personal protective equipment (PPE). The following are recommended control measures:

Table2Risk Control

No	Process	Danger	Elimination	Substitution
1	Earth excavation	Collapse of the side or wall of the excavation	Stop excavation activities on sections of land that show signs of instability and move the work point to a safer area if possible.	Changing the vertical excavation method to a gradual excavation or using a gentler wall slope according to soil conditions.
2	Work area	Slipping due to muddy surface	Remove mud, puddles, and materials that obstruct workers' paths before activities are resumed.	Use a footpath with a rougher surface or material that has better grip in areas that are difficult to drain.
3	material lifting	Injuries due to lifting excessively heavy materials	Eliminates the need for manual moving of materials that exceed the lifting capacity of workers by using mechanical assistance.	Replacing large or heavy materials with lighter components so they are easier to move safely
4	Channel installation	Material falls or falls on workers	Remove unnecessary material from the	Using channel components with lighter sizes and

			installation zone and clear the area under the material being moved.	weights so that the moving and installation process is more controlled.
5	finishing	Inhalation of dust particles during finishing work	Eliminate unnecessary dust sources by regularly cleaning up excess material and stopping activities that produce excess dust.	Replace dry cleaning with water cleaning techniques to reduce dust particles released into the air.

The assessment results indicate that the highest risk lies in excavation activities, particularly due to the potential for excavation landslides. This risk is a top priority for occupational health and safety (K3) management.



Fig. 1. safety construction

An evaluation of the HIRARC method for drainage work in Mojogede Village showed that most risks were moderate to high before controls were implemented. After implementing risk control recommendations, the risk level was reduced to low to moderate. The HIRARC method helps provide a systematic overview of potential hazards and their preventive measures, thereby increasing awareness among drainage workers of the importance of occupational safety.



Fig. 2 safety construction

The research results show that drainage work in Mojogede Village has risk characteristics influenced by environmental conditions, manual work methods, and limited implementation of OHS. The application of HIRARC has proven effective in identifying dominant hazards and establishing risk control priorities. This approach is suitable for village-scale construction work because it is simple, systematic, and easy for workers to understand. With a more structured application of OHS, the risk of workplace accidents can be minimized without requiring significant costs.



Fig. 3. safety construction

IV. CONCLUSION

Based on the analysis using the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method, drainage work in Mojogede Village, Balongpanggang District, Gresik Regency, has a number of potential hazards that require attention, especially in excavation, material transfer, and channel installation activities. The highest risk was found in excavation work with a score of 12, which is included in the high category, mainly due to the possibility of excavation wall collapse and relatively soft soil conditions. Meanwhile, material transport and channel installation activities generally have a medium risk level. The use of HIRARC helps identify hazards, determine risk levels, and set control priorities in a more targeted manner. Control efforts through technical engineering, administrative procedures, and the use of PPE can reduce the risk level to a low or medium category. The success of OHS implementation is also not only determined by technical controls, but is also influenced by worker knowledge, compliance with procedures, attitudes towards safety, and consistency of supervision in the field. Thus, HIRARC can be a practical approach to support OHS management in village-scale drainage projects, especially under conditions of limited resources. The consistent implementation of K3 from the preparation stage to the completion of work also has the potential to reduce accidents, work disruptions, and support the efficiency and quality of village infrastructure development.

Based on these findings, OHS management in drainage projects needs to be strengthened through several steps. Workers should receive regular OHS training, including refresher courses and simulations of potentially hazardous conditions that may arise during the work. Supervision should also be increased at points with high hazard potential, particularly excavation areas, locations with water flows, and activities involving heavy equipment or tools. The availability of appropriate PPE, such as safety helmets, protective shoes, vests, and gloves, needs to be accompanied by regular inspection and maintenance. Furthermore, the implementation of safety SOPs needs to be supported through pre-work communication, field briefings, and the formation of work habits that prioritize safety. Future research can expand the study object to different types of construction work and rural areas to obtain a broader picture of the effectiveness of HIRARC implementation and the factors that influence the success of the OHS system.

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