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Evaluation of the Implementation of Occupational Safety and Health (K3) in the Road Improvement Construction Project in Kabanjahe, Karo Regency

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ABSTRACT

Road construction projects are among the sectors with a high risk of work-related accidents. One of the main causes is the low awareness and compliance of workers in using Personal Protective Equipment (PPE), which should be an integral part of Occupational Safety and Health (OSH) implementation. This study aims to evaluate the implementation of OSH, particularly regarding the use of PPE, in a road improvement project in Kabanjahe District, Karo Regency. The method used is a quantitative approach through questionnaires distributed to 140 field workers. The analysis results show that factors such as lack of education on PPE, weak supervision by management, substandard PPE quality, and a work culture that neglects safety are the main reasons for low compliance. The most influential factors include lack of awareness of work safety importance and absence of routine training related to OSH. Therefore, an integrated strategy is needed, which includes intensive education, provision of PPE that meets national standards (SNI), as well as strict supervision and enforcement, to ensure optimal OSH implementation and reduce the number of work accidents in construction projects.

1. INTRODUCTION

Work-related accidents are common in many industries, but the construction industry is among the most hazardous. In addition, given the current state of technology and industry, the implementation of safety measures is becoming increasingly important, as it is a component of efforts to protect employees while they work. One of the criteria for the occurrence of work accidents is the use of inadequate personal protective equipment and a lack of understanding of occupational safety [1]. Occupational health and safety (K3) considerations are very important because of their impact on project



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outcomes. A high rate of work accidents in construction projects has been proven to occur when this criterion is ignored [2]

The rapid development of facilities and infrastructure in Indonesia can be seen from various advances in various sectors. In addition to cost efficiency and time effectiveness, one of the benchmarks of the success of a construction project is the lack of work-related incidents during the construction phase [3].

The number of work accidents in Indonesia is quite high. This is due to a lack of discipline and vigilance. The use of personal protective equipment is mandatory considering the many potential hazards that exist in the workplace in Indonesia; In particular, 60% of workers suffered head injuries due to not wearing safety helmets, 90% suffered facial injuries due to not wearing face shields, 77% suffered leg injuries due to not wearing safety shoes, and 66% suffered eye injuries due to not wearing eye protection [4]. There are many factors that cause the use of PPE by workers to be improper, one of which is the lack of supervision by company management, especially related to the use of PPE. The rules set by the company will be useless if they are not complied with by the employees; Therefore, direct supervision by management is essential [5].

The road widening project, which is the core of the Final Project, presents a significant risk of work-related injuries to its workers. Construction involving multiple work items and collision incidents requires comprehensive safety management [6].

So this Final Project aims to analyze the importance of personal protective equipment (PPE) for construction workers in the road improvement project in Kabanjahe, Karo Regency, North Sumatra. After knowing the importance of personal protective equipment for safety, health and concentration at work, efforts, actions and countermeasures are carried out to prevent work accidents.

1.1 Basic Theory of Occupational Safety and Health (OSH)

Occupational Safety and Health (OSH) refers to a set of efforts to guarantee and protect workers through the implementation of safety standards in the workplace. Philosophically, OSH aims to create safe working conditions for workers' well-being. Scientifically, OSH studies how to reduce risks of accidents, occupational diseases, and environmental hazards [7].

The main objectives of OSH are:

1. ensuring the physical and mental safety of workers
2. reducing the risk of work accidents
3. improving productivity
4. ensuring the safe and effective use of resources.

1.2 Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) refers to devices used by workers to protect themselves from potential hazards and risks of workplace accidents. PPE serves as the last line of defense after engineering and procedural controls. Common types of PPE include helmets, goggles, masks, gloves, safety shoes, reflective vests, and protective clothing. Factors influencing compliance with PPE usage include education and training, PPE quality, management supervision, and workplace safety culture [8].

1.3 Legal Basis of OSH and PPE

The implementation of OSH and PPE is regulated by national regulations, including [9]:

1. Law No. 1 of 1970: requires employers to provide PPE and workers to use it.
2. Minister of Manpower Regulation No. 08/MEN/VII/2010: emphasizes the obligation to provide PPE according to workplace hazards and the mandatory use of PPE by all persons in the work area.

1.4 OSH Risk Management

Risk management is a systematic process of identifying, assessing, and controlling potential hazards in the workplace. The main steps include [10] .:

1. hazard recognition
2. hazard identification
3. risk assessment

4. risk control. Methods commonly used are: Checklist, Job Safety Analysis (JSA), Preliminary Hazard Analysis (PHA), Failure Mode Effect Analysis (FMEA), and HAZOP.

1. 5. Safety Culture

Safety culture refers to the values, attitudes, perceptions, and behaviors of both workers and management that demonstrate commitment to safety. Organizations with a strong safety culture are characterized by management commitment, transparent incident reporting, learning from accidents, worker participation, and a reward system for safety compliance [11].

1.6 Accident Statistics and the Urgency of OSH in Construction

According to BPJS Ketenagakerjaan (Indonesia’s Social Security Agency for Employment), in 2023 more than 315,000 work accidents were recorded, with the construction sector being the highest contributor [12]. The International Labour Organization (ILO) also reported that over 2 million workers die each year due to work-related accidents or occupational diseases, with the majority occurring in developing countries, including Indonesia. These facts highlight the urgent need for strict implementation of OSH in construction projects [13].

1.7 Occupational Safety and Health (OSH) Risk Management

Risk management is a systematic approach to identifying, analyzing, and controlling potential hazards in the workplace. The main stages of risk management consist of [8]:

1. **Hazard Identification** – recognizing all possible hazards present in the work environment.
2. **Risk Assessment** – evaluating the likelihood and severity of hazards that may cause harm.
3. **Risk Control** – implementing appropriate control measures, which generally follow the hierarchy of controls: elimination, substitution, engineering controls, administrative controls, and the use of Personal Protective Equipment (PPE) [14].

Several methods are commonly applied in OSH risk management [15], such as:

- **Job Safety Analysis (JSA)**: analyzing each step of a job to identify potential hazards and determine preventive measures.
- **Failure Mode and Effect Analysis (FMEA)**: assessing possible failure modes within a process and their potential impacts.
- **Hazard and Operability Study (HAZOP)**: a structured and systematic technique for identifying risks and operability issues in complex operations.

Effective risk management ensures that hazards are minimized, safety performance is improved, and the overall safety culture within the organization is strengthened.

2. RESEARCH METHODS

2.1 The research association and research methods

This study was conducted on the road improvement project in Kabanjahe District, Karo Regency, North Sumatra. The project involved road widening along approximately 3 km with a total width of 22 meters (four lanes, two directions), funded by the state budget (APBN) with an allocation of IDR 32 billion . [16] The research employed a descriptive quantitative approach, using a survey method with questionnaires. This approach aimed to identify the factors influencing the use and understanding of Personal Protective Equipment (PPE) among construction workers The Construction Improvement Project is located on Jamin Ginting street in Kabanjahe - Berastagi Karo Regency, North Sumatra. Upon completion of data collection (including secondary and primary sources), 140 participants will be surveyed with 25 questions for analysis and processing. The processing of questionnaire data is divided into several stages as follows:

a) Assessment of Questionnaire Answers Questionnaires filled out by correspondents as construction workers in the project will be assessed to be used in the context of improving highways in the Kabanjahe – Berastagi area. Karo, North Sumatra. Analyzed. The expected values are given as follows .:

- 1 = Not Influential : Value 1
- 2 = Quite Influential : Value 2

3 = Influential : Value 3
4 = Highly Influential : Value 4

b) Weighted middle value (μ_w)

The weighted middle value is the middle value that arises due to the weight of each data that is not the same (different) from each other [6].

The formula :

Average weight

$$RB = \frac{\sum W_i X_i}{W_i}$$

$$= \frac{W_1 X_1 + W_2 X_2 + \dots + W_n X_n}{W_1 + W_2 + \dots + W_n}$$

$\sum W_i$ = total data weight

$\sum W_i X_i$ = the sum of the weight of i multiplied by the 1st data

And with the formula :

$$IKR = \frac{X}{M}$$

Information:

IKR = Relative Importance Index

M = Range of Value Factor M = 4

c) Data Conclusion

From the sequence of x scores that have been designed, the classification of x scores can be determined first as the following classification [17]:

$1.00 \leq x \leq 1.75$ = No Effect

$1.75 \leq x \leq 2.50$ = Quite Influential

$2.50 \leq x \leq 3.50$ = Influential

$3.50 \leq x \leq 4.00$ = Highly Influential

3. DATA COLLECTION TECHNIQUES

This study employed both **primary** and **secondary data collection methods** to ensure comprehensive findings [8]:

1. Primary Data

- Obtained through **questionnaires** distributed to 140 field workers directly involved in the Kabanjahe road improvement project.
- The questionnaire was structured using a **4-point Likert scale** (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree).
- The items were designed to measure five categories of influencing factors:
 - Individual factors,
 - Education factors,
 - PPE quality factors,
 - Field implementation factors,
 - PPE management factors.

- Direct observation was also conducted at the project site to support the questionnaire data.

2. Secondary Data

- Collected from project documentation, including project contracts, technical specifications, and safety reports.
- Supporting literature such as textbooks, previous research, regulations (Law No. 1/1970, Permenakertrans No. 08/2010), and statistical reports (BPJS Ketenagakerjaan, ILO)[18].

These data collection techniques ensured that both worker perceptions (through questionnaires) and contextual project information (through documents and literature) were integrated to provide a valid and reliable analysis of the factors influencing PPE compliance .

3. Flowchart

To provide a clear and systematic understanding of the process under study, a **flowchart** is developed to illustrate the sequence of activities, decision points, and process interactions from the initial stage to the final output. This flowchart serves as a visual representation to simplify the analysis and enhance the clarity of the system workflow [19].

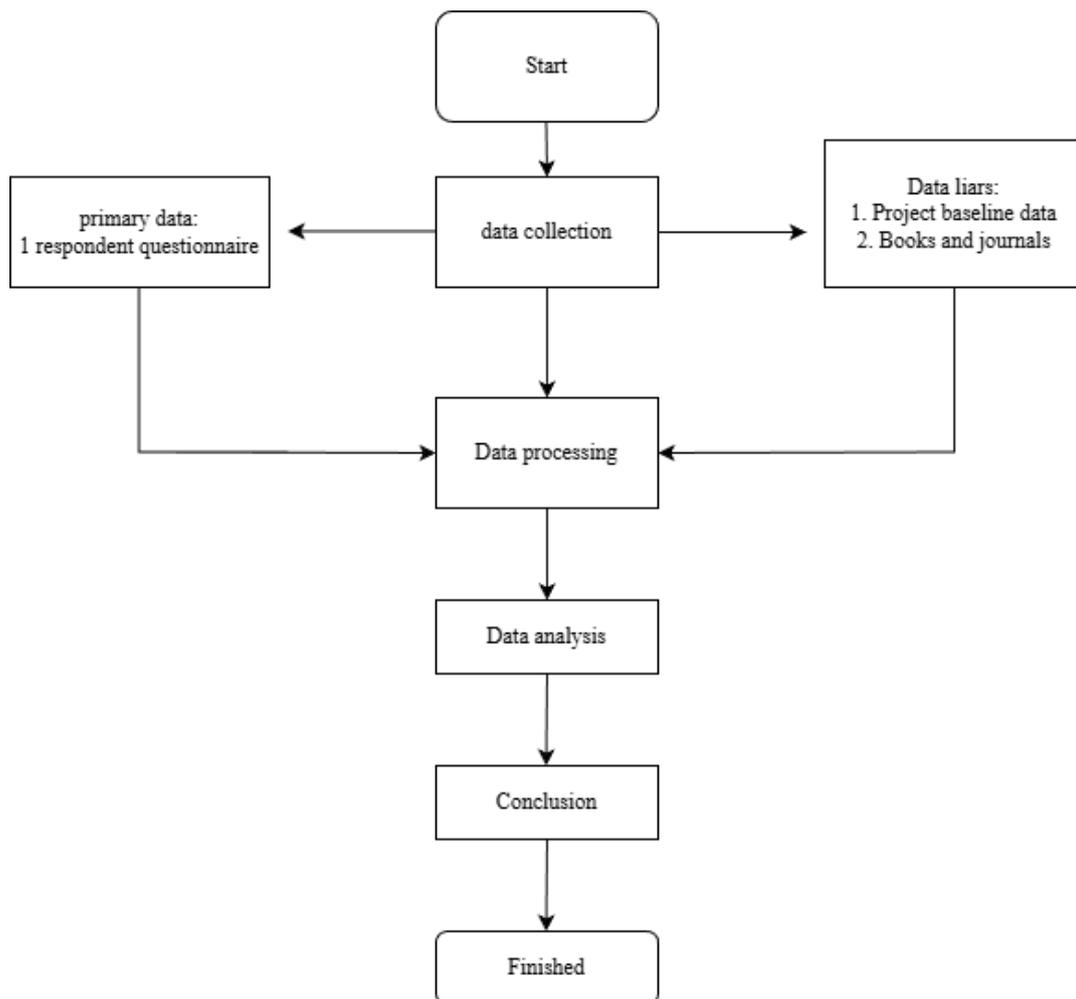


Figure 1.Flowchart Research Method

4. RESULTS AND DISCUSSION

Final recapitulation of "Factors Affecting the Use and Understanding of Personal Protective Equipment for Workers in the Kabanjahe Highway Improvement Project, Karo Regency." That is why

Table 1. Test Results

NO	Determinants of PPE Use and Understanding among Workers in the Kabanjahe Road Project	Σ	Mean	IKR	influence
A Individual Factors					
1	Workers Arrive Late for Work	478	3,414	0,853	Influential
2	Lack of Awareness of the Importance of Job Safety	508	3,628	0,907	Highly Influential
3	Feeling uncomfortable/uncomfortable using PPE	480	3,428	0,857	Influential
4	Feeling embarrassed because it seems strange to use PPE	449	3,207	0,802	Influential
5	Feeling Not Harmed	481	3,435	0,859	Influential
B Educational Factors					
1	Lack of Seminars on PPE in Work	494	3,528	0,882	Highly Influential
2	Lack of training on the use of PPE in handymen	488	3,485	0,871	Influential
3	Not knowing the function of the safety tools used	499	3,564	0,891	Highly Influential
4	Lack of discipline in the implementation of Safety Morning	497	3,55	0,887	Highly Influential
5	Lack of communication between workers not to remind each other	492	3,514	0,878	Highly Influential
C PPE Quality Factors					
1	The size of PPE does not suit the body of each worker	484	3,457	0,864	Influential
2	The weight of PPE adds to the burden on the body when working	474	3,385	0,846	Influential
3	Eligibility of PPE Conditions	487	3,478	0,869	Influential
4	Modifying PPE to be incompatible with function	491	3,507	0,876	Highly Influential
5	PPE equipment that does not have SNI standards so that there is often damage	493	3,521	0,880	Highly Influential
No	Determinants of PPE Use and Understanding among Workers in the Kabanjahe Road Project	Σ	Mean	IKR	Influence
D Implementation Factors					
1	Limited PPE stock	498	3,557	0,889	Highly Influential
2	Lack of oversight from QHSE	501	3,578	0,894	Highly Influential
3	Lack of occupational safety and health inspections	500	3,571	0,892	Highly Influential
4	Lack of strictness in the sanctions given by the company	490	3,5	0,875	Highly Influential
5	Lack of appreciation for workers yang taat on the use of PPE	483	3,45	0,8625	Influential

E	PPE Management Factors				
1	Investigation into the incident was not fully carried out	489	3,492	0,873	Influential
2	The handling of the first aid system for the treatment of wounds and other activities is too slow	492	3,514	0,878	Highly Influential
3	Too little funds for PPE	473	3,378	0,844	Influential
4	The dysfunction of the K3 organization	487	3,478	0,869	Influential
5	Internal audits are not conducted periodically	477	3,407	0,851	Influential

Source : Analysis Results of Tama Jagakarsa University (2025)

4.1 Respondent Profile

This study involved 140 field workers who directly participated in the road improvement project in Kabanjahe District, Karo Regency. The majority of respondents had a secondary education background and more than five years of work experience; however, most of them had never attended formal OSH training.

4.2 Factor Analysis Results

The questionnaire responses were analyzed using the Weighted Mean and the Relative Importance Index (RII). The influencing factors were grouped into five categories:

1. Individual Factors
 - Lack of awareness of the importance of safety.
 - Feelings of discomfort or embarrassment when wearing PPE.
 - Some workers believe they are unlikely to experience accidents.
→ Result: *influential* (mean = 3.12).
2. Education Factors
 - Limited seminars and safety training.
 - Lack of discipline in implementing daily safety talks.
 - Weak communication among workers in reminding each other to use PPE.
→ Result: *influential* (mean = 3.21).
3. PPE Quality Factors
 - PPE size not suitable or uncomfortable.
 - PPE not meeting SNI (Indonesian National Standard).
 - Poor condition and frequent damage.
→ Result: *highly influential* (mean = 3.55).
4. Implementation Factors
 - Limited availability of PPE.
 - Insufficient supervision by QHSE officers.
 - Weak sanctions and lack of rewards for compliance.
→ Result: *influential* (mean = 3.32).
5. PPE Management Factors
 - Internal audits not carried out routinely.
 - Limited budget allocation for PPE.
 - OSH organization not functioning optimally.
→ Result: *highly influential* (mean = 3.61).

4.3 Dominant Factors

Based on the RII results, the most dominant factors influencing PPE compliance were:

- PPE Management (3.61 – highly influential)
- PPE Quality (3.55 – highly influential)

These findings indicate that the provision of adequate and standard-compliant PPE, combined with consistent and firm management, is crucial to ensuring successful OSH implementation in

construction

projects.

4.4 Discussion

The results of this study can state that the availability and quality of PPE are the most significant factors in worker compliance. Even when workers have sufficient knowledge and awareness, without proper PPE supply and management support, compliance levels remain low.

[20] Moreover, weak supervision and the absence of strict sanctions hinder the development of a strong safety culture. This highlights the importance of an integrated management strategy, including:

- Providing PPE that complies with SNI standards,
- Conducting regular OSH training,
- Strengthening supervision,
- Enforcing strict sanctions for violations, and
- Rewarding compliant workers.

By applying these strategies, the level of PPE compliance is expected to improve, thereby reducing the risk of accidents in construction projects.

5. CONCLUSION

1. Compliance with the use of Personal Protective Equipment (PPE) in the Kabanjahe road improvement project is influenced by five main factors: individual, education, PPE quality, field implementation, and PPE management.
2. Based on the analysis, the most dominant factors are PPE management (RII 3.61) and PPE quality (RII 3.55), both categorized as *highly influential*.
3. These findings confirm that the success of OSH implementation is strongly determined by the provision of standard-compliant PPE in sufficient quantity, supported by firm, consistent, and structured management.

6. SUGGESTION

1. For Contractors
 - Ensure adequate provision of PPE that complies with national standards (SNI).
 - Conduct regular OSH training and socialization, including safety induction and toolbox meetings.
 - Enforce a reward and punishment system to improve PPE compliance.
2. For OSH Supervisors (QHSE Officers)
 - Strengthen monitoring of PPE use in the field through routine inspections.
 - Carry out regular internal OSH audits to ensure the sustainability of the safety management system.
3. For Workers
 - Improve personal awareness of occupational safety and health.
 - Use PPE consistently and in accordance with Standard Operating Procedures (SOP).
4. For Government/Regulators
 - Enhance monitoring of OSH implementation in construction projects.
 - Impose strict sanctions on companies that neglect the provision of PPE.

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