

**IMPROVING OCCUPATIONAL HEALTH AND SAFETY IN ROAD
CONSTRUCTION PROJECTS: A COMMUNITY SERVICE APPROACH ON THE
SEMARANG-DEMAK TOLL ROAD PROJECT**

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ABSTRACT

This Community Service activity focuses on improving occupational health and safety (OHS) for construction workers on the Semarang-Demak Toll Road project by assessing risks in three critical stages: manufacturing, mobilization, and placement of the armor jack. Through a risk assessment conducted with the Health, Safety, and Environment (HSE) team, risks were identified and categorized into Low Risk, Moderate Risk, and High Risk. While most risks can be managed with appropriate controls, there are high risks such as workers being trapped during formwork installation and webbing sling failure, which require greater attention. The solutions implemented in this PKM include redesigning safer work procedures, intensive safety training, and tighter supervision of Personal Protective Equipment (PPE) use. As a result, the control measures effectively raised worker awareness, created a safer work environment, reduced accidents, and supported smooth project operations, with a direct positive impact on workers and the strengthening of the safety culture on-site.

Keywords: armor jack; community service; construction workers; risk assessment; safety

INTRODUCTION

The construction of toll roads in Indonesia is a strategic effort aimed not only at improving transportation infrastructure but also supporting sustainable economic growth. Toll roads play a vital role in accelerating the mobility of goods and people, as well as reducing congestion on main routes. One concrete example of this large-scale project is the Semarang - Demak Toll Road development, which not only strengthens connectivity between regions but also contributes to regional development and the improvement of the quality of life of the surrounding communities (Fauzan et al., 2023; Natakusumah et al., 2023; Tarassya & Auwalin, 2024).

However, in this complex construction process, attention to occupational health and safety (OHS) becomes paramount. OHS aims to protect workers from various risks of accidents and work-related diseases while creating a safe and healthy working environment. The application of proper OHS procedures can not only reduce the rate of workplace accidents but also improve productivity and work quality (Gupta et al., 2023; Heru Winarno et al., 2024; Muhammad Rifqi et al., 2023; Park et al., 2023; Sulistyorini et al., 2024).

In the context of community service, risk management also plays a crucial role in infrastructure projects, such as toll road construction. Risk management is a systematic process that involves identifying, analyzing, and controlling potential risks that may arise. By taking the right measures, all possible hazards can be anticipated and addressed appropriately (Afroh & Basaria, 2023; Aprizaldi & Saputro, 2022; Kılıç & Vayvay, 2025). One method

commonly used in assessing and controlling risks is Hazard Identification Risk Assessment and Risk Control (HIRARC), which aims to ensure that control measures taken are in line with the level of risk involved (Ahda Imron et al., 2022; Gupta et al., 2023; Kabul & Yafi, 2022; Narandreswara et al., 2023; Priyanka & Basaria, 2023).

In toll road construction projects, effective risk control is critical, not only to protect workers from potential hazards but also to ensure the smooth and successful execution of the project as a whole (A. Fitri, Amin, 2022). One of the high-risk tasks is the armor jack operation, which functions to protect the road structure from erosion. This task is often faced with serious risks, such as workers being trapped during formwork installation, failure of heavy equipment systems, and unsafe environmental conditions. Therefore, it is important to conduct a thorough analysis of the potential hazards associated with this work and provide appropriate risk control recommendations (Aninditya et al., 2023; Mandia et al., 2022; Wigati et al., 2018; Yafri & Priyambodho, 2023).

Through this community service initiative, a deeper understanding of the importance of Occupational Health and Safety (K3) and risk management in infrastructure projects will be provided. The initiative also aims to offer practical solutions in the form of risk control recommendations that can enhance the safety of workers involved in the Semarang-Demak Toll project. It is hoped that this will create a safer, more efficient, and productive work environment for all parties involved.

METHOD

Data Collection

To create a tangible positive impact in the community, data collection is conducted using an applied approach based on local needs. This activity aims to identify the issues faced by workers and to design solutions that can be directly implemented in the field:

1. **Direct Observation:** The community service begins with direct observation at the project site to identify potential hazards, including working conditions and compliance with safety procedures. This observation provides a deeper understanding of the real situation faced by the worker community.
2. **Interviews with Stakeholders:** Interviews are conducted with workers, supervisors, and project managers to gather information about the safety procedures in place and their experiences with the risks present on-site. These interviews help explore issues and provide an opportunity for the community to voice their concerns.
3. **Questionnaires for Workers:** Questionnaires are distributed to collect data on workers' understanding of workplace safety, the use of personal protective equipment (PPE), and their experiences with workplace accidents. The collected data is used to develop more effective control recommendations that align with their needs.
4. **Document Study:** Documents related to workplace safety, such as accident reports, implemented safety procedures, and heavy equipment inspection records, are collected. This document study is essential for examining the effectiveness of existing safety procedures and evaluating their outcomes in real-world contexts.

Application of HIRARC in Community Service

The Hazard Identification Risk Assessment and Risk Control (HIRARC) method is applied to identify and assess the hazards faced by workers in the toll road construction project. HIRARC is an appropriate approach for this community service, allowing for the evaluation

of existing risks and the determination of control measures that can be directly implemented to protect workers.

Risk Assessment for the Worker Community

The risk assessment process provides a clear overview of potential hazards that may affect workers. Each risk is analyzed based on the likelihood of accidents occurring and the severity of their impact. Risks are categorized into low, medium, and high levels to prioritize the control measures that need to be implemented. This assessment is essential for educating the worker community about the importance of risk mitigation in their work environment.

Risk Control for Improving Worker Community Safety

Risk control is applied as a concrete step to protect the worker community, with a focus on providing solutions that can be directly implemented in the field.

RESULTS AND DISCUSSION

In this community service initiative, a risk assessment was conducted on several stages of work, including construction, mobilization, and placement of the armor jack. The results of the risk assessment indicate that most of the risks fall under the Low Risk and Moderate Risk categories, meaning these risks are acceptable with appropriate controls in place.

Table 1.

Risk Level of Armor Jack Construction

Hazard Risks	Risk Level
Worker trapped during formwork installation	High (H)
Mixer system failure during operation	Moderate (M)
Use of heavy equipment without proper authorization or procedures	Low (L)
Worker exposure to chemicals (casting) handled by the truck mixer	Moderate (M)
Rain causing slippery access	Low (L)

Overall, while most of the risks fall under the Low Risk and Moderate Risk categories, there are several hazards with High Risk levels that require greater attention. One of the most critical risks is workers being trapped during the installation of formwork. This risk not only jeopardizes worker safety but can also result in severe consequences for the workers and disrupt the smooth progress of the project. Therefore, in this community service initiative, we emphasize the importance of implementing stricter and more comprehensive control measures, such as redesigning safer work procedures, providing more intensive safety training for all workers, and ensuring the proper use of Personal Protective Equipment (PPE). All of these steps aim to reduce and eliminate the potential hazards that threaten worker safety on-site.

Moreover, although some risks are considered low, strict supervision and the implementation of standard procedures remain crucial elements of this community service project. Continuous monitoring of the safety measures on-site will ensure that the established procedures are properly implemented and followed. In this context, our community service not only identifies the problems but also provides practical and applicable solutions that can be immediately applied in the field. The implementation of these risk control recommendations is expected to create a safer work environment, significantly reduce work-related accidents, and ensure the overall smooth operation of the project. This community service will also increase worker awareness and active participation in maintaining workplace safety, leading to a healthier and more productive work climate.

Table 2.
 Risk Level of Armor Jack Mobilization

Hazard Risks	Risk Level
Operator hiab crane negligent during armor jack mobilization	Low (L)
Hiab crane collision with other vehicles	Moderate (M)
Failure of braking system or other components	High (H)
Use of heavy equipment without proper authorization or procedures	Low (L)
Slippery surface or bad weather conditions increasing accident risk	Low (L)

The risk assessment of the armor jack mobilization at the Semarang-Demak Toll Road project shows that most risks fall into the Low Risk and Moderate Risk categories, but some hazards require more attention. The failure of the brake system on the Hiab crane is classified as High Risk, as it can lead to fatal accidents. Therefore, control measures such as routine inspections and the implementation of diagnostic technology are necessary to detect potential failures early. Other Moderate Risks, such as crane collisions with other vehicles and slippery surfaces or bad weather conditions, require stricter control through proper traffic management and preventive measures for adverse weather conditions. Meanwhile, Low Risk hazards, such as using heavy equipment without proper procedures, can be managed through supervision and regular training to ensure safety procedures are followed. Although these risks are lower, proper controls are still needed to maintain a safe and efficient work environment. Overall, while most risks are in the lower categories, implementing appropriate mitigation measures for high-risk hazards is crucial to reducing accidents and ensuring smooth project operations.

Table 3.
 Risk Level of Armor Jack Placement

Risiko Bahaya	Tingkat Resiko
Operator hiab crane negligent during armor jack placement	Low (L)
Failure of the Hiab crane's braking and hydraulic system	Moderate (M)
Use of heavy equipment without proper authorization or procedures	Low (L)
Webbing sling failure causing armor jack material to fall on workers	High (H)

The risk assessment for the placement of the armor jack at the Semarang-Demak Toll Road project reveals several hazards with varying risk levels. The risk of Hiab crane operator negligence during the armor jack placement process is categorized as Low Risk, which can be managed through regular training and stricter supervision of the operators. However, it is crucial to ensure that safety procedures are followed diligently to minimize the potential for accidents. The risk of failure of the Hiab crane's brake and hydraulic systems, classified as Moderate Risk, requires more attention through routine inspections and stricter maintenance of the equipment. This ensures that the crane's systems function properly, reducing the likelihood of accidents due to equipment failure.

Meanwhile, the risk of using heavy equipment without proper authorization or procedures, also classified as Low Risk, can be managed through proper oversight and ensuring adherence to operational standards. The most critical risk, however, is the webbing sling breaking, classified as High Risk, as it can lead to serious accidents, such as the armor jack material falling onto workers. This risk is particularly dangerous and requires stronger control measures, such as using high-quality webbing slings, conducting routine inspections, and implementing strict safety procedures. Overall, while most risks can be managed with lighter controls, high risks, such as the breaking of the webbing sling, must be prioritized in mitigation efforts to ensure worker safety and the smooth operation of the project.



Figure 1. Collaboration with HSE Team at Semarang-Demak Toll Road Project

In the context of Community Service, this activity aims to improve occupational health and safety (OHS) for construction workers on the Semarang-Demak Toll Road project, focusing on the stages of manufacturing, mobilization, and placement of the armor jack. The risk assessment was conducted in collaboration with the Health, Safety, and Environment (HSE) team to ensure that the identified risks and recommendations can be directly and effectively applied in the field. We found that while most of the risks fall into the Low Risk and Moderate Risk categories, there are several High Risk hazards that require greater attention and stricter control.

In the manufacturing stage of the armor jack, the risk of workers being trapped during formwork installation is a major concern as it falls under the High Risk category. This risk has the potential to cause fatal accidents and disrupt the smooth progress of the project. Therefore, in this Community Service activity, we emphasize the importance of redesigning safer work procedures, providing intensive training for workers, and ensuring the proper use of Personal Protective Equipment (PPE). These measures have been discussed and implemented together with the HSE team, and the results have been directly applied to the project to improve worker safety and work efficiency. This community service focuses on empowering workers by providing them with better knowledge about safety procedures and existing risks.



Figure 2. Observation of the Construction and Mobilization Process of the Armor Jack

In the mobilization stage of the armor jack, several risks were identified, including crane operator negligence and collisions with other vehicles, categorized as Moderate Risk. While these risks are moderate, strict control is still required, particularly in traffic management and heavy equipment operator training. In this Community Service activity, we focus on raising awareness among workers and project managers about the importance of following correct operational procedures. The solutions proposed, such as assigning flagmen to manage traffic

and ensuring that all workers use appropriate Personal Protective Equipment (PPE), have been accepted and implemented in the project, resulting in a direct impact on accident reduction and productivity improvement.

In the placement stage of the armor jack, the risk of webbing sling failure, which can cause the armor jack material to fall and injure workers, is identified as a critical High Risk. Therefore, in this community service, emphasis is placed on using high-quality webbing slings, conducting routine inspections, and applying strict safety procedures. Workers are also educated about the importance of maintaining and replacing worn-out equipment. This risk control not only aims to protect workers from potential hazards but also ensures the smooth operation of the project as a whole. The proposed solutions have been accepted and implemented with the HSE team, significantly reducing the likelihood of fatal accidents during the work process.

Overall, while most risks in the manufacturing, mobilization, and placement stages of the armor jack fall into the Low Risk and Moderate Risk categories, High Risk hazards such as worker entrapment and webbing sling failure require more attention and stricter control measures. In this Community Service activity, the aim is not only to identify the problems but also to provide practical solutions that can be directly implemented in the field. With the control measures agreed upon with the HSE team and applied to the project, a safer work environment is created, accidents are reduced, and the smooth operation of the project is ensured (Fan et al., 2024; Soltanzadeh et al., 2022; Yang et al., 2024). This initiative has a direct positive impact on the construction worker community, strengthens the safety culture, and improves the quality of life for workers in the field (Chen et al., 2023; Jagtap et al., 2025; Zhong, 2024).

Through this Community Service, theoretical safety solutions are complemented by tangible, practical contributions that help reduce accident risks and enhance workers' welfare. The effective implementation of risk control in this project serves as a real example of how community service approaches can improve working conditions, increase operational efficiency, and provide long-term benefits to both workers and the broader community.

CONCLUSION

The Community Service activity conducted on the Semarang-Demak Toll Road project has made a significant contribution to improving occupational health and safety (OHS) for construction workers. This initiative focused on three critical stages of the project: the manufacturing, mobilization, and placement of the armor jack. Through a comprehensive risk assessment, in collaboration with the Health, Safety, and Environment (HSE) team, potential hazards were successfully identified and the risks categorized into Low Risk, Moderate Risk, and High Risk. While most of the risks can be managed with appropriate controls, high risks such as workers being trapped during formwork installation and webbing sling failure require greater attention and stricter controls to prevent fatal accidents.

This community service emphasizes the importance of applying practical and actionable solutions that can be directly implemented on-site, such as redesigning safer work procedures, providing intensive safety training, and strengthening supervision of Personal Protective Equipment (PPE) use. All the proposed control measures have been implemented in cooperation with the HSE team, resulting in increased worker awareness of the importance of safety. Overall, this Community Service initiative will help create a safer work environment

and reduce the risk of accidents, ensuring the smooth operation of the project. Furthermore, this activity also provides a direct positive impact on the construction worker community, strengthens the safety culture, and enhances the quality of life for workers on-site.

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