FINAL PROJECT

ANALYSIS OF OCCUPATIONAL HEALTH AND SAFETY USING HIRADC (HAZARD IDENTIFICATION, RISK ASSESMENT AND DETERMINING CONTROL) METHOD

(Case Study: Bored Pile for Bridge Foundation at Solo-Yogyakarta Toll Road Project)

Submitted to Universitas Islam indonesia Yogyakarta fulfil the requirements for obtaining Bachelor Degree in Civil Engineering Department

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CIVIL ENGINEERING STUDY BACHELOR PROGRAM
FACULTY OF CIVIL ENGINEERING AND PLANNING
UNIVERSITAS ISLAM INDONESIA

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(Case Study: Bored Pile for Bridge Foundation at Solo-Yogyakarta Toll Road Project)

Arranged by

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Has been accepted as one of the requirements to obtain
a Bachelor degree in Civil Engineering

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PLAGIARISM FREE STATEMENT

I here by declare that the Final Project Report that I made as a graduation requirement for the Bachelor degree in Civil Engineering program, Faculty of Civil Engineering and Planning, Universitas Islam Indonesia is the result of my own work. If there are certain sections in the Final Project Report that I quote from the work of other people, it has been clearly stated as a source in accordance with the norms and ethics of writing scientific papers. If in the future it is known that the entire Final Project Report that I have made is not my own work, I am willing to accept sanctions in accordance with applicable regulations.

Yogyakarta, October 23th 2023

Statement by,

Abdillah Hans Samara

(18511028)

PREFACE

Praise and gratitude I pray to Allah SWT, because thanks to His grace and guidance I was able to complete this final project entitled Analysis of Occupational Health and Safety Using HIRADC (Hazard Identification, Risk Assesment and Determining Control) Method (Case Study: Bored Pile for Bridge Foundation at Solo-Yogyakarta Toll Road Project). This final project is one of the academic requirements in completing undergraduate studies at the Civil Engineering Study Bachelor Program, Faculty of Civil Engineering and Planning, Universitas islam indonesia, Yogyakarta.

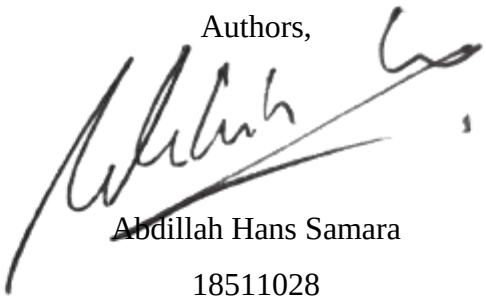
In preparing this Final Project Proposal, the author received a lot of help from other parties both in terms of guidance, direction, and suggestions and criticisms for the completion of this report with good results. For that, on this occasion the author would like to express his deepest gratitude to:

1. Mrs. Ir. Yunalia Muntafi S.T., M.T., Ph.D. (Eng). as Head of the Civil Engineering Study Program, Faculty of Civil Engineering and Planning, Universitas Islam Indonesia, Yogyakarta.
2. Mrs. Ir. Fitri Nugraheni, S.T., M.T., Ph.D., IP-M As a supervisor for final project who always take the time to discuss, provide useful knowledge and guide this Final Project to completion.
3. Mr. Setya Winarno, S.T., M.T., Ph.D. as first examiner, who are willing to spend their time for my exam and give many advices to my research.
4. Mr. Ir.Vendie Abma, S.T.,M.T., IP-M as second examiner, who also are willing to spend their time for my exam and give many advices to my research.
5. PT.ADHI KARYA who has given me the opportunity to carry out data for THE final procject in the Jogja – solo toll road project.
6. Mr. Aulia Rahman, as the project boredpile subcontractor and Mr Dodik Hadi as HSE project who has given a lot of knowledge in the field project.

With the completion of this Final Project, the authors hope that this report can provide benefits for authors and for readers in general. However, the authors also realize that there are many shortcomings in this report. For this reason, the authors really hope for constructive criticism and suggestions so that they can be better in the future.

Yogyakarta, October 23th 2023

Authors,



Abdillah Hans Samara

18511028

DEDICATION PAGE

In preparing this Final Project, the author faced many obstacles, but thanks to support from various parties, the author was able to complete this Final Assignment well. The author dedicates this final assignment to:

1. My lovely parents Max Victor Yuranis Samara, S.T. and Faridatun Nuria, S.Si. that have been through a lot of struggle and pain. But I promise I won't let it all go to waste. I want to do my best for every trust given. I will grow, to be the best that I can be. This final project is my special gift to my father and mother.
2. My grand parents Arismen Bermawi, Kharimatul Arifah and Yulius Samara who always prays for his beloved grandson all this time.
3. And last but not least for my partner Alya Bonitha, who always stay up late for company me and also gives strength for me to complete this final project.

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ABSTRACT

A construction project involves many aspects that require proper management to ensure that the project is carried out as planned. From many aspects associated with construction project activities, the effects of hazards in tangible and intangible forms such as injury, disengagement from the world, and environmental destruction can be detrimental. The main issue related to K3 is worker non-compliance when implementing K3. According to the Safety at Work Act No. 1 of 1970, an accident at work is an unforeseen and undesirable event that can disrupt the job assignment process and cause harm to both human and property victims. is. The objective of this reseacrh is to Identifying hazard, Obtain the results of risk level assestment level and Determine risk control action plan in boredpile work.

Hazard identification is carried out based on field observations. After that, draft the HIRADC (Hazard Identification, Risk Assessment and Determaining Control) table for identify hazards and control risks and verify with HSE handle related work. After verification is carried out, the next step is to carry out a risk assessment to the HSE.

From the results of the implementation of risk control in bored pile for bridge foundation work, it was found that there were changes in the level of risk in all types of work, including the high risk level was no longer there, the medium risk level was 27 risks (51.9%), and the small risk level was 25 risks (48.1%) which is obtained.

Keywords : *Occupational Health and Safety, HIRADC , Bored pile*

CHAPTER I
INTRODUCTION

1.1 Background

The rapid development of transportation mobility in Indonesia has made ease of access receive great attention. Efficient, accessible and barrier-free long-distance land transportation is needed to meet the mobility of many people and the distributions of goods and service. Because of this, Toll roads are needed to Streamlining traffic in developed areas. Improving the distribution of goods and services to support economic growth. Improving the distribution of development results.

Toll road jogja solo is a toll road that connects Yogyakarta City with Surakarta City. This toll road is part of the Trans Java Toll Road. This toll road started its construction in november 2020 and aims to boe finished in november 2023. This toll road is built from the colomadu toll gate in surakarta through the east part yogyakarta, and will be elevated along the North Ring Road of Yogyakarta (except at the Monjali/Palagan intersection which will be ongrade), then continues along the Mataram Ditch until it reaches the interchange in the Maguwoharjo area. Construction of Tol Jogja solo in surakarta is a project of PT Adhi Karya (Persero) as a Contractor and shareholder. The contractor is the party appointed by the project owner to carry out construction work. It takes human resources (HR) who are experts in their respective fields such as civil engineering, architecture, mechanical electrical, OHS (occupational health and safety) and others so that a building can be built properly in a fast and efficient manner.

A construction project involves many aspects that require proper management to ensure that the project is carried out as planned. From many aspects associated with construction project activities, the effects of hazards in tangible and intangible forms such as injury, disengagement from the world, and environmental destruction can be detrimental. The main issue related to K3 is worker non-compliance when

implementing K3. According to the Safety at Work Act No. 1 of 1970, an accident at work is an unforeseen and undesirable event that can disrupt the job assignment process and cause harm to both human and property victims. is. Factors that cause occupational accidents can be divided into three categories: human factors, environmental factors, and facility factors. The human factor is caused by careless human behavior, lack of occupational health and safety (K3) knowledge, and workers' non-compliance with company-set SOPs. Environmental factors relate to working conditions that do not meet workplace safety standards and weather conditions. The equipment factor, on the other hand, is caused by the age of the tool and the safe location of the tool, making it less and less likely for humans to interfere with the tool. Occupational safety in construction projects should be implemented to reduce the risk of occupational accidents. Therefore, further efforts are needed to reduce or even eliminate accidents when carrying out construction work.

One form of effort to minimize work accidents is to carry out risk management where the stages include assessment, planning, control and monitoring which can provide optimal benefits in minimizing the occurrence of accidents during construction if carried out from the beginning with careful planning. One of the SMK3 analysis methods is to use the HIRADC (Hazard Identification Risk Assessment and Determining Control) method. By analyzing SMK3 using the HIRADC method in a construction project, it will provide an overview of hazard identification, the magnitude of risks that may occur and control risks related to tunnel work in order to create a safe, productive and efficient work environment.

1.2 Problem Statement

Based on this background, research problems can be formulated on how to determine hazard identification, risk assessment, and risk control using the HIRADC analysis method. The formulation of the problem in detail is as follows:

1. What hazard indentification can cause work accidents during bored pile work for bridge foundations?

2. What are the results of the risk level assessment in bored pile for bridge foundation work?
3. What actions are taken to reduce the risk level of work accidents in bored pile for bridge foundation work?

1.3 Research Objectives

1. Identifying hazard that can cause work accidents in bored pile for bridge foundation work.
2. Obtain the results of risk level assestment level that may occur in bored pile bridge foundation work.
3. Determine a risk control action plan to reduce the level of risk involved in borepile bridge foundation work.

1.4 Significant of Research

In writing this research report, there are benefits for the company where the research is carried out as well as benefits for the author as the implementer of the research. The following is a brief review of the benefits of writing this report:

1. Benefits for companies:
    a. As a consideration and source of information for company leaders in making decisions or policies, especially those related to the Occupational Safety and Health Management System in the project field.
    b. Provides alternative hazard and risk control for companies to pay more attention to occupational safety and health to reduce work accidents so that workers are more prosperous and able to maximize the performance of project workers.
2. Benefits for authors:
    a. Improve the ability to apply K3 lecture knowledge experience, knowledge about K3 analysis using the HIRADC (Hazard Identification Risk Assessment and Determining Control) method.

b. The results of this research are expected to provide additional benefits of insight, knowledge for the author and as an implementation of the knowledge gained in college and to find out the real working conditions.

1.5 Research Limitations

This analysis has limitations in accordance with the objectives of the study so that the discussion does not deviate, it is necessary to give limitations in the research, including the following:

1. Research focuses only on the safety hazards of bridge bore pile work.
2. The study was conducted using the Hazard Identification Risk Assessment and Determination Control (HIRADC) method.
3. Data collection is carried out by observation and interviews in the field and implementing offices to obtain information related to the application of SMK3 in the Toll Road Solo – Yogyakarta Paket 1.1 KARTASURA – KLATEN STA 0+000 UNTIL 22 + 300.
4. Risk assessment using the Regulation of the Minister of Public Works No. 10 of 2021.
5. The location of the study was carried out in the toll road construction project located in the Toll Road Solo – Yogyakarta Paket 1.1 Kartasura – Klaten Sta 0+000 Until 22 + 300.

CHAPTER II
LITERATURE REVIEW

2.1 Introduction

In a study, it is necessary to conduct research or literature review to find some research results that have been carried out previously that are related to the topic under study which is used as consideration and becomes a reference in the work on the final project.

2.2 Previous Research

Research on the implementation of hazard identification, risk assessment, and determining control (HIRADC)-based occupational safety and health systems has been carried out by many previous researchers, which makes the research different from the previous research objects, location and time. The results of research on the implementation of the previous HIRADC-based occupational safety and health system, it can be used as a consideration and reference for final project research.

1. Hazard Risk Control Identification, Risk Asessement,And Determation Control (HIRADC) On The U ditch Installation Work Of The Klangon Road Improvement Project – Stick Wawan (2022). The purpose of the reaseacrh is . to understand what hazard control looks like in the Klangon – Tempel Road Section Improvement Project. Descriptive in question is to give an idea of a problem, and for qualitative is the way used to present the problem.
2. Implementation of Safety and Health Work (K3) on bridge pillar work using the HIRADC method (IMPLEMENTATION OF OCCUPATIONAL SAFETY AND HEALTH ON BRIDGE PILLAR CONSTRUCTION USING HIRADC METHOD) Sadewa (2021).This Study aims to determine the level of risk and risk control of bridge pillar work which is carried out based on the HIRADC (Hazard Identification Risk) method Assessment & Determining Control.The results of the study were obtained from nine (9) types of work and a total of 53

hazards, there was a decrease in the risk level after controlling at a moderate risk level (M) of 30 hazards (56.6%) to 8 hazards (15.1%) , the low risk level (L) is 23 hazards (43.4%) to 45 hazards (84.9%), there are no extreme (E) and high (H) risk levels.

3. (Implementation of OSH Using the HIRADC Method on the Curtain Wall installation work on the JKT new construction building project) Bahy (2021). This study aims to analysis on the installation of curtain wall facades in the JKT3 New Construction development project which aims to determine the level of risk and required risk control carried out based on the HIRADC method. The results showed that the identification of hazards from 12 jobs got a total of 37 risk, there was a decrease in the level of risk after controlling for a large risk level of 7 risk (18.9%) to 0 (0%), moderate risk level of 30 risk (81.1%) to 8 risk (21.6%) and a small risk level of 0 hazards (0%) to 29 risk (78.4%). Risk control carried out in this study is engineering, administration and personal protective equipment (PPE).
4. HIRADC (Hazard Identification, Risk Assessment, and Determining Control) Based Job Safety Analysis Model on Flat Project Structure Work Putra et al. (2019). This study aims to Knowing the level of potential hazard impact on the structural work of the flat project and controlling the potential impact of hazards using the HIRADC method. study obtained identification of Risk of Harm caused by unsafe behavior in the form of not using PPE correctly and appropriately; not to carry out maintenance of the tools to be used; and the placement of materials, tools, and the operation.
5. Implementation of HIRADC in Erection Girder Work in PT. WASKITA KARYA (Persero) Tbk Serpong – Cinere Toll Road Construction Project Khalima (2018). This thesis study aims to determine the effectiveness of HIRADC implementation as an effort to prevent work accidents in erection girder work. The results obtained after analyzing the data on the procedure for making HIRADC have been done well. Identify hazards that are already in accordance with the work done. The risk assessment provided is in accordance with the risk assessment.

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2.3 Comparison of Previous Research and Current Research

A comparison A comparison of some of the previous studies with the research on the final project carried out today can be seen in table 2.1 as follows.

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Tabel 2.1 Comparison of Previous Research with Research to be Conducted

No	Aspects	Wawan (2022)	Sadewa (2021)	Bahy (2021)	Putra et al. (2019)	Khalima (2018)
1.	Heading Research	Hazard-Based Risk Control Identification, Risk Assessment, And Determination Control (Hiradc) On The U Ditch Installation Work Of The Klangon Road Improvement Project – Stick	Implementation Of Safety And Health Work (K3) On Bridge Pillar Work Using The Hiradc Method (Implementation Of Occupational Safety And Health On Bridge Pillar Construction Using Hiradc Method)	Implementation Of Osh Using The Hiradc Method On The Curtain Wall Installation Work On The Jkt3 New Construction Building Project.	Hiradc (Hazard Identification, Risk Assessment, And Determining Control) Based Job Safety Analysis Model On Flat Project Structure Work	Implementation Of Hiradc In Erection Girder Work In Pt. Waskita Karya (Persero) Tbk Serpong – Cinere Toll Road Construction Project
2.	Purpose Research	to understand what hazard control looks like in the Klangon – Tempel Road Section Improvement Project. Descriptive in question is to give an idea of a problem, and for qualitative is the way used to present the problem	to determine the level of risk and risk control of bridge pillar work which is carried out based on the HIRADC (Hazard Identification Risk) method Assessment & Determining Control)	risk analysis on the installation of curtain wall facades in the JKT3 New Construction development project which aims to determine the level of risk and required risk control carried out based on the HIRADC method.	Knowing the level of potential hazard impact on the structural work of the flat project and controlling the potential impact of hazards using the HIRADC method	This thesis aims to determine the effectiveness of HIRADC implementation as an effort to prevent work accidents in erection girder work.

Continued Table 2.1 Comparison of Previous Research with Research to be Continued

No	Aspects	Wawan (2022)	Sadewa (2021)	Bahy (2021)	Putra et al. (2019)	Khalima (2018)
3.	Result Research	The results of hazard assistance in the Risk assessment in u ditch installation work is 26 hazards, obtained the type of hazard with a severe risk level (B) 1 hazard (3.85%), 15 hazards with moderate risk level (S). (57.69%), and 10 hazards with a small level of risk (K) (38.46%).	The results of the study were obtained from nine (9) types of work and a total of 53 hazards, there was a decrease in the risk level after controlling at a moderate risk level (M) of 30 hazards (56.6%) to 8 hazards (15.1%) , the low risk level (L) is 23 hazards (43.4%) to 45 hazards (84.9%), there are no extreme (E) and high (H) risk levels.	The results showed that the identification of hazards from 12 jobs got a total of 37 risk, there was a decrease in the level of risk after controlling for a large risk level of 7 risk (18.9%) to 0 (0%), moderate risk level of 30 risk (81.1%) to 8 risk (21.6%) and a small risk level of 0 hazards (0%) to 29 risk (78.4%). Risk control carried out in this study is engineering, administration and personal protective equipment (PPE)	study obtained identification of Risk of Harm caused by unsafe behavior in the form of not using PPE correctly and appropriately; not to carry out maintenance of the tools to be used; and the placement of materials, tools, and the operation	The results obtained after analyzing the data on the procedure for making HIRADC have been done well. Identify hazards that are already in accordance with the work done. The risk assessment provided is in accordance with the risk assessment

The difference between this research and previous studies is in the construction work process of building construction, bridges and toll roads using the Hazard Identification, Risk Assessment and Determining Control (HIRADC) method. with the aim of identifying the cause of the hazard and knowing the level of risk that may occur and making control measures to reduce the level of risk of hazard in Borepile work. The research was conducted by direct observation at the project site to determine the method of implementation and identify the risk of hazards posed to the bridge Borepile work.

CHAPTER III
THEORETICAL BASIS

3.1 Occupational Health and Safety (OHS)

3.1.1 General

According to Husein (2008). Management is a science about the art of leading an organization consisting of planning, organizing, implementing and controlling limited resources in an effort to achieve goals and objectives effectively and efficiently. For this reason, it is necessary to implement functions in management itself such as planning, organizing, actuating and controlling.In the Law (UU) of the Republic of Indonesia No.1 (1970) it is written "every citizen has the right to work and protection that is worthy of humanity, so an Occupational Safety Law was formed which aims to prosper and increase production as well. national productivity.

According to Trusyulianti (2007) Occupational Health and Safety (OHS) is a program created by companies and workers to prevent the occurrence of occupational accidents and occupational diseases by identifying factors that can cause accidents and occupational diseases as well as expected actions at the onset of occupational diseases and accidents aimed at reducing company costs in the event of accidents and occupational diseases. In OHSAS 18001:2007 it states " Occupational Health and Safety (OHS) factors and conditions that have an impact on the health and safety of employees or other workers".

3.1.2 Purpose

The objectives of implementing occupational safety and health according to Law No. 1 of 1970 are as follows

1. Protect and ensure the safety of every workforce and others in the workplace.
2. Reduce the presence of work accidents.
3. Guarantee that every source of production can be used safely and efficiently.

Meanwhile, according to the Decree of the Minister of Manpower R.I No. Kep. 463 / MEN / 1993, "the purpose of occupational health and safety is to create a safe, healthy and prosperous society and work environment, so that it will be achieved; a safe, healthy and comfortable work environment atmosphere with a healthy workforce state physically, mentally, socially and free of work accidents.

3.2 Work Accidents

3.2.1 Definition of Work Accident

Based on Law No. 1 of 1970 concerning occupational safety, a work accident is an unforeseen and unwanted event, which disrupts the regulated process of an activity and can cause losses to both human and property victims.

According to Tarwaka (2016) a work accident is an event that is clearly undesirable and often unexpected that can cause losses in both time, property or property as well as casualties that occur in an industrial work process or related to it. Thus an occupational accident contains the following elements:

1. It was not originally expected, because behind the accident there was no element of intentionality and planning.
2. It is not desirable or expected, because any accident event will always be accompanied by losses both physical and material.

Always cause losses and damage, which will at least be able to cause disruption of the work process.

3.2.2 Theory of Causes of Work Accidents

According to Tarwaka (2016) the cause of a work accident can only occur if there is a simultaneous cause at the work site or production process. Some studies provide indications if a work accident cannot occur by itself, but can occur because there are one or several factors that cause work accidents as well as one incident. The following are the causes of work accidents:

1. Policy reasons

   Because the basis of work accidents is based on general factors, an event or accident event. The basic causative factors of work accidents include:

a. Commitment from the company and management in an effort to implement occupational safety and health in their company.
b. The workers who are at work.
c. Conditions of the premises, facilities, and working environment.

2. The main cause of occupational mischief is the presence of Occupational Safety and Health (K3) factors and requirements that have not been implemented properly. The main causes of work accidents are:
   a. Unsafe actions by humans are dangerous actions caused by the workers themselves, the things that cause them include:
      1) Lack of knowledge
      2) Not able to work properly
      3) Malfunctioning of the body due to invisible defects
      4) Tired and saturated
      5) Behaviour that is not swift
      6) And others.
   b. Unsafe conditions caused by machinery, equipment, materials, environment and workplace, work methods, nature of work, and work systems. The environment in question is a factor related to the provision of facilities, human experience, the organization of work, relations between workers, political, economic, socio-cultural, resilience, and security conditions.
   c. Interactions between humans and machines and inappropriate means of supporting work are the source of the cause of accidents. If the interaction between the two is not in harmony, it will cause an error that triggers a work accident. Thus, the provision of work facilities and infrastructure in accordance with human capabilities must be implemented from the planning stage of the work system.

In Heinrich's domino theory, accidents consist of five interconnected factors, namely:

1. Working conditions

   Working conditions include a person's background, such as lack of knowledge or include one's traits such as stubbornness.

2. Human error

   Human error can be caused due to physical or mental problems, minimal skills and knowledge and misplacement of work positions that are not in accordance with the field of expertise, lack of focus, and others.

3. Unsafe actions and conditions

   Unsafe actions such as carelessness, not obeying security or safety signs in the field, not taking care of dangerous work permits before starting high-risk and dangerous work, carelessness, not using work protective equipment (PPE), and so on.

4. Accident

   Work accidents such as slipping, toxic substances, burns, being crushed and squeezed by objects at work, being crushed or exposed to tools, direct contact with sources of danger, and so on.

5. Impact of losses

   The impact of bias loss in the form of:

   a. Worker: injury, permanent disability, death
   b. Employer: tool malfunction and legal proceeding

   Consumer: product availability

These five factors are like dominoes that are struck down. If one card falls, then this card will fall on the other card so that all five will collapse together. An overview of Heinrich's domino theory can be seen in Figure 3.1.

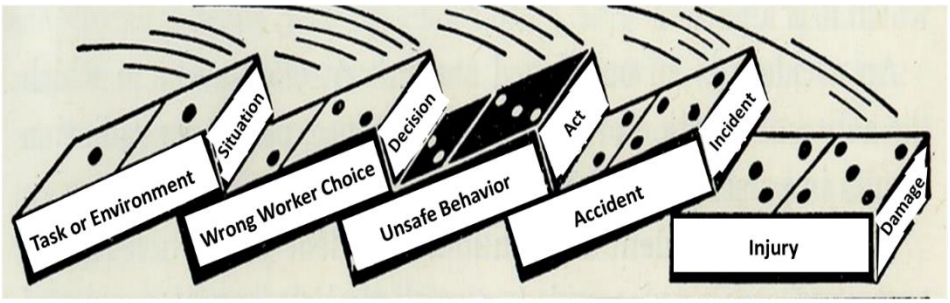


Figure 3.1 Heinrich's Domino Theory
(Source: The Role of Beliefs in Accident Prevention)

According to Heinrich, the key to preventing workplace accidents is to eliminate unsafe attitudes and conditions (card 3). According to the domino effect analogy, if the third card no longer exists, not all cards will fall, even if both the first and his second card fall. Even if there is a gap or distance from the 2nd card to his 4th card when the 2nd card falls, the 4th card will not be knocked down. After all, accidents (4th card) and damage (5th card) can be prevented. Prevention of work accidents by eliminating one of the factors causing work accidents can be seen in Figure 3.2.

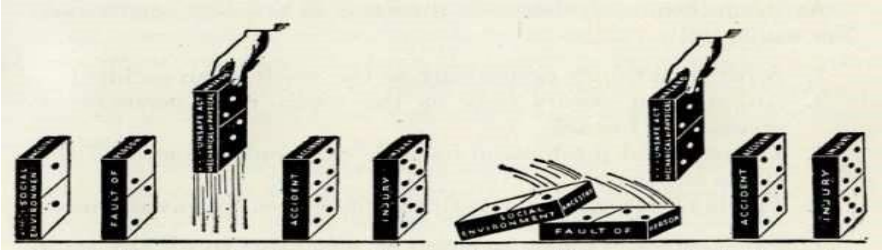


FIG. 4. The unsafe act and mechanical hazard constitute the central factor in the accident sequence.

FIG. 5. The removal of the central factor makes the action of preceding factors ineffective.

Figure 3.2 How to Prevent Work Accidents by Eliminating One of the Factors Causing Work Accidents
(Source : Heinrich's Domino Model od Accident Causion)

3.2.3 Source and Types of Work Accident

Decree of the Director General of Industrial Relations and Labor Supervision No.84 (1998) states that the sources and types of accidents are as follows.

1. Source of work accidents
   a. Machines (punching machines, presses, saws, drilling machines, weaving machines, and others).
   b. Starter drive and pump (compressor, combustion motor, water pump, fan, air suction, etc.).
   c. Elevators (elevators for people or goods either driven by steam, electrical, hydraulic, etc.).
   d. Lift aircraft (cranes, jacks, takels, lirs, etc.)
   e. Conveyor (conveyor belt, conveyor chain, etc.).
   f. Transport aircraft (lorries, forklifts, gerobags, cars, dump trucks, and others).

g. Handwork tools (chisels, hammers, knives, axes, etc.).
h. Electrical equipment (electric motors, generators, transformers, ornaments, electricity, switches, conducting wires, and others).
i. Chemicals (explosive or evaporable chemicals, toxic, corrosive, metal vapors, and others).

2. Type of accidents
   a. Bumped ((generally indicates contact or contact with a sharp object or hard object that results in being scratched, cut, punctured, etc.).
   b. Hit (generally due to falling, sliding, drifting, moving, etc.).
   c. Caught on, inside, and between objects (pinched, buried, drowned, etc.).
   d. Falling from a high altitude.
   e. Slip.
   f. Exposure (generally related to temperature, air pressure, vibration, radiation, sound, light, etc.).
   g. Absorption (indicates the process of entry of harmful substances or substances into the body, either through breathing or skin and which generally results in shortness of breath, poisoning, suffocation, and others).
   h. Touched by electricity.
   i. And others

3.3 Risk Management

K3 risk management, according to Soputan (2017), is an effort to manage risk in a thorough, organized, and structured manner. It is an effective strategy for preventing unintended incidents. As a result, managers can analyze and identify current hazards to improve results. Risk management focuses on workplace dangers and threats that could cost the business money.

Meanwhile, according to OHSAS 18001 (2007), K3 risk management is an integrated effort to manage risks that exist in the company's activities that can result in human injury, damage or disruption to the company's business.

According to Wicaksono (2011) risk management has the following objectives:

1. Help Minimize the spread of work accident
2. Implement Implement management programs efficiently so as to provide advantages not losses
3. Develop the right program to minimize losses at the time of failure
4. Improve decision-making at all levels
5. Creating proactive management is reactive

The purpose of the analysis is to separate acceptable minor risks from major risks and to provide data to support risk assessment and control. Risk analysis is based on consideration of risk sources, consequences of damage, and the probability of being able to identify these consequences. You can identify factors that influence outcomes and probabilities. Risk analysis uses a combination of impact and probability estimates in the context of existing control measures. (AS/NZS 4360, 1999).

3.4 HIRADC (Hazard Identification, Risk Assessment and Determining Control)

Based on the Civil Service and Public Housing Minister Decree No. 10 2021 regarding Construction Safety Management System Guidelines Article 1 No. 13, hazard identification, risk assessment, risk management decisions and opportunities are stipulated below. Processes for identifying threats, assessing and managing risks, and assessing opportunities. HIRADC consists of her three phases: hazard identification, risk assessment, and Determaining control.

3.4.1 Hazard Identification

1. Definition of Hazard

   Hazard is a circumstance that allows or has the potential to occur in the form of injury, illness, death, damage or the ability to carry out established operational functions (Tarwaka, 2008).

   According to Kuswana (2014) that the types of potential hazards are as follows.

   a. Physical Hazard

Physical hazards are the most common and present in most workplaces at some point. These include injuries, illnesses, and potentially fatal conditions.

b. Danger of Chemicals

Chemical hazards are substances with properties and effects that can affect human health and safety. Chemical hazards can be classified as Exposure, Vapor, Gas, Mist, Dust and Smoke.

c. Psychological Danger

Mental hazards cause mental stress and distraction in workers. Although a fairly new hazard taxonomy is involved, it is very important to fully identify and manage psychological hazards.

2. Process of Hazard Identification

According to (Ramli, 2009) Hazard identification is a systematic effort to determine potential dangers that exist in the work environment. By knowing the nature and characteristics of hazards, you can be more careful and vigilant in taking safety measures to avoid work accidents, but not all Dangers can be controlled easily.

Procedures for identifying hazards, evaluating risks, and choosing controls must consider the following:

a. Regular and irregular activities.
b. Characteristics, skills, and other aspects of human nature.
c. Risks that might develop outside the workplace and affect the workers' health and safety in settings under the organization's control.
d. Potential risks near the location where a related work activity that is within the organization's control ends up.
e. Workplace infrastructure, furnishings, and supplies that are either provided by the company or third parties.
f. Changes to the OHS Management System, including brief modifications, and their effects on activities, processes, and operations.
g. the existence of relevant statutory obligations related to risk assessment and the implementation of required risk control.

h. Design of work areas, processes, installations, machinery/equipment, operational procedures and work organization, including their adaptation to human capabilities.

3.4.2 Risk Assesment

1. Definition of Risk

AS/NZS 4360 (1999) states that the purpose of analysis is to separate small tolerable risks from major risks and to provide data useful in risk assessment and management. Risk analysis is based on considering the sources of risk, the consequences of hazards, and the likelihood of identifying consequences. Identify factors that influence outcomes and opportunities. Risk analysis uses a combination of impact and likelihood estimates in existing control measures. According to Ramli et al., (2010) K3 risk is a risk related to the source of danger arising in business activities that concerns human aspects, equipment, materials and the work environment. Generally, the risk of K3 is connoted as negative, including:

a. Accidents to people and company assets.
b. Fire and blasting.
c. Occupational diseases.
d. Damage to the means of production.
e. Interruptions at the time of operation

The definition of risk according to Vaughan (2007) states as follows.

a. Risk is the chance of loss

   This risk is usually used to indicate circumstances in which there is a possibility of loss or opportunity for loss.

b. Risk is the possibility of loss

   Risks like this indicate risks that can cause losses if not immediately overcome / resolved.

c. Risk is uncertainty

   The risk referred to in this case is that the risk is related to uncertainty, and the existence of risk due to uncertainty.

It can be concluded that risk is an impact or result of a potential adverse event that can cause the failure to achieve the desired target due to uncertainty.

2. Process of Risk Assesment

   Referring to the Regulation of the Minister of PUPR number 10 of 2021 article 1 explains that "construction safety risk assessment is a calculation of the amount of potential based on the possibility of events that have an impact on losses to construction, human life, public safety and the environment that can arise from certain sources of danger, occurring in construction work". The risk assessment will be carried out with reference to PUPR Ministerial Regulation No. 10 of 2021 on Construction Safety Management System Guidelines. Risk ratings at each stage of work are calculated based on multiplication of frequency values and severity of hazard effects. The grading scale can be illustrated in table 3.1 following Table 3.1 *Determination of Frequency Level*.

Table 3.1 Determination of Frequency Level

Frequency Level	Description	Definition
5	Almost certainly happened	a. It is likely that there will be accidents when doing work b. The possibility of accidents occurs more than 2 times a year
4	Very Maybe Happen	a. The possibility of accidents when doing b. work in almost all conditions Possible accidents 1 time in the last 1 year
3	Maybe Happen	a. The possibility of accidents when doing work under certain conditions b. Possibility of accidents 2 times in the last 3 years
2	Small Likelihood Happen	a. Less likely to occur accidents while b. doing work under certain conditions Possible occurrence of accidents 1 times in the last 3 years

Continued Table 3.1 Determination of Frequency Level

Frequency Level	Description	Definition
1	Almost Never Happen	a. There can be accidents while working on certain conditions

(Source: PERMEN PUPR No. 10 of 2021)

Table 3.2 Severity Assignment Table

Severity	Safety Consequence Scale			Environment/Public Facilities
	Human (Worker & Society)	Equipment	Material	
5	The onset of fatality of more than 1 person dies	There was a major equipment that was damaged by more than one and resulted in work stopping for more than 1 week	The material is damaged and needs to bring in new material which takes more than 1 week and results in job stops	Cause air/water/soil/sound pollution that results in complaints from the community or the occurrence of environmental damage in National Parks related to flora and fauna or destruction of community assets around as a whole. Severe damage occurs to community access roads. There was a traffic jam for more than 2 hours
4	The onset of fatality of 1 person dies; or 1 person with permanent disability	There was one main equipment that was completely damaged and resulted in work stopping for 1 week	The material is damaged and needs to bring in new material which takes 1 week and results in the work stopping	Causing pollution air/water/land/sound but no complaints from the community; or there is environmental damage related to flora and fauna; or partial destruction of assets surrounding communities. There was damage to part of the community access road. There is a traffic jam for 1-2 hours
3	There was an incident that resulted in more than 1 worker with inpatient medical care, losing work time	There was more than one piece of equipment that was damaged and required repairs and resulted in work stopping for less than seven days	The material is damaged and needs to bring in new material which takes more than 1 week and does not result in work stop	Cause air/water/soil/sound pollution that affects the work environment; or There is environmental damage related to plants in the work environment or There is damage to road access in the work environment There is a traffic jam for 30 minutes – 1 hour.

Continued Table 3.2 Severity Assignments

Severity	Safety Consequence Scale			Environment/Public Facilities
	Human (Worker & Society)	Equipment	Material	
2	There was an incident that resulted in 1 worker using inpatient medical care, losing work time	There was one piece of equipment that was damaged, required repair and resulted in work stopping for more than 1 day	The material is damaged and needs to bring in new material which takes less than 1 week, but does not result in work stopping	Cause air/water/soil/sound pollution that affects some working environment; There was damage to part of the access road in the work environment
1	There are incidents that are handled only through P3K, not loss of working time	There was one piece of equipment that was damaged, required repair and resulted in work stopping for less than 1 day	Does not result in Material damage	Does not result in environmental disturbances

(Source: PERMEN PUPR No. 10 of 2021)

Table 3.3 Risk Level Assignment Table

	Severity				
Frequency	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

(Source : PERMEN PUPR No. 10 of 2021)

Information:

Value 1-4: Small Risk Level

Value 5-12: Medium Risk Level

Value 15-25: Severe Risk Level

The value of the risk level in table 3.3 by doing calculations on the equation as follows:

RL = F x S

With the caption:

RL : Risk Level

F : Frequency

S : Severity / Effect

3.4.3 Determining Control

Determaining control Risk management, according to Tarwaka (2008), is a strategy for avoiding potential risks present in the workplace. The risk control hierarchy is a series of steps used to prevent and manage potential risks. It has numerous stages.

After performing a risk assessment and taking into account current controls, an organization is required by OHSAS 18002:2008 to be able to decide whether existing controls are sufficient, need to be improved, or call for additional controls aid. Introduce personal protective equipment (PPE) to reduce risk if new or

enhanced controls are needed, then prioritize and make decisions in accordance with the principle of eliminating practical dangers (possible injury or danger) lowering possible severity or sexuality). A few examples of the hierarchy of risk mitigation controls include :

1. Elimination

   Risk management through this method of elimination is a hazard control strategy that includes the complete elimination of the material or process that caused the hazard, if possible.

2. Substitution

   This method is a tool-based risk management strategy or a way to replace jobs with other jobs with a lower level of risk.

3. Engineering Control

   Control is technically hazarding management strategies designed to protect workers from imminent danger. One approach to controlling hazards on projects is to provide placement of materials, tools, and signage, and to conduct routine maintenance according to procedures for equipment and materials used in the work.

4. Administrative

   Management is the control of risks and hazards through management procedures, permits to work, analysis of work safety, and improvement of work skills.

5. Personal Protective Equipment / PPE

   PPE control is the ultimate control option in the risk management hierarchy to reduce the impact of hazards. This last control option is a less effective control, but should be carried out on the condition that workers use full personal protective equipment to protect workers from injury for smooth workflow. The hierarchy of risk control can be seen in Figure 3.4.

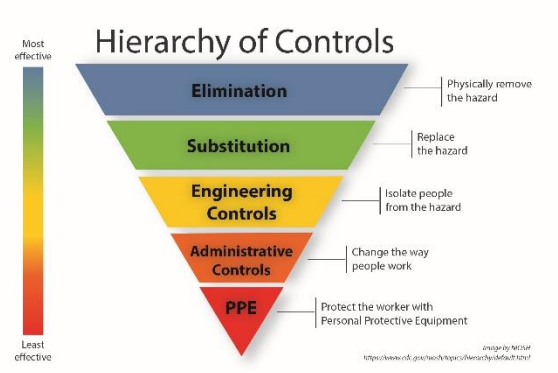


Figure 3.3 Risk Control Hierarchy
(Source: 5th Intenational Project and Construction Management Conference)

The purpose of the risk management hierarchy is to provide a systematic approach to improving project safety and health. In the risk management hierarchy, it is agreed that higher controls are more effective than lower ones. If your implementation has used a higher tier but the existing risks are still high, use a lower tier to mitigate the existing risks and implement multiple risk controls with the aim of successfully managing occupational health and safety related risks. Can be combined possible level.

3.5 Bridge Works

A bridge is a construction built to connect two roads that are cut off due to obstacles such as river flows, steep valleys, ravines, transverse roads, railways, reservoirs, irrigation canals and others. It can be said that the bridge is a very important means of transportation, because the existence of a bridge can shortens the travel time to a place or area.

Bore pile foundation is one type of deep foundation that is made in the soil surface, the foundation is placed to the required depth (reaching hard ground) by making holes with a drilling system or soil dredging. After the drilling reaches the planned depth, then input the bore pile reinforcement that has been assembled or fabricated, then reinforced concrete is placed on the drilled holes. The stages of working on the bore pile foundation based on field observations are as follows :

1. Preparation
    a. Measurements and determination of bore pile points are carried out

b. Bore pile reinforcement fabrication. The fabrication of bore pile reinforcement can be seen in
c. Schedule bore pile casting and keep it under control
d. Create a form for bore pile monitoring report

2. Bore Pile Work
   a. Setting the drill tool at the drilling point. Drilling tool settings.
   b. It is feared that the soil conditions are not good, so the casing is installed. If the earth wall collapses, additional water is required.
   c. Then proceed with the drilling process, drilling is carried out with an auger after groundwater is found, drilling is continued by using a drilling bucket to a depth according to the plan, which is + 34 meters for each bore pile point.
   d. Continuously when drilling using heavy equipment in holes accompanied by adding red soil and water to bind the sandy soil inside so as not to slide during drilling and to facilitate the drilling process. Discharge of mud is channeled by making its own drainage path and disposed of with a dump truck.
   e. Check whether the design depth has been reached then clean the mud at the bottom of the borehole with a cleaning bucket
   f. During the process, record the depth of the groundwater table, the type of soil including the depth and thickness of the soil layer
   g. Bore pile reinforcement that has been fabricated or assembled is then installed into holes that have been drilled using heavy equipment.
   h. Installing the tremie pipe into the drilled hole is useful for delivering the cast to the bottom of the hole, so that the drill hole is filled from below and the mud water is pushed out from the outside of the tremie pipe. The installation of the tremie pipe is part of the preparation for casting the bore pile foundation.
   i. After everything is ready, proceed with casting. The casting process must be carried out directly and continuously, the concrete is poured directly from the mixer truck into the tremie hole through the available tremie funnel.

CHAPTER IV
RESEARCH METHOD

4.1 Research Method

In general, a research method is a pathway or process specifically chosen to solve a problem encountered and proposed in research to obtain data with a specific purpose and application. In general, data obtained from research can be used to solve, understand, and predict problems as they arise. The method used in this study is a descriptive study. Descriptive methods are methods used to examine the state of a human group, object, state, thought system, or class of events in the present. Analysis is performed to check whether labour protection for toll road bridge construction projects complies with applicable regulations and to make recommendations where project decision controls are not sufficient to ensure the implementation of labour protection. will be Improve your project's future and reduce the risk of workplace accidents.

4.2 Research Location

The construction of Toll Road Solo – Yogyakarta Paket 1.1 located in, border of solo city and klaten district. The project location can be seen in Figure 4.1 below.

Figure 4.1 Reseacrh Location

4.3 Subject and Object of The Research

According to Sugiyono (2013) the research subject is an attribute or trait or value of a person, object or activity that has certain variables set to be studied and

conclusions drawn. In this study, the research subjects were hazard identification, risk level assessment and control measures using the HIRADC (Hazard Identification Risk Assessment and Determining Control) method.

According to Sugiyono (2013) the object of research is an attribute or trait or value of a person, object or activity that has certain variations determined by the researcher to be studied and then drawn conclusions. Based on the definition above, the object of this research is as follows:

1. Research Project

   The object of this research is the activity of Borepile construction work on the construction of Toll Road Solo – Yogyakarta Pack 1.1 Kartasura – Klaten Sta 22 + 300.

2. Research Location

   The research location is located in Klaten Km 28 direct to Solo City Jawa Tengah.

3. Field Observation Time

   Field observation time is carried out during working hours and adjusted to the situation and conditions in the field. Observations were carried out from 25 May 2023 to 28 June 2023.

4.4 Data Collection and Analysis

According to Arikunto (2013) explains that research data are all forms of facts and figures that can be used as material to compile information. To carry out the analysis process, data relating to the conditions in the field is needed. These data were obtained from various sources and with different methods. The sources and methods of data collection in this study are as follows.

1. Primary Data

   Primary data is data that is directly collected by researchers to facilitate the analysis process for research by means of direct measurements, panel groups, interviews, or questionnaires. According to Arikunto (2013) explains that primary data is data collected through the first party, can be through interviews, traces and others. The primary data in this study are as follows.

a. Observation

Observation According to Sutrisno Hadi Observation is a very complex process, consisting of various processes, both biological and psychological, which prioritize the processes of memory and observation. In addition to collecting data, observations are made with the aim of getting a conclusion about the object being observed. Observation also aims to describe an object and all things related to the object being studied.

b. Interview

Interview According to Koentjaraningrat 2017 Interviews are a method used for certain tasks, trying to get information from respondents verbally, and to communicate face to face. When conducting free interviews, the interviewer can ask the respondent anything. However, what must be considered is that the question has a relationship with the desired data. If you're not careful, this free interview usually has questions that are out of control.

2. Secondary Data

Secondary data is data obtained and has been collected apart from primary data which is complementary data. Secondary Data According to Arikunto Secondary data is data obtained from graphic documents (tables, notes, minutes of meetings, SMS, etc.), photographs, films, video recordings, objects and others that can enrich data primary data can enrich the primary data. Secondary data used in this study are as follows.

a. Regulations and Legislation of the Republic of Indonesia concerning Occupational Safety and Health (K3).
b. Minister of Manpower Regulation No. 5 of 2018 concerning K3 Work Environment.
c. 2021 PUPR Ministerial Regulation About Hiradc Table.
d. OHSAS 18001:2007 concerning Requirements for Occupational Health and Safety Management System (SMK3).
e. OHSAS 18002:2008 concerning Implementation of Occupational Safety and Health Management Systems (SMK3).

f. Literature study related to Occupational Safety and Health (K3).

4.5 Systematic Research

Research must be carried out systematically in order to obtain appropriate results. Therefore, the implementation of the research was divided into several stages, including the following.

1. Literature Review

   Carried out to deepen understanding of the research topic by reading several scientific journals, lecture materials, and references related to the research topic before starting research.

2. Determining the Research Object

   The research object is determined by observing in the field and identifying the problem to be studied. Licensing to related parties must be carried out if the conditions in the field are in accordance with the topic to be studied.

3. Data Collection

   Data analysis was obtained from collecting the required data such as primary and secondary data, that primary data is data collected through field observations and interviews with related parties. While secondary data comes from data sources obtained by reading, understanding and studying through other media sourced from books, literature and documents.

4. Data Analysis

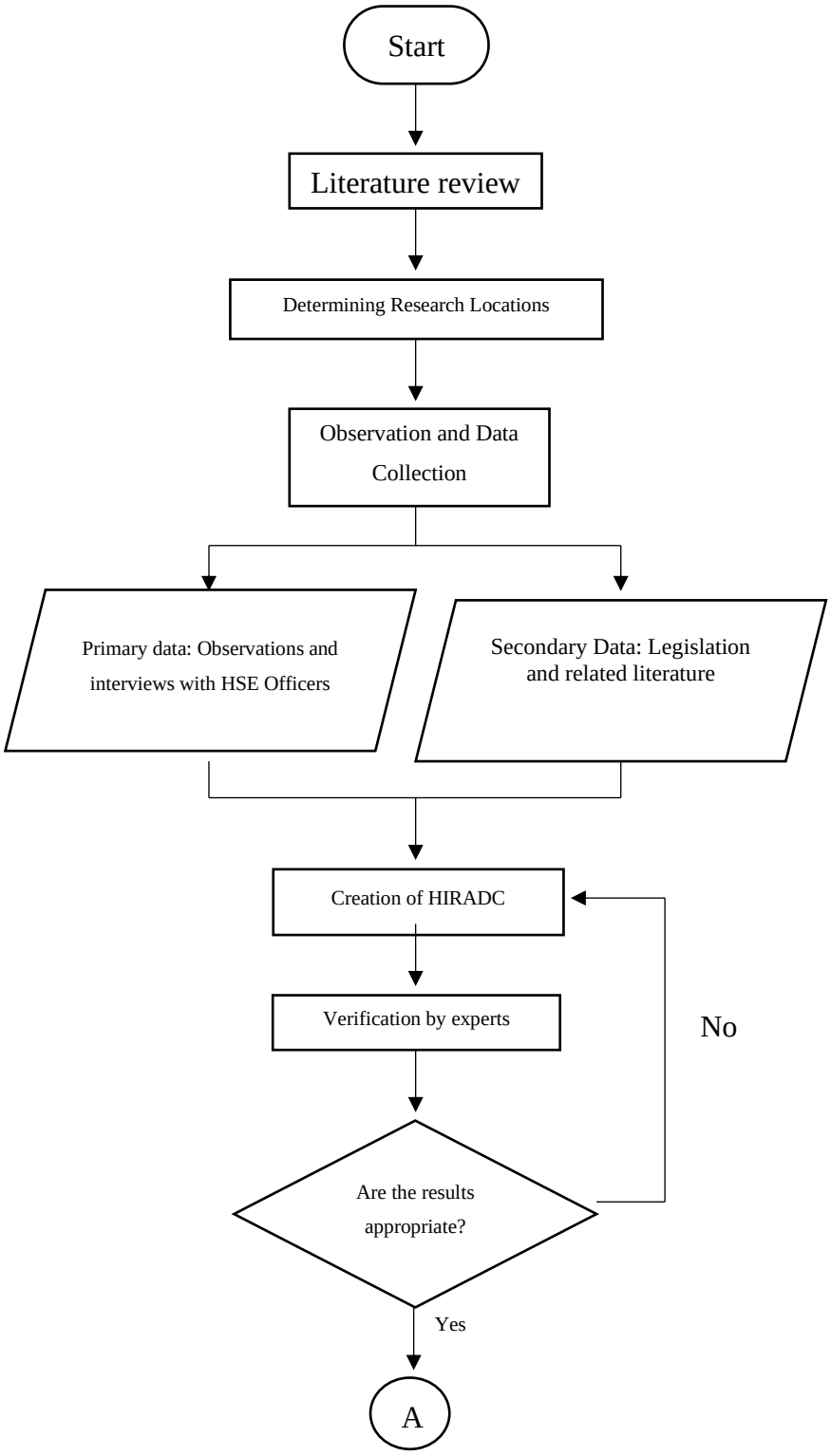
   Research must be carried out systematically using a clear and orderly sequence in order to obtain objectives and results that are aligned with the desired. Therefore, the implementation of this research is divided into several stages as follows.

   a. Collection of sources that become literature and regulations related to the topic under study in order to sharpen knowledge related to the research topic.
   b. Determine the object used and make observations on the object of research in order to find out the sources of danger that can lead to accidents in the field.
   c. Develop customized HIRADC tables for research needs.
   d. Identify hazards that can cause hazards to occur in the work location.

e. Researchers obtain results from K3 experts that have been verified to further revise if there are things that are not the same as what has been made/applied by related organizations regarding the hazards that exist in work related to the hazard identification process.
f. Verify the identification of hazards that may occur and controls that the author has compiled in the draft HIRADC table. From the results verification, input is obtained from the draft HIRADC table stacking writer.
g. Identify hazards that can cause hazards to occur in the work location.
h. Hazards that may occur are assessed the risk of the possibility of occurrence in each work step related to the analysis taken from the risk level scale table by means of interviews with K3 experts.
i. Make a discussion about the results that have been obtained.

4.6 Flowchart

The flowchart of this research can be seen in Figure 4.2 as follows.


Start
Literature review
Determining Research Locations
Observation and Data Collection
Primary data: Observations and interviews with HSE Officers
Secondary Data: Legislation and related literature
Creation of HIRADC
Verification by experts
No
Are the results appropriate?
Yes
A

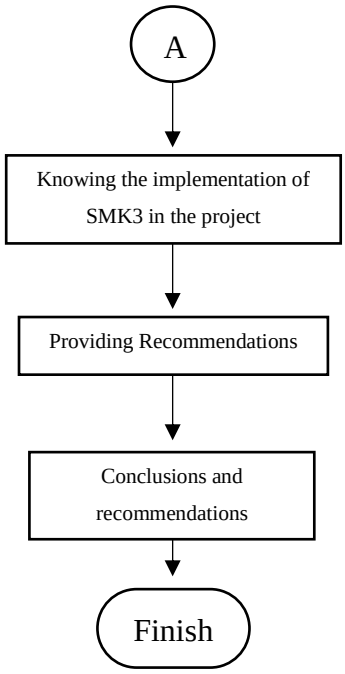


Figure 4.2 Research Flow Chart
(Source: Personal Documentation)

CHAPTER V
ANALYSIS AND DISCUSSION

5.1 Project Overview

5.1.1 Project Profile

The rapid development of transportation mobility in Indonesia has made easy access to receive great attention. Efficient, accessible and barrier-free long-distance land transportation is needed to meet the mobility of many people and the distribution of goods and services. Because of this, Toll roads are needed to streamline traffic in developed areas. Improving the distribution of goods and services to support economic growth. Improving the distribution of development results.

The construction of Tol Jogja solo in Surakarta is a project of PT Adhi Karya (Persero) as a contractor and shareholder. The contractor is the party appointed by the project owner to carry out the construction work. It takes human resources (HR) who are experts in their respective fields such as civil engineering, architecture, mechanical electrical, OHS (occupational health and safety) and others so that a building can be built properly in a fast and efficient manner.

Project Name : Construction of the Solo-Jogja-NYIA Toll Road section I package 1.1
Project Location : Border of Kartasura Regency & Klaten Regency
Project Owner : PT. Jogjasolo Marga Makmur
Contractor Project : PT. Adhi Karya (persero) Tbk
Consultant Project : PT. ESKAPINDO MATRA CE
Contract Value : Rp 4.378.674.174.000,00
Completion time plan : 730 calendar days

5.1.2 Research Sites

The research location for the Solo Jogja Toll Road Development Project is on the border of Kartasura & Klaten Regencies.

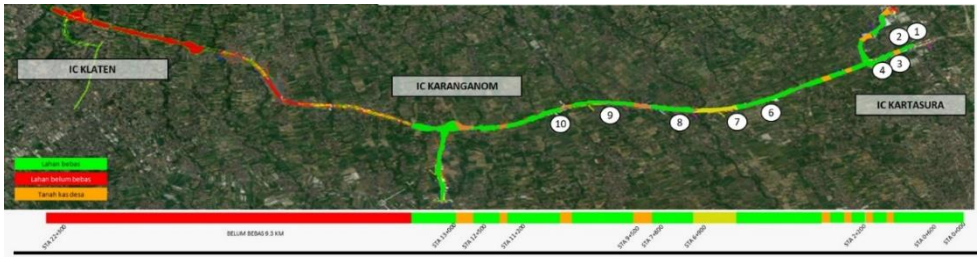


Figure 5.1 Project Location Map
(Source: Map of STA 13+867 Construction of the Solo – Jogja Toll Road)

5.2 Results of Data Collection

The object of this research is the bore pile foundation work on the project Construction of the Solo-Jogja-NYIA Toll Road STA 13+867 section 1 package 1.1 The types of bore pile work studied include:

1. Preparation of heavy equipment and setting of work tools
2. Creation of drilling points
3. Reinforcement fabrication
4. Initial drilling work
5. Casing installation work
6. Further drilling work
7. Transfer of reinforcement to hole location
8. Installing reinforcement to the borepile hole
9. Reinforcement connection
10. Tremie pipe installation work
11. Execution of casting

5.3 Observation Subject

The subjects in this study are identifying hazards, risk assessment, and risk control using the Hazard Identification Risk Assessment and Determining Control (HIRADC) method on bore pile foundation work on development projects. Construction of the Solo-Jogja-NYIA Toll Road section I package 1.1based on the research object and also the research boundaries that have been determined.

5.4 Data Analysist

Data analysis is obtained in the form of risk identification and risk control data which is then used to compile HIRADC tables which aim to evaluate the magnitude of the risk level before control is carried out and after control is carried out with the aim of reducing the occurrence of risk levels.

After the collected data has been obtained, the next process is data analysis in the form of making tables of Hazard Identification, Risk Assessment and Risk Control with the aim of assessing the level of risk before controlling and after controlling with a view to reducing the level of risk in borepile foundation construction projects Solo – Jogja toll bridge Package 1.1 based on Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 10 of 2021 concerning Guidelines for Construction Safety Management Systems.

After observing in the field, the next step is the interview method. The interview process was conducted with Mr. Dodik hadi to verify the hazard identification process. Based on the results of the interviews that have been carried out, there have been changes in the results of the identification of hazards that have been observed at the project site. The following is an example of an identification table that has been revised and has been verified by K3 experts in the field.

5.4.1 Hazard Identification

In every work done in a project cannot be separated from the existing hazards, the cause is by several factors that can lead to work accidents. Therefore, on project workConstruction of the Solo-Jogja-NYIA Toll Road section I package 1.1 Risk identification is carried out based on the bore pile foundation work. To obtain hazard risk identification, a construction safety analysis or (AKK) is carried out. the steps to take are as follows. Collect references related to research objects with reasoning, especially regarding potential hazards by conducting hazard identification for all observation objects. One of example type of hazard identification be seen in table 5.1.

Table 5.1 Hazard Identification

No	Work	Hazard Identification
1.	Preparation of heavy equipment and setting of work tools	1) The heavy equipment needed is not feasible. 2) The bar cutter tool is not feasible 3) Bar bending tool is not feasible. 4) Lack of awareness of workers not fulfilling PPE. 5) Worker fatigue.

For others type of hazard identification can be seen in the attachment 6.

5.4.2 Risk Assesment

After identifying the hazards, namely determining what will happen from the hazards, the results of observations that have been made where the work is a mandatory component that must be prepared can be known so that no work accidents occur. Carrying out risk analysis using the HIRADC method which aims to determine the level of risk by determining and calculating the value obtained from two factors, namely the level of severity and the level of possibility that can occur in project work. One of type risk assestment example can be seen in table 5.2.

Table 5.2 Risk Assesment

No	**Risk Description**		
	Job Description / Workplace	**Hazard Identification**	**Risk**
1	Equipment preparation and work tool setting	1) The heavy equipment needed is not feasible.	1) There was a fire (workers got sparks).
		2) The bar cutter tool is not feasible	2) The worker's finger was cut by a cutter
		3) Bar bending tool is not feasible.	3) Worker is hit by a bar bending tool
		4) Lack of awareness of workers not fulfilling PPE.	4) Sandwichedby reinforcing steel.
		5) Worker fatigue.	5) Workers experience dehydration and stress

For others type of hazard identification can be seen in the attachment 6.

5.4.3 Determaining Control

After identifying the next risk, namely determining controls that aim to reduce or eliminate the risk of hazards that will occur. The control technique used in this study is by using the risk reduction hierarchy as follows.

1. Elimination
2. Subtitution
3. Engineering (engineering control)
4. Administrative control
5. Personal protective equipment

To obtain hazard risk control, a construction safety analysis or (AKK) is carried out. The steps that must be taken are to collect references related to research objects with reasoning, especially related to risk control by carrying out risk control for all observation objects as in the following example.

In the preparatory work, there is work on the preparation and setting of heavy equipment from the stage of the work based on references, basic hierarchies and results of field observations, risk control is obtained, namely:

1. Conducting safety morning talks, toolbox meetings periodically to remind workers of hazard risks
2. Instructions for use of PPE (vest, helmet, gloves, shoes)
3. Survey traffic and roads, make appropriate road signs, prepare special officers to manage traffic around the project
4. Ensure operators are competent and certified in the operation of related work item tools
5. Given an iron plate anvil when operating

For the Determaining control obtained in the same way risk analysis by using HIRADC method, of type risk determaining control. One of example can be seen in table 5.3

Table 5.3 Determaining Control

No	RISK DESCRIPTION			DETERMAINING CONTROL
	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK	1. Elimination 2. Substitution 3. Technical Engineering 4. Administrative 5. Personal protective equipment
1.	Equipment preparation and Setting tools	1) The heavy equipment needed is not feasible. 2) Worker fatigue.	1) There was a fire (workers got sparks)	ADM : Preparation of fire extinguishers and Make sure workers must use PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)
		3) The bar cutter tool is not feasible	2) The worker's finger was cut by a cutter	ADM : Always check the condition of work tools such as cutters before starting work PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)
		4) Bar bending tool is not feasible.	3) Worker is hit by a bar bending tool	TE : Always check that the bar bending tool is in a condition suitable for use. PPE :(vest, helmet, glove hands, shoes)
		5) Lack of awareness of workers not fulfilling PPE	4) Sandwiched by reinforcing steel.	TE : ensure that operators are competent and certified in operating related work equipment PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)
		6) Worker fatigue.	5) Workers experience dehydration and stress.	TE : Ensure workers are in good health by carrying out physical checks before work.

For others type of Determainig control can be seen in the attachment 7.

5.4.4 Compile Table Draf Hazard Identification, Risk Assesment and Determaining Control (HIRADC)

After collecting reference data from the results of hazard identification and determaining risk control, the authors then prepared a draft HIRADC table which would later be used for verification to the HSE and would be used to calculate the level of risk in installation borepile for bridge foundation work. One of example draft HIRADC table can be seen in Table 5.4.

Table 5.4 Table Draf Hazard Identification, Risk Assesment, and Determaining Control (HIRADC)

No	RISK DESCRIPTION			LEGAL REQUIREMENTS	RISK LEVEL ASSESSMENT			DETERMAINING CONTROL	ASSESSMENT LEVEL OF RELIEF RISK		
	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL	1. Elimination 2. Substitution 3. Technical Engineering 4. Administrative 5. Personal protective equipment	F	S	RL
1.	Equipment preparation and Setting tools	1) The heavy equipment needed is not feasible.	1) There was a fire (workers got sparks)	1. Law No. 1 of 1970, concerning Work Safety, Article 3. 2. Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 42. 3. Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 4. 1. Permenakertrans No. 8 of 2020, concerning OHS of Lifting and Transport Aircraft, Article 42.				ADM : Preparation of fire extinguishers and Make sure workers must use PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)			
		2) The bar cutter tool is not feasible	2) The worker's finger was cut by a cutter					ADM : Always check the condition of work tools such as cutters before starting work PPE : Require workers to wear construction gloves.			
		3) Bar bending tool is not feasible.	3) Worker is hit by a bar bending tool					TE : Always check that the bar bending tool is in a condition suitable for use. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)			
		4) Lack of awareness of workers not fulfilling PPE.	4) Sandwiched by reinforcing steel.					TE : ensure that operators are competent and certified in operating related work equipment PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes).			
		5) Worker fatigue.	5) Workers experience dehydration and stress.					TE : Ensure workers are in good health by carrying out physical checks before work.			

For others Table Draf Hazard Identification, Risk Assesment, and Determaining Control (HIRADC**)** be seen in attachment 8.

5.4.5 Scoring Risk

The next stage is to carry out a score risk to determine the scale of the risk level. Before assessing the risk there are several steps that must be carried out to obtain a risk score.

1. Risk Analysis

   Risk analysis is carried out to get the value of a risk that occurs in a job. Calculation of risk analysis requires scoring based on the criteria in the table of severity and level of possibility. The end result of the risk analysis is to produce data and information on the level of risk (RL) and status which is obtained from the multiplication of the severity level with the probability level of a work accident risk. The calculation of the risk level can be seen in table 5.5.

2. Risk Level Assesment into the HIRADC Table

   After carrying out a risk analysis based on the severity level table, the frequency level table and determining the risk value with the risk level determination table, the next step is to determine the risk level scale in the HIRADC table before and after hazard risk control is carried out. This risk level assessment is assessed by the HSE of PT. ADHI KARYA. The HIRADC table that has been verified and has been carried out a risk assessment by HSE. For full HIRADC draft table can be seen in the appendices but one of example table HIRADC can be seen in Table 5.5.

Table 5.5 Table Hazard Identification, Risk Assesment, and Determaining Control (HIRADC)

No	RISK DESCRIPTION			LEGAL REQUIREMENTS	RISK LEVEL ASSESSMENT				DETERMAINING CONTROL	ASSESSMENT LEVEL OF RELIEF RISK			
	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL		1. Elimination 2. Substitution 3. Technical Engineering 4. Administrative 5. Personal protective equipment	F	S	RL	
1.	Equipment preparation and Setting tools	1) The heavy equipment needed is not feasible.	1) There was a fire (workers got sparks)	1. Law No. 1 of 1970, concerning Work Safety, Article 3. 2. Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 42. 3. Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 4. 4. Permenakertrans No. 8 of 2020, concerning OHS of Lifting and Transport Aircraft, Article 42.	2	4	8	M	ADM : Preparation of fire extinguishers and Make sure workers must use PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes).	2	2	4	S
		2) The bar cutter tool is not feasible	2) The worker's finger was cut by a cutter		3	5	15	H	ADM : Always check the condition of work tools such as cutters before starting work PPE : Require workers to wear construction gloves.	2	4	8	M
		3) Bar bending tool is not feasible.	3) Worker is hit by a bar bending tool		4	5	20	H	TE : Always check that the bar bending tool is in a condition suitable for use. PPE :(vest, helmet, glove hands, shoes)	2	3	6	M
		4) Lack of awareness of workers not fulfilling PPE.	4) Sandwiched by reinforcing steel.		4	2	8	M	TE : ensure that operators are competent and certified in operating related work equipment ADM : Provide food and drink distribution so that workers can focus on work.	1	4	4	S
		5) Worker fatigue.	5) Workers experience dehydration and stress.		3	4	12	M	TE : Ensure workers are in good health by carrying out physical checks before work.	2	1	2	S

For others Table Hazard Identification, Risk Assesment, and Determaining Control (HIRADC) Level Risk Assesrment can be seen in attachment 8

5.5 Discussion

5.5.1 Risk Assesment Result

The risk assessment aims to determine the level of risk in terms of two parameters, namely frequency and severity. Consequence value determination with symbol (F) and probability (S) based on hiradc table above. Then the results of the risk level are evaluated to determine the risk criteria. The table can be seen in table 5.6.

Table 5.6 Risk Level Bore Pile Work Before Control is Done

No	Type of work	Risk Catagory			Amount of Risk
		S	M	H	
1	Preparation of heavy equipment and setting of work tools	0	3	2	5
2	Creation of drilling points	0	2	0	2
3	Reinforcement fabrication	0	3	3	6
4	Initial drilling work	0	1	4	5
5	Casing installation work	0	3	2	5
6	Advance drilling	0	1	4	5
7	Transfer of reinforcement to hole location	0	2	3	5
8	Installing reinforcement to the borepile hole	0	4	1	5
9	Reinforcement connection	0	2	3	5
10	Tremie pipe installation work	0	2	2	4
11	Execution of casting	0	1	4	5
Total value		0	24	28	52

Based on the results from the HIRADC table for assessing the level of risk in bore pile work before control is carried out, the following data is obtained:

1. Jobs with a high level of risk are as many as 28 Risk, the type of work including Preparation of heavy equipment and setting of work tools, Reinforcement

fabrication, Initial drilling work, Casing installation work, Advance drilling, Transfer of reinforcement to hole location, Installing reinforcement to the borepile hole, Reinforcement connection, Tremie pipe installation work, Execution of casting

2. Jobs with a moderate level of risk, namely as many as 24 Risk, the type of work including Preparation of heavy equipment and setting of work tools, Creation of drilling points, Reinforcement fabrication, Casing installation work, Transfer of reinforcement to hole location, Reinforcement connection, Tremie pipe installation work, Execution of casting.
3. There are no job with a small risk level.

Based on the results above, it shows that the average level of work is at a moderate risk level, but for work at heights and work using electricity the risk level is at a high level. So, of the 54 jobs that have been analyzed using the HIRADC method, if they are converted into percentages, the following results are obtained:

1. High Risk $= \frac{28\ Risk}{52\ Risk} \times 100\% = 54{,}8\ \%$
2. Moderate Risk $= \frac{24\ Risk}{52\ Risk} \times 100\% = 46.2\ \%$
3. Small Risk $= \frac{0\ work}{52\ work} \times 100\% = 0{,}0\%$

5.5.2 Risk Assesment After Determaining Control is Done

At is stage the aim is to find out how much the risk reduction occurs from the hazard after carrying out risk control using HIRADC. The controls carried out in this study include the following:

1. Elimination
2. Subtitution
3. Engineering (engineering control)
4. Administration
5. Personal protective equipment

The result obtained can be seen In table 5.7 below.

Table 5.7 Risk Level Bore Pile Work After Controlling Risk

No	Type of work	Risk Catagory			Amount of Risk
		S	M	H	
1	Preparation of heavy equipment and setting of work tools	3	2	0	5
2	Creation of drilling points	2	0	0	2
3	Reinforcement fabrication	4	2	0	6
4	Initial drilling work	1	4	0	5
5	Casing installation work	3	2	0	5
6	Advanced drilling work	1	4	0	5
7	Transfer of reinforcement to hole location	2	3	0	5
8	Installing reinforcement to the borepile hole	4	1	0	5
9	Reinforcement connection	2	3	0	5
10	Tremie pipe installation work	2	2	0	4
11	Execution of casting	1	4	0	5
Total value		25	27	0	52

After controlling and also preventing the risk of hazard, there is a decrease in the level of risk for each type of work. The results obtained after controlling are as follows:

1. There is no longer a type of work with a high risk level.
2. The existing moderate risk levels as 28 risk were the result of spillover reduction from high risk levels. where the types of work including Preparation of heavy equipment and setting of work tools, Reinforcement fabrication, Initial drilling work, Casing installation work, Advanced drilling work, Transfer of reinforcement to hole location, Installing reinforcement to the borepile hole, Reinforcement connection and Execution of casting.

3. The existing small risk levels as 24 were the result of spillover reduction from moderate risk levels, where the types of work including Preparation of heavy equipment and setting of work tools, Creation of drilling points
4. , because after control was carried out, the risk level above was reduced to a low risk level, where the types of work including Reinforcement fabrication, Initial drilling work, Reinforcement connection, Tremie pipe installation work and Execution of casting which means that the increase in the low risk level was the result of the spillover of the reduction in the medium risk level. The low risk levels include:.

If used in units of percent then the result is as follows.

1. High Risk $= \frac{0\ Risk}{52\ Risk} \times 100\% = 0.0\ \%$
2. Moderate Risk $= \frac{27\ Risk}{52\ Risk} \times 100\% = 51{,}9\ \%$
3. Small Risk $= \frac{25\ Risk}{52\ Risk} \times 100\% = 48{,}1\%$

Comparison of the level of risk before carrying out the control and after carrying out the hazard risk control can be seen in the picture below.

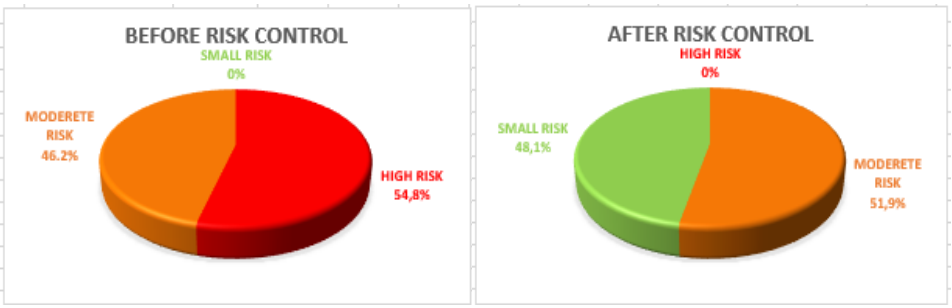


Figure 5.2 Graph of Risk Level Comparison

From the results of the data obtained that there is a decrease in the level of risk in each job. So, from the results of the existing data controlling the risk of occupational hazards is an important effort in the commitment to maintaining health and safety work.

5.5.3 Control Risk Assestmrnt

After conducting a risk assessment and analysis based on HIRADC (hazard identification, risk assessment, and determining control) in this study, risk control was carried out. Where this control has an important role in minimizing the impact

of hazard risks that can occur. Determination of this control effort considers the basic hierarchy of controls, namely elimination, substitution, engineering, administrative and personal protective equipment (PPE) by adjusting the conditions in the field. The control measures carried out in this study were based on a basic hierarchy and after going through the risk level assessment process and risk analysis, the overall control efforts were obtained, namely engineering, administrative and personal protective equipment.

In this study the control carried out only covered several aspects due to certain considerations. Among them are:

1. The first first aspect is the workforce where in this aspect control efforts are carried out based on basic hierarchies such as administration, namely by conducting safety morning talks and toolbox meetings periodically in order to remind workers of the risk of danger, after that personal protective equipment (PPE) is the role important in minimizing the level of risk,
2. The two aspects of heavy equipment control efforts carried out are technical and administrative engineering, in which engineering engineering involves Installing down an iron plate before starting work with the aim of stabilizing the position of the heavy equipment and preventing the machine from tipping over. Administratively by carrying out heavy equipment inspections such as machine condition and equipment item feasibility, for example the condition of steel slings related to safety when lifting material and drilling, then operator certification to determine that the operator is competent in carrying out work items related to the heavy equipment used.
3. The third is the location aspect of the control effort, namely by engineering engineering where the area of the project is quite narrow, the activity of heavy equipment with large sizes and the placement of installation materials such as pile reinforcement material makes engineering very necessary for smooth and safe work when carrying out work such as carrying out work with the safest reach or maneuver of heavy equipment and avoid the traffic of surrounding worker activities so as to minimize the impact of hazard risks between workers and heavy equipment activities.

CHAPTER VI
CONCLUSIONS AND RECOMENDATION

6.1 Conclusion

Based on the research that has been done, the following conclusions are obtained. The results of construction safety risk management for bore pile work at Construction Solo-Jogja-NYIA Toll Road section I package 1.1 using the HIRADC method are as follows.

1. From the 11 stages in the borepile bridge foundation work, there are 52 hazards can be found. The source of hazard that can make work accidents comes from human factors, namely if actions or work methods are not in accordance with predetermined work procedures. Then the next is the situational factor, namely the location of the construction project work location which has a high potential for danger, which means workers have to face conditions with unexpected risks.
2. Based on the results of the risk assessment obtained from 52 total risks in all works, there were 28 high risks (54,8%), 24 moderate risks (46,2%), and no jobs with a low risk level were found.
3. The risk control measures carried out in this research are in accordance with the OHS hierarchical risk control management system, namely control techniques, administration and personal protective equipment (PPE). From the results of the implementation of risk control, it was found that there were changes in the level of risk in all types of work, including the high risk level was no longer there, the medium risk level was 27 risks (51.9%), and the small risk level was 25 risks (48.1%) which is obtained.

6.2 Recommendation

Based on the analysis and conclusions made based on the HIRADC method (Hazard Identification, Risk Assessment, and Determining Control) on project observationsConstruction of the Solo-Jogja-NYIA Toll Road section I package 1.1.

In order to obtain better results, several suggestions are given to complement or continue similar research, namely:

1. In an effort to create a zero-accident division of K3 or HSE (health, safety and environment) to carry out strict and disciplined supervision of work safety supervision so as to avoid potential risks of hazards that will occur in the project to be worked on.
2. It is necessary to carry out counseling or training on the importance of implementing OSH while working so that workers can work safely and securely in accordance with work safety procedures.
3. It is hoped that the implementation of the occupational safety and health management system on the Solo - Jogja toll road construction project, especially for borepile work, can be a good example of its application.

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APPENDICES

APPENDICES 1 LETTER OF PERMISSION TO CONDUCT RESEARCH.

UNIVERSITAS ISLAM INDONESIA

FAKULTAS TEKNIK SIPIL & PERENCANAAN

PROGRAM STUDI TEKNIK SIPIL

Assalamu'alaikum Wr.Wb.
Yang bertanda tangan dibawah ini kami,

Nama : ABDILLAH HANS SAMARA
No. Mhs : 18511028
Prodi : Teknik Sipil

Dengan ini kami mengajukan Permohonan untuk pelaksanaan pengambilan data Penelitian di PT. JOGJASOLO MARGA MAKMUR dalam rangka menyelesaikan tugas akhir studi jenjang Program Strata Satu (S1). Adapun data yang kami ingin peroleh sebagai berikut:

Nama : Abdillah Hans Samara
Nama Dosen Pembimbing :
Bidang Penelitian : K3
Nama Perusahaan : PT. JOGJASOLO MARGA MAKMUR
Nama Proyek : PEMBANGUNAN JALAN TOL SOLO – YOGYAKARTA
Lokasi Proyek : Kota Solo
Tanggal Rencana Mulai Penelitian : 8 Mei 2023
Recana Lama Penelitian : 2 Bulan
Deskripsi Pekerjaan Yang Dibutuhkan Untuk Penelitian : Pekerjaan Pier Head Jembatan

Wassalamu'alaikum wr. wb.

Yogyakarta, 28 April 2023

Mengetahui, An.Proyek	Dosen Pembimbing	Mahasiswa Pemohon
( )	IR. FITRI NUGHRAHENI, S.T., M.T., ph.D IPM	ABDILLAH HANS SAMARA

Gedung KH. Moh. Natsir Lt.1 Sayap Timur
Jl. Kaliurang Km 14,5 Yogyakarta
T. (0274) 898444 ext. 3235
F. (0274) 895330

APPENDICES 2 TIMELINE RESEARCH DATA.

Rencana Waktu Pelaksanaan Penelitian Skripsi
Proyek Pembangunan Tol Jogja – Solo Di PT MARGA MAKMUR
ABDILLAH HANS SAMARA (18511028)

mei 2023						
Senin	Selasa	Rabu	Kamis	Jumat	Sabtu	Minggu
1	2	3	4	5	6	7
Pengajuan Surat						
8	9	10	11	12	13	14
Pengambilan Data						
15	16	17	18	19	20	21
Pengambilan Data						
22	23	24	25	26	27	28
Pengambilan Data						
29	30	31	1	2	3	4
Pengambilan Data						

Juni 2023						
Senin	Selasa	Rabu	Kamis	Jumat	Sabtu	Minggu
5	6	7	8	9	10	11
Analisis dan Verifikasi Data						
12	13	14	15	16	17	18
Analisis dan Verifikasi Data						
19	20	21	22	23	24	25
Analisis dan Verifikasi Data						
26	27	28	29	30		
Hasil						

***Note*:**

a. Pengambilan data di lapangan dilakukan selama 20 hari kerja (4 minggu)
b. Analisis dan verifikasi data dilakukan selama 15 hari kerja (3 minggu)
c. Penelitian dimulai pada tanggal 13 Juni – 22 Juli 2022
d. Penelitian dapat diselesaikan sebelum batas waktu apabila data yang dibutuhkan telah mencukupi
e. Pengambilan data berupa observasi lapangan dan wawancara
f. Verifikasi data kepada *HSE Officer*

Data yang dibutuhkan:

a. Data profil proyek
b. Struktur organisasi proyek
c. Struktur organisasi K3
d. Data pelaksanaan SMKK
e. Data pendukung lainnya

APPENDICES 3 RESEARCH COMPLETION LETTER.

JASAMARGA
JOGJA SOLO

Nomor : 316/CB3-JMJ/OT/VII/2023 7 Juli 2023
Lampiran : -
Perihal : **Pelaksanaan Penelitian Pada Proyek Pembangunan Jalan Tol Solo – Yogyakarta – NYIA Kulon Progo Seksi 1 Paket 1.1**

Kepada Yth :
Sekretaris Prodi Teknik Sipil
Universitas Islam Indonesia
Di Tempat

Menindaklanjuti surat Sekretaris Prodi Teknik Sipil Universitas Islam Indonesia nomor : 32/Sek. Prodi/20/FTSP/III/2023 tanggal 14 Maret 2023 perihal Permohonan Izin Penelitian dan Pengambilan Data TA, dengan ini disampaikan bahwa :

Nama : Abdillah Hans Samara
NIM : 18511028

Mahasiswa tersebut telah melaksanakan penelitian pada Proyek Pembangunan Jalan Tol Solo – Yogyakarta - NYIA Kulonprogo Seksi 1 Paket 1.1 Ruas Solo – Klaten Sta 0+000 – Sta 22+300 yang diselesaikan pada tanggal 5 Juli 2023, dengan judul Tugas Akhir "Analysis Of Occupational Health and Safety (K3) Borepile Bridge Work Using HIRADC"

Demikian kami sampaikan, atas perhatiannya diucapkan terima kasih.

Pembangunan Jalan Tol
Solo – Yogyakarta – NYIA Kulon Progo

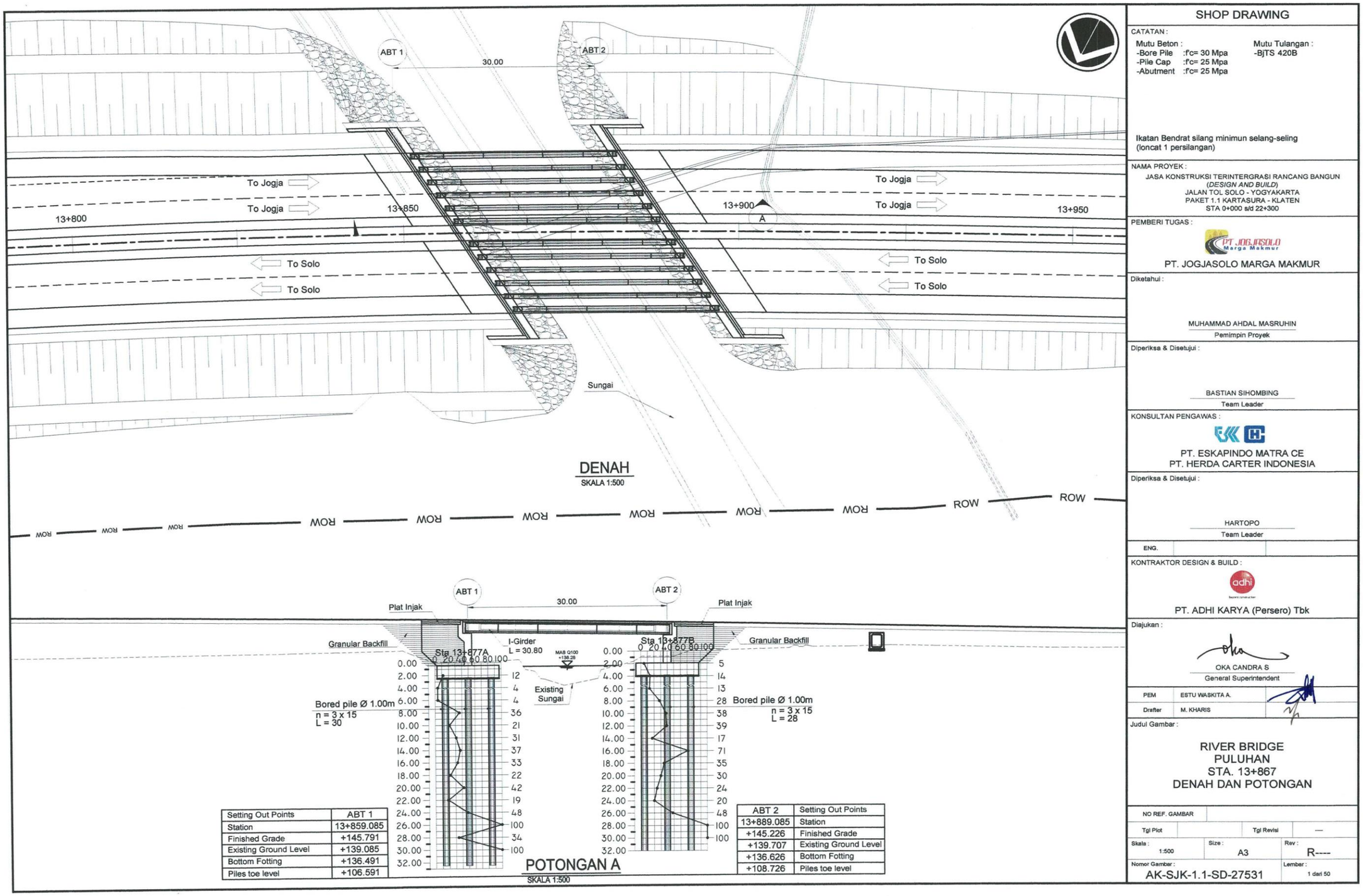
JASAMARGA
JOGJA SOLO

Muhammad Ahdal Masruhin
Pemimpin Proyek

Tembusan Yth.
1. Arsip
CTR/rzt

PT JASAMARGA JOGJA SOLO
Head Office, Jl. Ring Road Utara No. 98
Maguwoharjo, Depok, Sleman
Daerah Istimewa Yogyakarta 55282
Jogjasolo.mm@gmail.com
www.jsmm.co.id

APPENDICES 4 RESEARCH COMPLETION LETTER.



Setting Out Points	ABT 1
Station	13+859.085
Finished Grade	+145.791
Existing Ground Level	+139.085
Bottom Fotting	+136.491
Piles toe level	+106.591

ABT 2	Setting Out Points
13+889.085	Station
+145.226	Finished Grade
+139.707	Existing Ground Level
+136.626	Bottom Fotting
+108.726	Piles toe level

SHOP DRAWING

CATATAN :

Mutu Beton :
-Bore Pile :fc= 30 Mpa
-Pile Cap :fc= 25 Mpa
-Abutment :fc= 25 Mpa

Mutu Tulangan :
-BjTS 420B

Ikatan Bendrat silang minimun selang-seling
(loncat 1 persilangan)

NAMA PROYEK :
JASA KONSTRUKSI TERINTERGRASI RANCANG BANGUN
(*DESIGN AND BUILD*)
JALAN TOL SOLO - YOGYAKARTA
PAKET 1.1 KARTASURA - KLATEN
STA 0+000 s/d 22+300

PEMBERI TUGAS :
PT. JOGJASOLO MARGA MAKMUR

Diketahui :
MUHAMMAD AHDAL MASRUHIN
Pemimpin Proyek

Diperiksa & Disetujui :
BASTIAN SIHOMBING
Team Leader

KONSULTAN PENGAWAS :
PT. ESKAPINDO MATRA CE
PT. HERDA CARTER INDONESIA

Diperiksa & Disetujui :
HARTOPO
Team Leader

ENG.

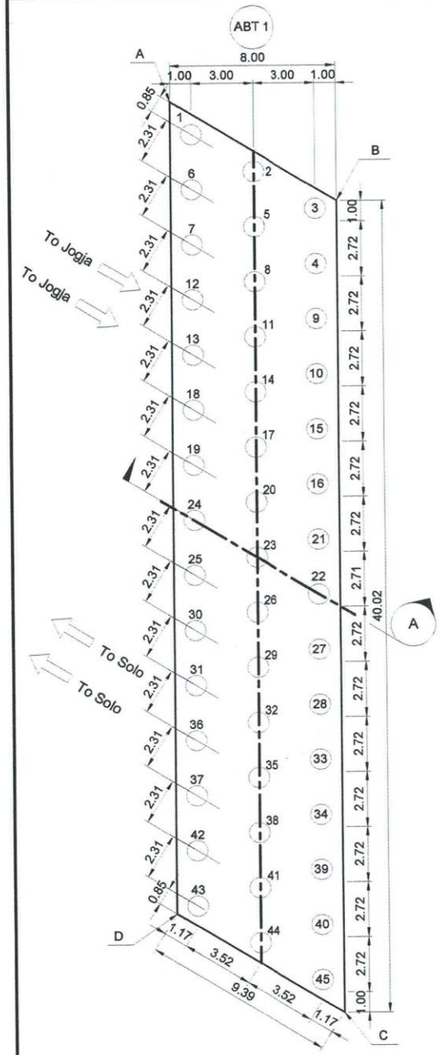
KONTRAKTOR DESIGN & BUILD :
PT. ADHI KARYA (Persero) Tbk

Diajukan :
OKA CANDRA S
General Superintendent

PEM	ESTU WASKITA A.	
Drafter	M. KHARIS	

Judul Gambar :
RIVER BRIDGE
PULUHAN
STA. 13+867
DENAH DAN POTONGAN

NO REF. GAMBAR			
Tgl Plot		Tgl Revisi	—
Skala : 1:500	Size : A3		Rev : R----
Nomor Gambar : AK-SJK-1.1-SD-27531			Lembar : 1 dari 50

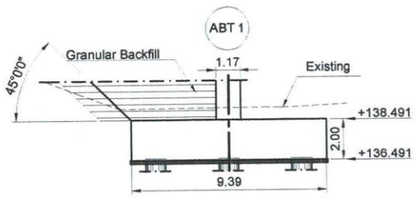


PONDASI A1

SKALA 1:250

KOORDINAT BORE PILE A1

NO	X	Y
1	462206.393	9155060.401
2	462203.248	9155058.816
3	462200.103	9155057.231
4	462197.792	9155058.658
5	462200.937	9155060.242
6	462204.082	9155061.827
7	462201.770	9155063.253
8	462198.626	9155061.668
9	462195.481	9155060.084
10	462193.170	9155061.510
11	462196.315	9155063.094
12	462199.459	9155064.679
13	462197.148	9155066.105
14	462194.003	9155064.521
15	462190.859	9155062.936
16	462188.548	9155064.362
17	462191.692	9155065.947
18	462194.837	9155067.531
19	462192.526	9155068.957
20	462189.381	9155067.373
21	462186.237	9155065.788
22	462183.930	9155067.211
23	462187.070	9155068.799
24	462190.215	9155070.384
25	462187.904	9155071.810
26	462184.759	9155070.225
27	462181.614	9155068.640
28	462179.303	9155070.066
29	462182.448	9155071.651
30	462185.592	9155073.236
31	462183.281	9155074.662
32	462180.137	9155073.077
33	462176.992	9155071.492
34	462174.681	9155072.918
35	462177.826	9155074.503
36	462180.970	9155076.088
37	462178.659	9155077.514
38	462175.514	9155075.929
39	462172.370	9155074.345
40	462170.059	9155075.771
41	462173.203	9155077.355
42	462176.348	9155078.940
43	462174.037	9155080.366
44	462170.892	9155078.782
45	462167.747	9155077.197

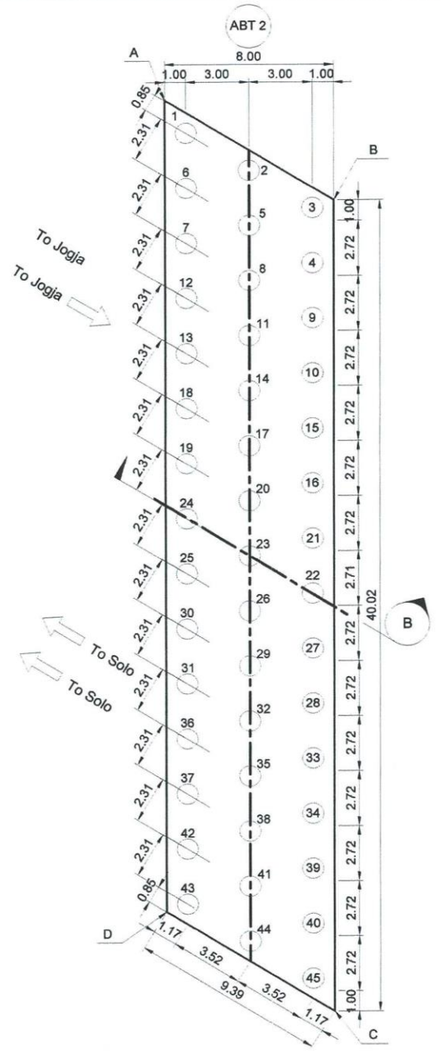


POTONGAN A

SKALA 1:250

KOORDINAT FOOTING A1

NOT	X	Y
A	462208.292	9155060.404
B	462199.906	9155056.178
C	462165.848	9155077.194
D	462174.234	9155081.420

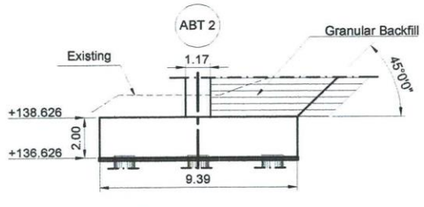


PONDASI A2

SKALA 1:250

KOORDINAT BORE PILE A2

NO	X	Y
1	462179.551	9155047.003
2	462176.406	9155045.418
3	462173.261	9155043.834
4	462170.950	9155045.260
5	462174.095	9155046.844
6	462177.239	9155048.429
7	462174.928	9155049.855
8	462171.784	9155048.270
9	462168.639	9155046.686
10	462166.328	9155048.112
11	462169.473	9155049.697
12	462172.617	9155051.281
13	462170.306	9155052.707
14	462167.161	9155051.123
15	462164.017	9155049.538
16	462161.706	9155050.964
17	462164.850	9155052.549
18	462167.995	9155054.133
19	462165.684	9155055.560
20	462162.539	9155053.975
21	462159.394	9155052.390
22	462157.083	9155053.816
23	462160.228	9155055.401
24	462163.373	9155056.986
25	462161.062	9155058.412
26	462157.917	9155056.827
27	462154.772	9155055.242
28	462152.461	9155056.668
29	462155.606	9155058.253
30	462158.750	9155059.838
31	462156.439	9155061.264
32	462153.295	9155059.679
33	462150.150	9155058.095
34	462147.839	9155059.521
35	462150.983	9155061.105
36	462154.128	9155062.690
37	462151.817	9155064.116
38	462148.672	9155062.531
39	462145.528	9155060.947
40	462143.216	9155062.373
41	462146.361	9155063.958
42	462149.506	9155065.542
43	462147.195	9155066.968
44	462144.050	9155065.384
45	462140.905	9155063.799



POTONGAN B

SKALA 1:250

KOORDINAT FOOTING A2

NOT	X	Y
A	462181.450	9155047.006
B	462173.064	9155042.780
C	462139.006	9155063.796
D	462147.392	9155068.022

SHOP DRAWING

CATATAN :

Mutu Beton :
-Bore Pile :f'c= 30 Mpa
-Pile Cap :f'c= 25 Mpa
-Abutment :f'c= 25 Mpa

Mutu Tulangan :
-BjTS 420B

Ikatan Bendrat silang minimun selang-seling
(loncat 1 persilangan)

NAMA PROYEK :
JASA KONSTRUKSI TERINTERGRASI RANCANG BANGUN
(*DESIGN AND BUILD*)
JALAN TOL SOLO - YOGYAKARTA
PAKET 1.1 KARTASURA - KLATEN
STA 0+000 s/d 22+300

PEMBERI TUGAS :
PT. JOGJASOLO MARGA MAKMUR

Diketahui :
MUHAMMAD AHDAL MASRUHIN
Pemimpin Proyek

Diperiksa & Disetujui :
BASTIAN SIHOMBING
Team Leader

KONSULTAN PENGAWAS :
PT. ESKAPINDO MATRA CE
PT. HERDA CARTER INDONESIA

Diperiksa & Disetujui :
HARTOPO
Team Leader

ENG.

KONTRAKTOR DESIGN & BUILD :
PT. ADHI KARYA (Persero) Tbk

Diajukan :
OKA CANDRA S
General Superintendent

PEM	ESTU WASKITA A.	
Drafter	M. KHARIS	

Judul Gambar :
RIVER BRIDGE
PULUHAN
STA. 13+867
PONDASI BORE PILE

NO REF. GAMBAR			
Tgl Plot		Tgl Revisi	—
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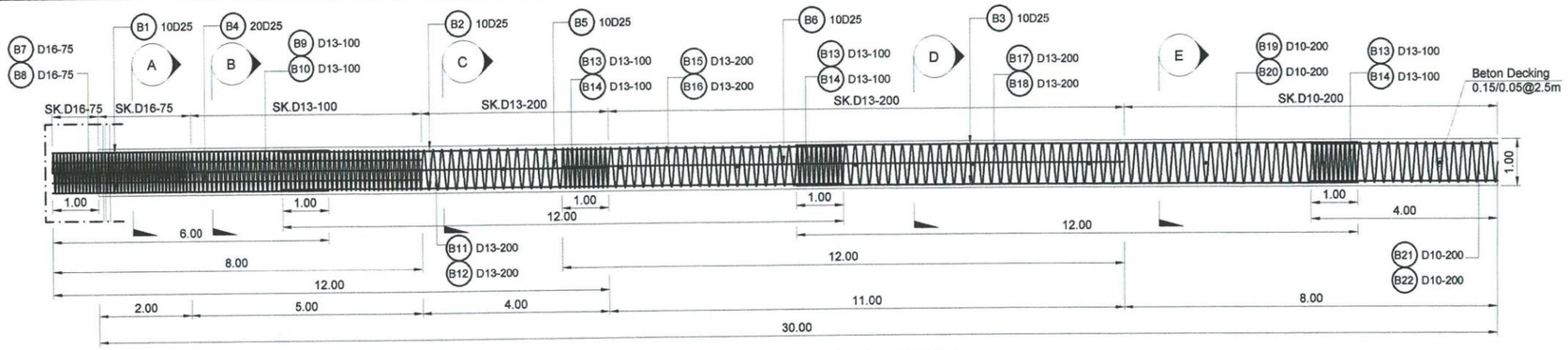
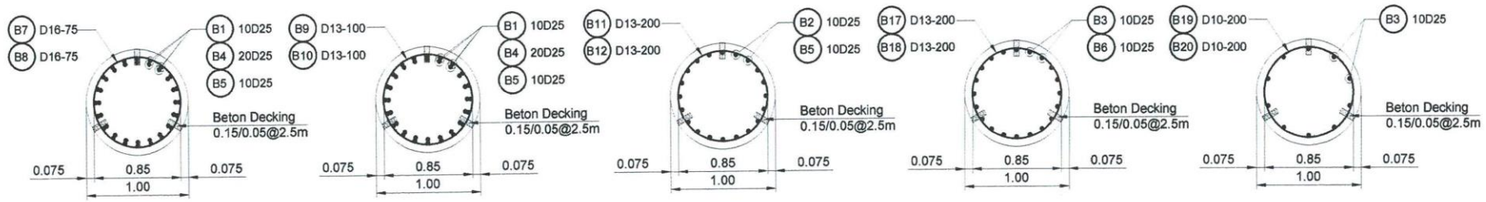
Nomor Gambar : AK-SJK-1.1-SD-27532		Lembar :	2 dari 50



POTONGAN BORE PILE A1

SKALA 1:100



POTONGAN A

SKALA 1:50

POTONGAN B

SKALA 1:50

POTONGAN C

SKALA 1:50

POTONGAN D

SKALA 1:50

POTONGAN E

SKALA 1:50

LOKASI	NO	BARMARK DIA	BARMARK NO	TOTAL NOS	GAMBAR SKET	PANJANG (M)	TOTAL PANJANG (M)	BERAT (KG/M)	TOT.BERAT (KG)
1	2	3	4	5	6	7 = FORM6	8 = (5 x 7)	9 = 3	10 = (8 x 9)
	1	25	B1	10	6.00	6.00	60.00	3.850	231.00
	2	25	B2	10	12.00	12.00	120.00	3.850	462.00
	3	25	B3	10	12.00 / 4.00	16.00	160.00	3.850	616.00
	4	25	B4	20	8.00	8.00	160.00	3.850	616.00
	5	25	B5	10	12.00	12.00	120.00	3.850	462.00
	6	25	B6	10	12.00	12.00	120.00	3.850	462.00

LOKASI	NO	BARMARK DIA	BARMARK NO	TOTAL NOS	GAMBAR SKET	PANJANG (M)	TOTAL PANJANG (M)	BERAT (KG/M)	TOT.BERAT (KG)
1	2	3	4	5	6	7 = FORM6	8 = (5 x 7)	9 = 3	10 = (8 x 9)
	7	16	B7	9	12.00	12.00	108.00	1.580	170.64
	8	16	B8	1	4.62	4.62	4.62	1.580	7.30
	9	13	B9	11	12.00	12.00	132.00	1.040	137.28
	10	13	B10	1	7.85	7.85	7.85	1.040	8.16
	11	13	B11	3	12.00	12.00	36.00	1.040	37.44
	12	13	B12	1	6.25	6.25	6.25	1.040	6.50

SHOP DRAWING

CATATAN :

Mutu Beton :
-Bore Pile :f'c= 30 Mpa
-Pile Cap :f'c= 25 Mpa
-Abutment :f'c= 25 Mpa

Mutu Tulangan :
-BjTS 420B

Ikatan Bendrat silang minimun selang-seling
(loncat 1 persilangan)

NAMA PROYEK :
JASA KONSTRUKSI TERINTERGRASI RANCANG BANGUN
(*DESIGN AND BUILD*)
JALAN TOL SOLO - YOGYAKARTA
PAKET 1.1 KARTASURA - KLATEN
STA 0+000 s/d 22+300

PEMBERI TUGAS :
PT. JOGJASOLO MARGA MAKMUR

Diketahui :
MUHAMMAD AHDAL MASRUHIN
Pemimpin Proyek

Diperiksa & Disetujui :
BASTIAN SIHOMBING
Team Leader

KONSULTAN PENGAWAS :
PT. ESKAPINDO MATRA CE
PT. HERDA CARTER INDONESIA

Diperiksa & Disetujui :
HARTOPO
Team Leader

ENG.

KONTRAKTOR DESIGN & BUILD :
PT. ADHI KARYA (Persero) Tbk

Diajukan :
OKA CANDRA S
General Superintendent

PEM	ESTU WASKITA A.	
Drafter	M. KHARIS	

Judul Gambar :
RIVER BRIDGE
PULUHAN
STA. 13+867
BORE PILE A1 (1-2)

NO REF. GAMBAR			
Tgl Plot		Tgl Revisi	—
Skala : 1:100 1:50	Size : A3	Rev :	R----
Nomor Gambar : AK-SJK-1.1-SD-27559		Lembar :	29 dari 50

APPENDICES 5 BOREPILE WORK PROCESS.

1. Preparation

Figure A-1.1 Setting the borepile Wash Boring

Figure A-1.2 Reinforcememt Steel Fabrication

2. Bore Pile Work

Figure A-1.3 *Initial Drilling Point*

Figure A-1.4 *Casing Installation at Ground Drilling Points*

Figure A-1.5 *Advance Drilling Process for Bore Foundation*

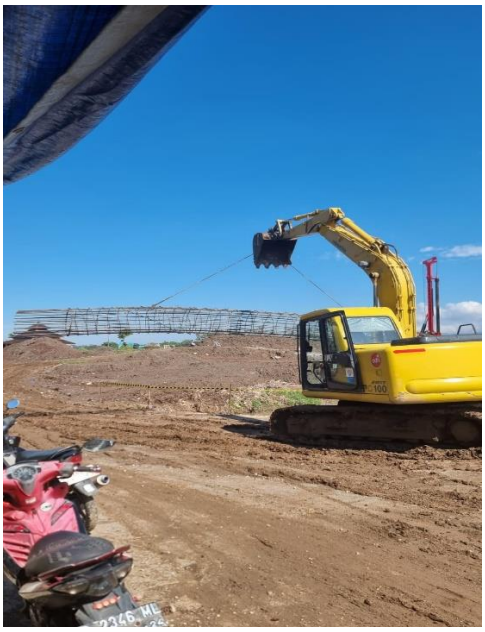


Figure A-1.7 *Transfer of reinforcement steel to hole location*

Figure A-1.8 *Installation of the Bore Pile Reinforcement to the Hole*

Figure A-1.8 Reinforcement Steel Connection

Figure A-1.9 *The Process of Installing the Tremie Pipe to the Hole*

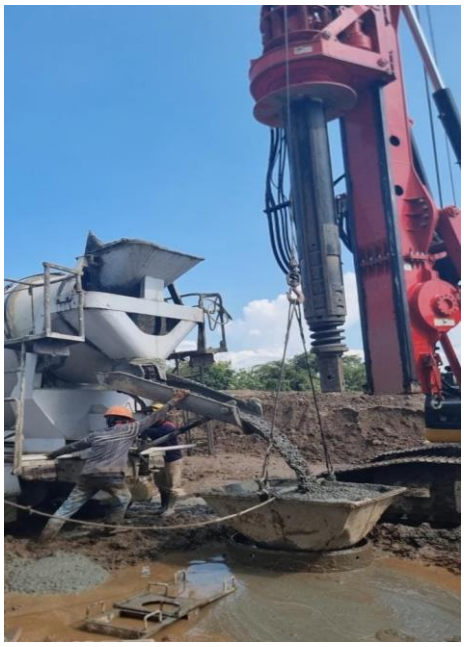


Figure A-1.10 *Bore Pile Foundation Casting Process*

APPENDICES 6 OBSERVATION RESULT

Table 5.2 Risk Assesment

No	Risk Description		
	Job Description / Workplace	Hazard Identification	Risk
1.	Equipment preparation and work tool settings	1. The heavy equipment needed is not feasible. 2. The bar cutter tool is not feasible 3. Bar bending tool is not feasible. 4. Lack of awareness of workers not fulfilling PPE. 5. Worker fatigue 6. Slippery work floor.	1. There was a fire (workers got sparks) 2. The worker's finger was cut by a cutter 3. Worker is hit by a bar bending tool 4. Sandwiched by reinforcing steel. 5. Workers experience dehydration and stress. 6. Worker slipped.
2.	Creation of drilling points	1. The point determination tool, namely the theodolite, is no longer feasible. 2. Exhausted workers.	1. The tool falls so that the worker is crushed. 2. Workersexperience dehydration and stress.
3.	Reinforcement fabrication	1) Welding tools are not feasible. 2) The bar cutter tool is not feasible. 3) Bar bending tool is not feasible. 4) Lack of awareness of workers not fulfilling PPE. 5) Worker fatigue. 6) The condition of the electric generator is damaged.	1. There was a fire (workers got sparks). 2. The worker's finger was cut by a cutter. 3. Worker is hit by a bar bending tool. 4. Sandwiched by reinforcing steel. 5. Workers experience dehydration and stress. Workers electrocuted or burned.

4.	Initial hole drilling	1) Incompetent operator. 2) The condition of the drilling machine is not feasible. 3) Unstable ground area. 4) Locations prone to natural disasters 5) Lack of awareness of work safety. 6) There are no K3 signs.	1) The drill machine overturned and was damaged. 2) Halts work and overrides workers. 3) Slippage in the hole and difficulty accessing heavy equipment. 4) Landslides and floods. Occupational accidents such as (crushed, fallen and ejected).
5.	Casing installation	1. Incompetent operator. 2. The condition of the alternating wire is not feasible. 3. Improper condition of equipment. 4. Worker fatigue. 5. Lack of awareness of workers not fulfilling PPE. 6. Conditions in the work area are not feasible.	1. The drilling machine is out of control and out of balance. 2. Cables alternately break and fall on workers. 3. The seal broke and fell on the worker 4. Workers experience dehydration and stress. 5. Work accidents are crushed, fallen and bounced. 6. Heavy equipment overturns, workers are exposed to waste and drill waste pollutes the environment.
6.	Advanced drilling	1) Incompetent operator. 2) The condition of the drilling machine is not feasible. 3) Unstable ground area 4) Locations prone to natural disasters 5) There are no K3 signs.	1. The drill machine overturned and was damaged. 2. Halts work and overrides workers. 3. Slippage in the hole and difficulty accessing heavy equipment. 4. Landslides and floods. 5. Occupational accidents such as (crushed, fallen and ejected).

7.	Transfer of reinforcement to hole location	1. Heavy excavator and drilling equipment were damaged. 2. Intermittent wire is not feasible. 3. Welding on reinforcing steel does not meet the standards. 4. Operator fatigue. 5. Worker fatigue. 6. Inadequate field conditions (there is a lot of waste).	1. The machine is out of control and off balance. 2. The wire broke so that the iron fell and hit the workers. 3. The results of the welding were damaged so that the iron fell and hit the workers. 4. Machine out of control / under control. 5. Dehydrated workers, stressed, sick. 6. Heavy equipment collapsed and overturned.
8.	Installing reinforcement to in the borepile hole	1. Heavy excavator and drilling equipment were damaged. 2. Intermittent wire is not feasible. 3. Welding on reinforcing steel does not meet the standards 4. Operator fatigue. 5. Worker fatigue. 6. Inadequate field conditions (there is a lot of waste)	1. The machine is out of control and off balance. 2. The wire broke so that the iron fell and hit the workers. 3. The results of the welding were damaged so that the iron fell and hit the workers. 4. Machine out of control / under control. 5. Dehydrated workers, stressed, sick. 6. Heavy equipment collapsed and overturned.
9.	Reinforment connection	1. Welding machine is not feasible. 2. Welders do not have certificates or are not competent. 3. Worker fatigue. 4. There are no safeguards for flammable equipment. 5. Unsuitable field conditions contained a lot of waste.	1. There was a fire (workers got sparks). 2. The results of the welding were not good so that the reinforcing steel was damaged and it hit the workers. 3. Dehydration, stress and pain. 4. Burned and there was an explosion in the gas cylinder. 5. Workers stuck in mud.

10	Tremie pipe installation	1. Workers lack awareness to fulfill PPE. 2. intermittent wire is not feasible. 3. Operator fatigue. 4. Worker fatigue. 5. Improper tremie pipe conditions. 6. Field conditions are not feasible there is a lot of waste.	1. Work accidents are crushed, fallen and bounced. 2. The pipe fell so that it hit the worker. 3. Uncontrolled and uncontrolled units. 4. Dehydrated, stressed and sick workers. 5. The pipe comes off and falls into the hole. 6. The workers got stuck in the mud and the heavy equipment collapsed.
11	Borepile casting	1. The access condition of the mixer truck is not feasible. 2. Lack of awareness of workers to fulfill PPE. 3. Intermittent wire is not feasible. 4. condition of the concreed bucket is not feasible. 5. Worker fatigue. Operator fatigue	1. The truck collapsed, overturned and spilled concrete polluting the environment. 2. Worker hit by splashed concrete. 3. The tremie pipe broke and fell on the worker. 4. A casting failure occurs and it can befall the workers. 5. Dehydration, stress and pain. 6. The machine is out of control and out of control.

APPENDICES 7 HIRADC TABLE VERIFICATION.

Do the verification Risk level asesstment with Mr. Aulia Rahmat **as a subcontractor PT. Adhi Karya for borepile work**

Do the verification of Determaining Control with Mr. Dodik Hadi P As HSE Officer P.T Adhi Karya

ATTACHEMNT 8 RISK LEVEL SCORE RESULTS OF TABLE HIRADC BORE PILE TOLL SOLO JOGJA TOLL ROAD.

No	RISK DESCRIPTION			LEGAL REQUIREMENTS	RISK LEVEL ASSESSMENT				DETERMAINING CONTROL 1. Elimination 2. Substitution 3. Technical Engineering 4. Administrative 5. Personal protective equipment	ASSESSMENT OF LEVEL OF RELIEF RISK			
	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL			F	S	RL	
1.	Equipment preparation and Setting tools	1) The heavy equipment needed is not feasible.	1) There was a fire (workers got sparks)	1) Law No. 1 of 1970, concerning Work Safety, Article 3. 2) Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 42. 3) Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 4. 4) Permenakertrans No. 8 of 2020, concerning OHS of Lifting and Transport Aircraft, Article 42.	2	4	8	M	ADM : Preparation of fire extinguishers and Make sure workers must use PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	2	4	S
		2) The bar cutter tool is not feasible	2) The worker's finger was cut by a cutter		3	5	15	H	ADM : Always check the condition of work tools such as cutters before starting work PPE : Require workers to wear construction gloves.	2	4	8	M
		3) Bar bending tool is not feasible.	3) Worker is hit by a bar bending tool		4	5	20	H	TE : Always check that the bar bending tool is in a condition suitable for use. PPE :(vest, helmet, glove hands, shoes)	2	3	6	M
		4) Lack of awareness of workers not fulfilling PPE.	4) Sandwiched by reinforcing steel.		4	2	8	M	TE : ensure that operators are competent and certified in operating related work equipment ADM : Provide food and drink distribution so that workers can focus on work.	1	4	4	S
		5) Worker fatigue.	5) Workers experience dehydration and stress.		3	4	12	M	TE : Ensure workers are in good health by carrying out physical checks before work.	2	1	2	S

No	RISK DESCRIPTION			LEGAL REQUIREMENTS	RISK LEVEL ASSESSMENT				DETERMAINING CONTROL 1. Elimination 2. Substitution 3. Technical Engineering 4. Administrative 5. Personal protective equipment	ASSESSMENT OF LEVEL OF RELIEF RISK			
	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL			F	S	RL	
2.	Creation of drilling points	1) The point determination tool, namely the theodolite, is no longer feasible.	1) The tool falls so that the worker is crushed.	1) Law No. 1 of 1970, concerning Work Safety, Article 3. 2) Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 42. 3) Law No. 1 of 1970, concerning Work Safety, Article 3. 4) Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 42.	2	3	6	M	TE : 1. Ensure that operators are competent and certified in operating related work tools and 2.always check the condition of work tools such as theodolites and spirit levels PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	1	2	2	S
		2) Exhausted workers.	2) Workers experience dehydration and stress.		2	4	8	M	TE :Ensure workers are fit by carrying out health checks once a week ADM : providing consumption such as food and drinks.	1	3	3	S

No	RISK DESCRIPTION			LEGAL REQUIREMENTS	RISK LEVEL ASSESSMENT				DETERMAINING CONTROL 1. Elimination 2. Substitution 3. Technical Engineering 4. Administrative 5. Personal protective equipment	ASSESSMENT OF LEVEL OF RELIEF RISK			
	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL			F	S	RL	
3.	Reinforcement fabrication	1) Welding tools are not feasible.	1) There was a fire (workers got sparks).	1) Law No. 1 of 1970, concerning Work Safety, Article 3. 2) Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 52. 3) Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 3 and Article 4.	4	4	16	M	TE : Always check that the welding tool besfore is in a condition suitable for use. ADM: Preparation of fire extinguishers PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	2	4	S
		2) The bar cutter tool is not feasible.	2) The worker's finger was cut by a cutter.		3	5	15	H	TE : Always check the condition of work tools such as cutters before starting work. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	3	6	M
		3) Bar bending tool is not feasible.	3) Worker is hit by a bar bending tool.		3	4	12	H	TE : Always check that the bar bending tool is in a condition suitable for use. PPE :(vest, helmet, glove hands, shoes)	2	2	4	S
		4) Lack of awareness of workers not fulfilling PPE.	4) Sandwiched by reinforcing steel.		4	2	8	M	TE : ensure that operators are competent and certified in operating related work equipment ADM : Provide food and drink distribution so that workers can focus on work.	1	4	4	S
		5) Worker fatigue.	5) Workers experience dehydration and stress.		3	4	12	M	TE : Ensure workers are in good health by carrying out physical checks before work..	1	3	3	S
		6) The condition of the electric generator is damaged.	6) Workers electrocuted		3	5	15	M	TE : Always check the generator condition before get it wokrs PPE : Require workers to use PPE such as rubber construction gloves.	2	3	6	M

No	RISK DESCRIPTION			LEGAL REQUIREMENTS	RISK LEVEL ASSESSMENT				DETERMAINING CONTROL 1. Elimination 2. Substitution 3. Technical Engineering 4. Administrative 5. Personal protective equipment	ASSESSMENT OF LEVEL OF RELIEF RISK			
	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL			F	S	RL	
4.	Initial hole drilling	1) Incompetent operator.	1) The drill machine overturned and was damaged.	1) Law No. 1 of 1970, concerning Work Safety, Article 3. 2) Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 9 and Article 67. 3) Permenakertrans No.8 of 2020 concerning OHS of Lifting and Transport Aircraft, Articles 17,35,68 and 140.	3	4	12	M	SUBS : make sure the operator is certified for the work item related, ADM : the installation of sign "beware of maneuvering heavy equipment", install the light/signal on the back of the tool. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes).	2	2	4	S
		2) The condition of the drilling machine is not feasible.	2) Halts work and overrides workers.		4	5	20	H	TE : Always check the condition of work tools such as cutters before starting work. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes).	2	4	8	M
		3) Unstable ground area.	3) Slippage in the hole and difficulty accessing heavy equipment.		3	5	15	H	TE : Pay attention to soil condition.	2	3	6	M
		4) Lack of awareness of work safety.	4) Landslides and floods.		4	5	20	H	SUBS : make sure the operator is certified for the work item related, PPE : Make sure workers must use PPE such as (vest, helmet, glove hands, shoes)	2	4	8	M
		5) There are no K3 signs.	5) Occupational accidents such as (crushed, fallen and ejected).		4	4	16	H	ADM : take action precautions such as installing safety signs, safety line installation	2	4	8	M

No	RISK DESCRIPTION			LEGAL REQUIREMENTS	RISK LEVEL ASSESSMENT				DETERMAINING CONTROL 1. Elimination 2. Substitution 3. Technical Engineering 4. Administrative 5. Personal protective equipment	ASSESSMENT OF LEVEL OF RELIEF RISK			
	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL			F	S	RL	
5.	Casing intallation	1) Incompetent operator.	1) The drilling machine is out of control and out of balance.	1. Law No. 1 of 1970, concerning Work Safety, Article 3. 2. Permenakertrans No.PER.08/MEN/VII/2010, Article 3 and Article 4 concerning PPE. 3. Permenakertrans No. 8 of 2020 concerning OHS of Lifting and Transport Aircraft, Article 17,20,35,68.	3	4	12	M	SUBS : make sure the operator is certified for the work item related, ADM : the installation of sign "beware of maneuvering heavy equipment", install the light/signal on the back of the tool. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes).	2	2	4	S
		2) The condition of the alternating wire is not feasible.	2) Cables alternately break and fall on workers.		3	5	15	H	TE : Always check the condition of work tools such as cabels before starting work. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	3	6	M
		3) Improper condition of equipment.	3) Workers experience dehydration and stress.		3	4	12	M	TE : 1.ensure that the operator is certified for work items related to installing "watch out for heavy equipment maneuvering" signs, 2. installing lights/signals on the back of the equipment.	2	2	4	S
		4) Lack of awareness of workers not fulfilling PPE.	4) Work accidents are crushed, fallen and bounced.		3	5	15	H	TE : Make sure operators and technicians are workers certified for related work items, installation safety line, PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	3	6	M
		5) Conditions in the work area are not feasible.	5) Heavy equipment overturns, workers are exposed to waste and drill waste pollutes the environment.		3	4	12	M	TE : Always clean the work area, pay attention to soil conditions and install signs "watch out for heavy equipment maneuvers", ADM : install lights/signals at the back of the heavy equipment. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	1	3	3	S

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	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL			F	S	RL	
6.	Advance Drilling	1) Incompetent operator.	1) The drill machine overturned and was damaged.	4) Law No. 1 of 1970, concerning Work Safety, Article 3. 5) Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 9 and Article 67. 1) Permenakertrans No.8 of 2020 concerning OHS of Lifting and Transport Aircraft, Articles 17,35,68 and 140.	3	4	12	M	SUBS : make sure the operator is certified for the work item related, ADM : the installation of sign "beware of maneuvering heavy equipment", install the light/signal on the back of the tool. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes).	2	2	4	S
		2) The condition of the drilling machine is not feasible.	2) Halts work and overrides workers.		4	5	20	H	TE : Always check the condition of work tools such as cutters before starting work. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes).	2	4	8	M
		3) Unstable ground area.	3) Slippage in the hole and difficulty accessing heavy equipment.		3	5	15	H	TE : Pay attention to soil condition.	2	3	6	M
		4) Lack of awareness of work safety.	4) Landslides and floods.		4	5	20	H	SUBS : make sure the operator is certified for the work item related, PPE : Make sure workers must use PPE such as (vest, helmet, glove hands, shoes)	2	4	8	M
		5) There are no K3 signs.	5) Occupational accidents such as (crushed, fallen and ejected).		4	4	16	H	ADM : take action precautions such as installing safety signs, safety line installation	2	4	8	M

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7.	Transfer of reinforcement To hole location	1) Heavy excavator and drilling equipment were damaged.	1) The machine is out of control and off balance.	1. Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 4. 2. Permenakertrans No. 8 of 2020, concerning OHS of Lifting and Transport Aircraft, Article 42.	3	5	15	H	TE : Always check the condition of heavy work tools such as excavators before starting work and make sure the operator is certified for the work item related, ADM : installation of signs "beware of maneuvering heavy equipment", install the light/signal.	2	3	6	M
		2) Intermittent sling wire is not feasible.	2) The sling wire broke so that the steel fell and hit the workers.		4	5	15	H	TE : Always check the condition of work tools such as cutters before starting work. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	4	8	M
		3) Welding on reinforcing steel does not meet the standards.	3) The results of the welding were damaged so that the iron fell and hit the workers.		4	5	20	H	TE : Always check the condition of workers' tools such as welding machines before working. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	3	6	M
		4) Operator fatigue.	4) Machine out of control / under control.		3	4	12	M	SUBS : ensure that operators are competent and certified in operating related work tools. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	1	3	3	S
		5) Worker fatigue.	5) Dehydrated workers, stressed, sick.		3	4	12	M	ADM : Providing contributions such as food and drinks so that workers can focus on work. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	1	2	2	S

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8.	Installing reinforcement toin the borepile hole	1) Heavy excavator and drilling equipment were damaged.	1) The machine is out of control and off balance.	1. Law No. 1 of 1970, concerning Work Safety, Article 3. 2. Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 3 and Article 4. 3. Permenakertrans No.8 of 2020 concerning K3 Lifting and Transporting Aircraft, Articles 17, 35, 68, 140.	2	5	10	M	TE : Check the condition of suitability of heavy equipment such as drilling rigs ADM : provide them with iron plate bases when operating. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	1	3	3	S
		2) Intermittent wire is not feasible.	2) The wire broke so that the iron fell and hit the workers.		3	5	15	H	TE : Check the condition of the iron cables before work is carried PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)out.	1	4	4	M
		3) Operator fatigue.	3) Machine out of control / under control.		3	4	12	M	SUBS : ensure that operators are competent and certified in operating related work tools. ADM : Providing contributions such as food and drinks so that workers can focus on work PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	1	3	3	S
		4) Worker fatigue.	4) Dehydrated workers, stressed, sick.		3	4	12	M	ADM : Providing contributions such as food and drinks so that workers can focus on work.	1	3	3	S
		5) Inadequate field conditions (there is a lot of waste)	5) Heavy equipment collapsed and overturned.		3	4	12	H	TE : Always clean the worker's area and provide a metal plate base when working	2	2	4	S

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	JOB DESCRIPTION /WORKPLACE	HAZARD IDENTIFICATION	RISK		F	S	RL			F	S	RL	
9.	Reinforcement connection	1) Welding machine is not feasible.	1) There was a fire (workers got sparks).	1) Law No. 1 of 1970, concerning Work Safety, Article 3. 2) Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 3 and Article 4. 3) Permenakertrans No.8 of 2020 concerning K3 Lifting and Transporting Aircraft, Articles 17, 20, 35, 68, 140.	3	5	15	H	TE : Check the condition of the welding machine PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	3	6	M
		2) Welders do not have certificates or are not competent.	2) The results of the welding were not good so that the reinforcing steel was damaged and it hit the workers.		4	5	20	H	SUBS : ensure that operators are competent and certified in operating the related work tools. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	3	3	9	M
		3) Worker fatigue.	3) Dehydration, stress and pain.		3	4	12	M	ADM : Providing contributions such as food and drinks so that workers can focus on work.	1	3	3	S
		4) There are no safeguards for flammable equipment.	4) Burned and there was an explosion in the gas cylinder.		4	5	20	H	ADM : Preparation of fire extinguishers TE : installation of signs "beware of explosion". PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	4	8	M
		5) Welding machine is not feasible.	5) There was a fire (workers got sparks).		2	4	12	M	TE : Check the condition of the welding machine and ensure that PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	1	3	4	S

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10	Tremie pipe installation	1) Workers lack awareness to fulfill PPE.	1) Work accidents are crushed, fallen and bounced.	1) Law No. 1 of 1970, concerning Work Safety, Article 3. 2) Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 3 and Article 4. 3) Permenakertrans No.8 of 2020 concerning OHS of Lifting and Transport Aircraft, Article 17,35,68,140.	4	5	20	H	TE : Always clean the worker's area and provide a metal plate base when working PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	3	6	M
		2) intermittent wire is not feasible.	2) The pipe fell so that it hit the worker.		4	4	16	H	TE : Check the condition of the iron cables before work is carried out. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	3	3	9	M
		3) Worker fatigue.	3) Dehydrated, stressed and sick workers.		3	4	12	M	ADM : Providing contributions such as food and drinks so that workers can focus on work.	1	3	3	S
		4) Improper tremie pipe conditions.	4) The pipe comes off and falls into the hole.		3	4	12	M	TE : Check the appropriate condition of the tremie pipe before installing it. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	2	4	S

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11.	Casting process	1) The access condition of the mixer truck is not feasible.	1) The truck collapsed, overturned and spilled concrete polluting the environment.	1. Law No. 1 of 1970, concerning Work Safety, Article 3. 2. Permenakertrans No.PER.01/MEN/1980 concerning K3 in Building Construction, Article 73. 3. Permenakertrans No.PER.08/MEN/VII/2010 concerning PPE, Article 3 and Article 4. 4. Permenakertrans No.8 of 2020 concerning K3 Lifting and Transporting Aircraft, Articles 17, 35, 68, 140.	4	4	16	H	TE : Determine the size of the mixer truck according to field conditions ADM : provide an iron plate base when working.	2	3	6	M
		2) Lack of awareness of workers to fulfill PPE.	2) Worker hit by splashed concrete.		3	5	15	H	ADM : provide an iron plate base when working. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	4	8	M
		3) Intermittent wire is not feasible.	3) The tremie pipe broke and fell on the worker.		4	5	20	H	TE : Check the condition of the iron cables before work is carried out. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	3	6	M
		4) condition of the concreed bucket is not feasible.	4) A casting failure occurs and it can befall the workers.		4	5	20	H	TE : Always clean the work area and provide it with an iron plate when carrying out the work. PPE : workers must use PPE such as (vest, helmet, gloves hands, shoes)	2	4	8	M
		5) Operator fatigue	5) The machine is out of control and out of control.		3	4	12	M	SUBS : ensure that operators are competent and certified in operating related work equipment ADMN : provide distribution of food and drinks so that workers can focus on work.	1	3	3	S