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Research Paper

Construction Safety in Girder Installation Work on Cibitung – Cilincing Toll Road Construction Project

Carissa Komalasari[1]*, Halimah Tunafiah[1], Ricky Kusmawan Natadipura[1], Arman Jayady[1], Rahman Danil[1], Tri Ismawanto[1], Reynaldo Pratama[1]
[1] Universitas Persada Indonesia Y.A.I, Indonesia

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Abstract

Toll road development, in its implementation, has a relatively high risk of work accidents, and it cannot be denied that work safety management is still weak and there is a lack of awareness about the magnitude of the risks that threaten workers. Girder erection work is included in high-risk work. The method used is HIRADC, according to PUPR Ministerial regulation No. 10 of 2021 concerning SMKK guidelines. This study aims to identify hazards, make risk level assessments, and make risk control efforts that can reduce the risk level of work accidents in girder installation work at the Cibitung – Cilincing Toll Road Construction Project. The limitation of the problem is that the research location only focuses on Section 4 of Sta 33+150, the Cibitung – Cilincing Toll Road Construction Project on the P2 – P3 JU Cakung Drain Pillar Span with the girder installation process using a Gantry Launcher.

This study uses a qualitative research approach with a descriptive form to determine the possibility and the consequences that will occur, as well as control the hazard to reduce the possibility and severity. In this study, there are 2 data collection techniques: Primary Data (Observation, Interviews were conducted with 3 sources, K3 Experts, and a Questionnaire was conducted related to risk assessment of the likelihood and severity values) and Secondary Data. This research's novelty lies in using tools during the girder lifting process because the girder length is 50.8 m, and the danger factors are different.

The questionnaire data collected found that implementation of the girder installation work identified 52 hazards, with a large level of risk are 20 hazards (38.46%) and medium risk levels are 32 hazards (61.54%). Control efforts by means of engineering, administration and personal protective equipment (PPE) found a decrease in the level of high risk and the level of moderate risk is no longer found, and the level of small risk becomes as many as 52 hazards (100%). So, it can be concluded that the results of the risk level assessment have been better than before.

Keywords *Girder Installation, Risk, HIRADC*

INTRODUCTION

The development of road transportation facilities, especially toll roads such as the Cibitung–Cilincing, toll roads is very important for the progress of regions in Indonesia. It helps overcome congestion, supports economic development, and provides an efficient alternative to large-capacity vehicles between Cibitung and Tanjung Priok Port to reduce congestion in Bekasi and Jakarta.

The construction of toll roads consists of lower and upper structures that work with a high risk of work accidents, but the management of work safety is still weak, and there is a lack of awareness about the magnitude of the risks that threaten workers. Each method of work in a construction project has a risk of hazards that cannot be eliminated but can be estimated and controlled. Projects with high mobility have a risk of hazards that can cause work accidents, traffic jams, and decreased productivity. To reduce such risks, it is necessary to identify potential causes of danger and assess the level of risk in order to make appropriate controls.

Corresponding author's email: carissakomalasari.ck@gmail.com

The HIRADC (Hazard Identification, Risk Assessment, and Determining control) method is used in occupational health and safety management systems to prevent and control hazards. The results of HIRADC are used as the basis for K3 goals and plans, including efforts to achieve zero accidents within the company.

Girder installation work is a high-risk job. Accidents occurred from 2017-2021 such as:

1. The girder fell during bracing on the Pasuruan Probolinggo STA 4+556 Toll Project Overpass (PT. Waskita Karya)
2. The crawler crane sling rope was cut at the Caringin Overpass Bocimi STA 6+735 Toll Project Bogor – Ciawi – Sukabumi toll road (PT. Waskita Karya)
3. Bearing pad position error in Pemalang - Batang Toll Project Overpass (PT. Waskita Karya);
4. Jack Hidrolik experienced a failure in the Ciput Bridge Project rapinggan STA 206+950 Banjar – Pangandaran toll road (PT. Wijaya Karya)
5. Heavy Equipment suffered a collision at the Depok – Antasari Toll Road Project (PT. Citra Wasphutowa)
6. The loading exceeds the capacity so that the girders fall on the toll road Cibitung – Cilincing

Research on the causes of risk and prevention of accident risks in the Cibitung – Cilincing Toll Road project is carried out using the HIRADC method so that it can meet the criteria for high-risk types based on Regulation No. 10 of 2021 concerning SMKK Guidelines (Ministry of Public Works and Public Housing, 2021).

Problem Statement

Based on the description above, several questions arise, including:

1. What are the hazard identifications in girder installation work at the Cibitung – Cilincing) Toll Road Construction Project?
2. How is the risk level assessed in girder installation work at the Cibitung – Cilincing) Toll Road Construction Project?
3. How are risk control efforts to reduce the risk level of work accidents in girder installation work at the Cibitung – Cilincing) Toll Road Construction Project?

Research Objectives

The objectives of this study are as follows:

1. Identifying hazards in girder installation work
2. Conduct a risk level assessment on girder installation work
3. Make risk control efforts that can reduce the level of work accident risk in girder installation work at the Cibitung – Cilincing Toll Road Construction Project.

LITERATURE REVIEW

Construction Safety Management System (SMKK)

According to PUPR Ministerial Regulation No. 10 of 2021, the Construction Safety Management System (SMKK) is part of the management system to ensure the implementation of construction safety, namely the fulfilment of safety, security, health and sustainability standards that ensure the safety and health of labour, safety in construction engineering, society and the environment (Ministry of Public Works and Public Housing, 2021).

Work Accidents

According to Tarwaka (2016), work accidents are unexpected and often unexpected events that cause losses of time, property, and casualties during the industrial work process, while according to Suma'mur (1996), work accidents are unexpected and unwanted events and in the event there is no element of intentional and unplanned.

Hazard

Department of Occupational Safety and Health Malaysia (2008, p. 5) says danger is a source or situation that is dangerous and has the potential for accidents to occur, causing disease in humans, damage to equipment and even the environment, whereas according to Ramli et al. (2010), , danger is an action or situation that has the possibility of causing damage, accidents or injuries to humans, and other disturbances.

Risk

According to AS/NZS 4360 (1999), risk is the probability of something happening that has an impact and is measured by the law of cause and effect. According to Ramli et al. (2010), risk is a combination of probability and severity in an event. The greater the chance of an event occurring, the greater the impact caused, so the event is considered high risk.

HIRADC

HIRADC is a key element in the K3 management system to prevent and control hazards (OHSAS 18001, 2007). HIRADC is a system for managing hazard risk consisting of 3 stages, namely hazard identification, risk assessment, and determining control.

Hazard Identification

According to Ramli et al. (2010), hazard identification is a way to systematically determine the existence of hazards in organizational activities. Risk identification is an initial action in preventing accidents and controlling risks. According to the Department of Occupational Safety and Health, risk identification aims to determine the potential hazards that exist from a device, material, or system.

Risk Assessment

According to AS/NZS 4360 (1999), risk analysis aims to separate small and main risks. Risk assessment is measured from 2 factors, namely the level of frequency/likelihood and severity on a scale of 1 to 5. Frequency indicates how likely the accident is to occur, while severity indicates how severe the result of the accident is. The result of the multiplication value between frequency and severity is used as a determinant of the risk level.

Hazard Control (Determining Control)

The level of hierarchy of risk control is divided into 5, which are as follows:

a. Elimination
   The top level is to eliminate the risk of danger by not employing humans at all stages of work.
b. Substitution
   Substitution is the replacement of work processes or work stages, equipment or materials with a high level of danger to be lower or less dangerous.
c. Engineering Control
   Engineering aims to ensure construction safety by making control efforts on equipment, materials or work sites by separating potential hazards from workers.
d. Administrative (Administrative Control)
   Administrative control is control over work permits, procedures and increasing the ability

of workers who are expected to have the ability / expertise to complete work properly and safely.

e. PPE
The use of personal protective equipment is useful to minimize the risk of hazards at work.

Erection Girder

Erection is the stage of installing girder beams to the top of the pedestal, namely the elastomeric bearing pad. According to Fadhilah et al. (2011), a girder is a bridge structure that supports the weight of the building above it, namely the floor plate and connects two supports (pier or abutment) on the bridge.

Launcher Gantry

According to Kristijanto et al. (2007), Gantry Launcher is a special lifting device that serves to install precast girders in bridge construction. The girder is lifted and then launched using a trolley that moves over the longitudinal rail to the intended position then the girder beam is carried by the gantry launcher transversely onto the bearing pad to be laid.

PC – I Girder

PC – I girder is a bridge girder in the form of a cross-section I with a cross-section of the edge larger than the middle and, per unit, has a relatively lighter weight.

Methods of Implementation of Girder Installation Work

a. Preparatory Work
   1. Preparing for traffic management and safety
   2. Equipment mobilization
   3. Material mobilization
   4. Mobilization of workers
   5. Preparing the work area/land

b. Gantry Launcher Tool Mobilization Work
   1. Gantry Launcher tool mobilization work
   2. Gantry Launcher tool drop work
   3. Gantry Launcher tool setting work

c. Girder Mobilization Work
   1. Girder mobilization work
   2. Girder lowering work

d. Work Stressing Girder

e. Girder Installation Work
   1. Girder lifting using a gantry portal
   2. Launching girder with trolley
   3. Erection girder
   4. Girder drop on bearing pad

f. Bracing Iron Installation Work

g. Gantry Launcher Tool Demobilization Work
   1. Gantry Launcher tool disassembly work
   2. Gantry Launcher tool lifting work
   3. Gantry Launcher tool mobilization work

RESEARCH METHOD

This study uses a qualitative research approach with a descriptive form to determine the possibility, the consequences that will occur, and control of the hazard as a measure to reduce the possibility and severity. In this study, there are 2 data collection techniques, namely:

Primary Data

Observation

Direct observation of the implementation and application of work safety when installing girders on the P2 – P3 JU Cakung Drain Pillar Span on Section 4 Sta 33+150 Cibitung – Cilincing Toll Road Project.

Interview

Interviews were conducted with 3 sources (Construction K3 Experts, Site Engineering Manager, and Site Operational Manager.

Questionnaire

A questionnaire was conducted related to risk assessment of the likelihood and severity values

Secondary Data

- PUPR Minister Regulation No. 10 of 2021 concerning SMKK guidelines (Ministry of Public Works and Public Housing, 2021),
- Literature study on K3: Erection Girder Accident Event,
- Construction Safety Analysis.

In this study, researchers used triangulation to test data credibility, with two triangulation techniques, namely source triangulation (comparing and re-checking the degree of trustworthiness of information) and technical triangulation (checking data from the same source with different techniques, namely interviews and questionnaires). In this study, the stages of analysis were carried out as follows:

1. Collect data from literature studies related to work accidents on girder work and regulatory sources that will be a reference in analyzing data.
2. Observe girder work to identify hazard risks and determine hazard control
3. Make a list of hazard identification results (Hazard Identification) and hazard control
4. Interviews with experts in the field of K3 to verify and improve the results of hazard identification that researchers have made and determine appropriate hazard control (Determining Control) to reduce potential hazards
5. Assess the level of risk before and after hazard control with three resource persons, namely K3 Construction experts, related experts, and site operational managers (SOM)
6. Compile HIRADC overall results of hazard identification, risk assessment, and hazard control into the IBPRP table in accordance with PUPR Ministerial Regulation No.10 of 2021 (Ministry of Public Works and Public Housing, 2021)

7. Make discussions related to the results of risk assessment data before control, risk control efforts, results of risk assessment data after control, and comparison of risk level category results before and after control
8. Make conclusions related to research results

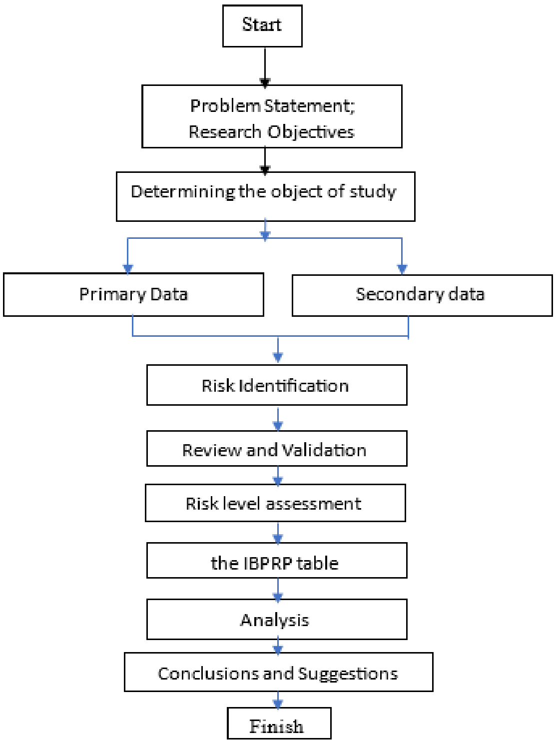

Figure 1. Research Flow Diagram

FINDINGS AND DISCUSSION

Cibitung – Cilincing Toll Road is part of JORR II (Jakarta Outer Ring Road II), consisting of:

- Cibitung Interchange, Jakarta-Cikampek KM 25 toll road; North towards Babelan – Bekasi; West to northern outer ring towards Cilincing-North Jakarta; Road length 43,760 kilometers
- This work is a work to connect pillar P2 to pillar P3 on the Cakung Drain river with a length of 50.80 m
- The number of girders is 14 units with PCI type, which weighs 143.71 tons
- Bridge height 2.3 m, bridge radius 410 m; bend road conditions with 6% superelevation at elevations above 9 M

After making hazard and risk identification, risk assessment, and hazard control in 7 jobs in the implementation of girder installation, the next stage is to compile HIRADC into the IBPRP table according to PUPR Regulation No. 10 of 2021 (Ministry of Public Works and Public Housing, 2021). The author is accompanied by K3 experts in preparing HIRADC, after which the final results of the IBPRP table are verified and validated again so that the results remain valid. The IBPRP table that has been compiled as a whole can be seen in the table below, namely:

Table 1. Hazard Identification, Risk Assessment, and Hazard Control in Preparatory Work

No.	Job description	Hazard identification	Risk of Danger	Initial Risk Assessment Before Control Is Carried Out				Residual Risk Value After Control			
				N.1	N.2	N.3	Risk Value	N.1	N.2	N.3	Risk Value
1.	**Preparatory Work**										
1.1	Past management and safety Cross	Employee / safety man hit at the project area location	Safety man dies or is permanently disabled	10	10	10	**10**	4	4	5	**4**
1.2	Mobilization of heavy equipment with trailers	The heavy equipment skidded from the top of the trailer and the trailer car hit another vehicle/residential building	Heavy equipment damaged, Road user dies or is permanently disabled, Broken machine	10	10	10	**10**	4	3	4	**4**
1.3	Mobilization of materials to the project area	Material slipping from the top of the trailer	Damaged materials and accidents which results in community/employee	12	12	12	**12**	4	4	6	**4**
1.4	Mobilization of personnel from the MES to the office and project area and vice versa	Crashing/being hit by another vehicle	Employees and road users die or are permanently disabled, vehicle damage (material or property loss)	8	10	8	**8**	4	4	4	**4**
1.5	Cleaning of the workplace with heavy equipment	Hit by an Excavator and Hit by a swing and bucket	Workers experience temporary/permanent disability and even die	8	6	8	**8**	4	3	4	**4**
		Dust	Respiratory distress and mild eye irritation	6	6	6	**6**	2	2	2	**2**

Table 2. Hazard Identification, Risk Assessment, and Hazard Control on Gantry Launcher Tool Installation Work

2.	**Gantry launcher Tool Installation Work**										
2.1	Mobilization Launcher Tool	Milieu: Hit a vehicle / hit by a vehicle other	Traffic accidents involving the community	8	8	8	**8**	3	4	3	**3**
		Equipment : Tools Launcher terguling	Workers : Workers hit (fatality), Tool : Multi axel damaged, Material : Launcher tool broken, Environment : Creates congestion	8	8	8	**8**	3	3	4	**3**
2.2	Drop Launcher Tool	Tool: Crane service terguling	Workers : Workers hit by crane, Tools : Service crane toppled	8	8	6	**8**	3	4	3	**3**
		Material : Sling breaks during lifting process	Workers: Workers hit by launcher devices, Material : broken launcher tool	8	6	8	**8**	3	3	3	**3**
2.3	Setting Alat Launcher	Material : Sling breaks during lifting process	Workers: Workers hit by launcher devices, Material : broken launcher tool	12	6	12	**12**	3	3	4	**3**
		Tools : Service cranes and rollover launchers	Workers : workers hit by cranes and launchers,	12	8	12	**12**	3	3	4	**3**

Table 3. Hazard Identification, Risk Assessment, and Hazard Control in Girder Mobilization Work

No.	Job description	Hazard identification	Risk of Danger	Initial Risk Assessment Before Control Is Carried Out				Residual Risk Value After Control			
				N.1	N.2	N.3	Risk Value	N.1	N.2	N.3	Risk Value
3.	**Girder Mobilization Work**										
3.1	Mobilization Girder	Material : Slip Girder	Worker : Worker crushed by girder (fatality), Tool : Multi axle damaged, Material: Broken Girder, Environment: Creates congestion	15	15	12	**15**	3	4	3	**3**
		Equipment : Rolling device	Workers : Workers hit by tools (Fatality), Tool : Broken tool, Material: Damaged girders, Environment: public unrest, and causing traffic jams	15	10	15	**15**	4	3	4	**4**
		Environment: Hit a vehicle/hit by another vehicle	Traffic accidents involving the community	10	8	10	**10**	3	2	3	**3**
3.2	Girder Drop	Material : sling breaks during lifting process	Worker : Worker crushed by girder, Material : Broken girder	15	15	10	**15**	3	4	3	**3**
		Alat : Crane service	Workers : workers hit by crane,	15	15	15	**15**	3	3	3	**3**

Table 4. Hazard Identification, Risk Assessment, and Hazard Control in Stressing Girder Work

No.	Job description	Hazard identification	Risk of Danger	Initial Risk Assessment Before Control Is Carried Out				Residual Risk Value After Control			
				N.1	N.2	N.3	Risk Value	N.1	N.2	N.3	Risk Value
4.	Work Stressing Girder										
4.1	Stressing Girder	Worker : Ergonomics (long squat position)	Workers : tired of leg muscles	6	6	6	6	2	2	2	2
		Worker: Snapped/crushed girder	Worker : worker pinched / crushed by girder, Material : Cracked / damaged girder	15	10	15	15	3	3	3	3
		Material : Strand break	Worker : punctured strand (MTC)	6	6	6	6	3	3	2	3
		Equipment : Broken grinder	Tool : Broken tool, Worker: exposed to grinding eyes (FAC MTC), and electrocuted	10	10	10	10	3	3	3	3

Table 5. Hazard Identification, Risk Assessment, and Hazard Control on Girder Installation Work

No.	Job description	Hazard identification	Risk of Danger	Initial Risk Assessment Before Control Is Carried Out				Residual Risk Value After Control			
				N.1	N.2	N.3	Risk Value	N.1	N.2	N.3	Risk Value
5.1	Girder Lifting using Gantry Portal	Equipment : Disconnected sling	Workers : Workers hit by girder/tool (Fatality), Material : Rolled Girder and Broken	15	15	15	15	3	4	3	3
		Employees : Employees Slips, trippings	Workers injured or fatality	15	15	10	15	3	4	3	3
		Alat : Portal Gantry Roboh	Workers : Workers crushed by materials, Material : Broken girder and broken slab	15	15	15	15	3	3	3	3
		Tool : Dead Genset Motor	Material : Girder hanging too long	15	15	12	15	4	4	4	4
		Tool : Burning Generator	Tool : Burning tool	8	8	8	8	2	2	2	2
		Tool : The control/remote does not work	Tool : Girder Jammed / Not moving	9	9	6	9	4	4	2	4
5.2	Launching Girder with Trolley	Material : Girder Terguling	Tools : Chain broken, Workers : Workers crushed by materials, Material: Slab retak	15	15	15	15	3	3	4	3
		Tool : Dead Genset Motor	Material : Girder hanging too long	15	15	15	15	4	4	3	4
		Tool : Burning Generator	Tool : Burning tool	8	8	12	8	2	2	4	2
		Tool : The control/remote does not work	Tool : Girder Jammed / Not moving	9	9	8	9	4	4	2	4
5.3	Erection Girder	Material : Girder terguling	Worker : Worker crushed by girder, Tool : sling disconnected and launcher collapsed, Material : Slab cracked	15	15	15	15	3	3	3	3
		Worker : falling from a height	Workers : drowning	15	15	15	15	3	3	3	3
		Environment : Bad Weather	Can't erection	15	15	15	15	3	3	3	3

Table 6. Hazard Identification, Risk Assessment, and Hazard Control in Bracing Iron Installation Work

No.	Job description	Hazard identification	Risk of Danger	Initial Risk Assessment Before Control Is Carried Out				Residual Risk Value After Control			
				N.1	N.2					N.1	N.2
6.	Iron Bracing Girder Installation Work										
6.1	Bracing Girder	Environment: Falling from a height (splashing into the river)	Employee : Fatality	12	15	12	12	4	4	3	4
		Material : Girder terguling	Worker: Worker falls from a height	15	12	15	15	3	3	4	3
		Worker : Ergonomics (long squat position)	Worker : Tired of leg muscles	6	6	6	6	2	2	2	2
		Environment : Hotwork		8	8	6	8	2	3	2	2
		Environment : Bad weather	Can't erection	8	8	8	8	3	3	2	3

Table 7. Hazard Identification, Risk Assessment, and Hazard Control on Gantry Launcher Tool Demobilization Work

No.	Job description	Hazard identification	Risk of Danger	Initial Risk Assessment Before Control Is Carried Out				Residual Risk Value After Control			
				N.1	N.2	N.3	Risk Value	N.1	N.2	N.3	Risk Value
7.	**Gantry launcher Tool Demobilization Work**										
7.1	Disassembly of launcher tools	Tools : Service cranes and rollover launchers	Workers: Workers hit by launchers and cranes, Material: broken launcher, Tool : crane service terguling	12	8	12	**12**	3	3	4	**3**
7.2	Drop Launcher Tool	Material : Sling breaks during lifting process	Workers: Workers hit by launcher devices, Material : broken launcher tool	8	6	8	**8**	3	3	3	**3**
		Tool: Crane service terguling	Workers : Workers hit by crane, Tools : Service crane toppled	8	8	6	**8**	3	4	3	**3**
7.3	Demobilization of launcher tools	Equipment : Tools Launcher terguling	Workers : Workers hit (fatality), Tool : Multi axel damaged, Material : Launcher tool broken, Environment : Creates congestion	8	8	8	**8**	3	3	4	**3**
		Milieu: Hit a vehicle / hit by a vehicle other	Traffic accidents involving the community	8	8	8	**8**	3	4	3	**3**

Table 8. Risk Level in Girder Installation Work After Control

No	Job Description	Risk Level Category			Sum Danger
		Small	Keep	Big	
1	Preparatory Work	7	0	0	7
2	Launcher Tool Installation Work	6	0	0	6
3	Girder Mobilization Work	5	0	0	5
4	Work Stressing Girder	4	0	0	4
5	Girder Installation Work	20	0	0	20
6	Bracing Iron Installation Work	5	0	0	5
7	Launcher Tool Demobilization Work	5	0	0	5
	Total	52	0	0	52

Comparison of Risk Levels Before and After Control

Based on the results of the overall risk level data before control, from 7 jobs, there are 52 hazards that have been analyzed in the IBPRP table and then calculated in the form of percentage numbers so that data is produced, namely:

- Large Risk Level = $\frac{20}{52} \times 100\% = 38.46\%$
- Medium Risk Level = $\frac{32}{52} \times 100\% = 61.54\%$
- Small Risk Level = $\frac{0}{52} \times 100\% = 0\%$

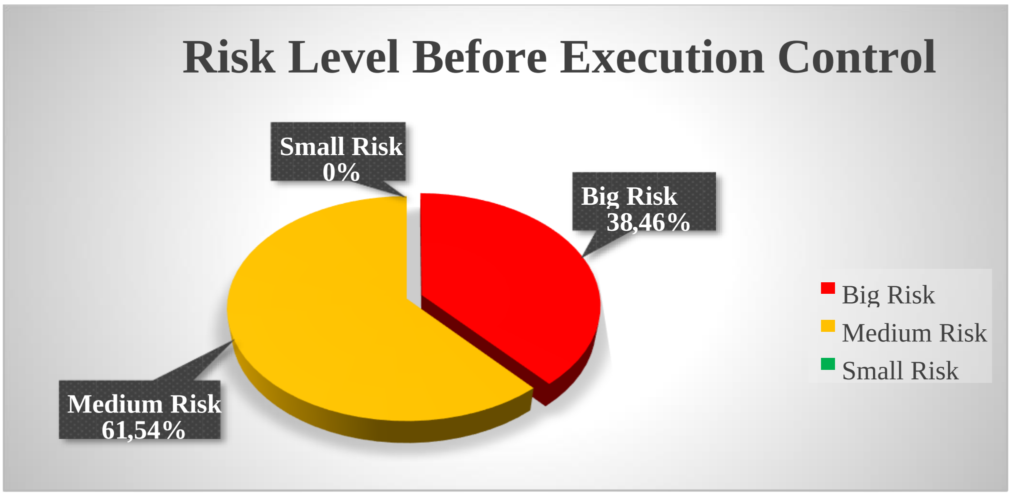

Figure 2. Risk Level Diagram Before Control

Based on the results of overall data from 7 occupations, there are 52 hazards that have been analyzed and controlled in the IBPRP table; the level of risk after the control is then calculated in the form of percentage numbers so that the data is produced, namely:

- Large Risk Level = $\frac{0}{52} \times 100\% = 0\%$
- Medium Risk Level = $\frac{0}{52} \times 100\% = 0\%$
- Small Risk Level = $\frac{52}{52} \times 100\% = 100\%$

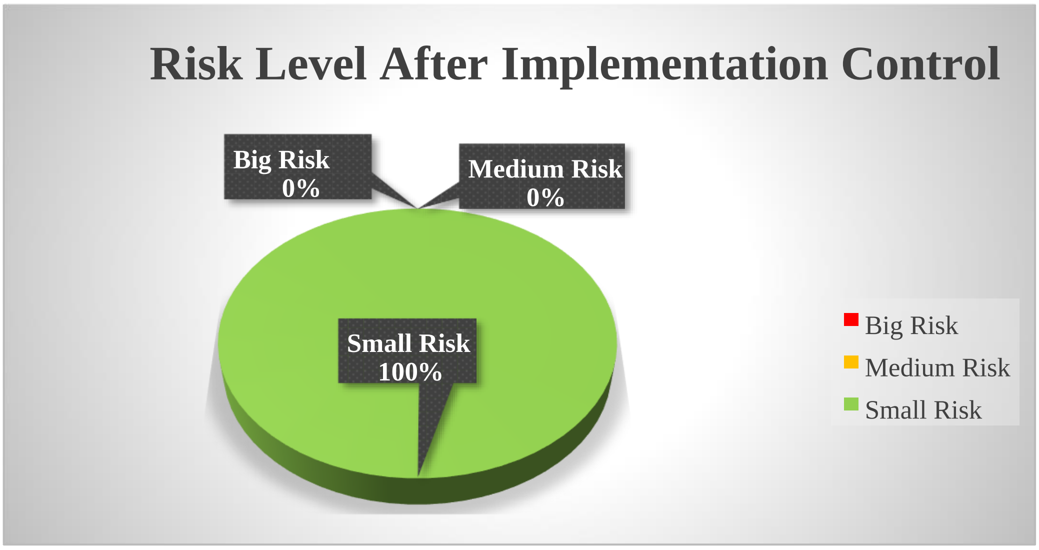

Figure 3. Risk Level Diagram After Control

Based on the results of the analysis above, the level of risk before control was carried out, namely for the category of large risk level of 38.46%, medium risk level of 61.54%, and small risk level of 0%. After the control was carried out, there was a decrease in the medium risk level category and the large risk level to 0% or none, so the small risk level increased to 100%. The results of this data can be concluded to have achieved risk level assessment results that are much better than before the control; this is applied as a form of effort to achieve zero accidents.

CONCLUSIONS

From the results of research that has been carried out on girder work in the Cibitung – Cilincing Toll Road Construction Project using the HIRADC method it can be concluded, among others:

1. The limitation of the problem in this research is that the research location only focuses on Section 4 of Sta 33+150, the Cibitung – Cilincing Toll Road Construction Project on the P2 – P3 JU Cakung Drain Pillar Span with the girder installation process using a Gantry Launcher, and this research uses the HIRADC (Hazard Identification, Risk Assessment and Determining Control) method in accordance with PUPR Ministerial Regulation No. 10 of 2021 concerning SMKK Guidelines (Ministry of Public Works and Public Housing, 2021). The novelty of this research lies in using tools during the girder lifting process because the girder length is 50.8 m, and the lifting location is above the water of the Cakung Drain River, so the risk and danger factors are different.
2. The implementation of girder installation work is described into 7 types of work consisting of preparatory work, gantry launcher installation work, girder mobilization work, girder stressing work, girder installation work, bracing iron installation work, and gantry launcher equipment demobilization work. A total of 52 hazards were identified originating from humans, equipment, materials, processes, and work methods that could pose a risk to workers/people, equipment, materials, and the environment/public. The source of danger that occurs is caused by 2 factors such as unsafe actions from humans such as not using complete PPE according to K3 standards or not complying with established SOP, and unsafe conditions such as work using inappropriate equipment so that it does not meet standards.
3. In the results of data analysis of 7 job descriptions consisting of 52 hazards, 2 types of risk level categories were obtained, namely hazards with a large risk level of 20 hazards with a percentage of 38.46% and hazards with a moderate risk level of 32 hazards with a percentage of 61.54%, and no hazards with a small risk level in the overall work.
4. Control efforts have been carried out thoroughly in this study by carrying out 3 levels or control hierarchies, namely engineering control, administration and personal protective equipment (PPE). Based on the results of data analysis after the control was carried out, there were changes in the risk level category in each job description, namely a decrease in the large risk level, a medium risk level and an increase in the small risk level. After control, hazards with large risk level and medium risk level categories are no longer found, and then small risk levels become as many as 52 hazards with a percentage of 100%. So, the results of this data can be concluded that they have obtained better risk level assessment results than before.

Advice

Based on the results of data analysis and conclusions, several suggestions were obtained to complement or continue similar research so as to obtain better results, including:

1. To realize zero accidents, extra supervision and strict action on work safety are needed to prevent potential hazards during the implementation of work.
2. It is necessary to provide training or counselling to the workforce regarding the importance of implementing K3 during work so that workers can work safely.
3. At the time of research, when making observations and interviews directly at the work site, it must be detailed and in-depth so that it can identify all job descriptions in accordance with the standard operational procedures for installing precast concrete girders regulated

by the PUPR ministry so that the results of the data produced are more accurate and comprehensive.

4. In subsequent research in compiling the IBPRP table in order to use the latest laws and regulations as a valid reference.

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