ISSN No:-2456-2165

Study of Application of Construction Safety Management System in the Implementation of Road Construction Project

Muhammad Andra Pranatha[1], Irfan Prasetia[2]
Civil Engineering Study Program, Engineering Faculty,
University of Lambung Mangkurat

Abstract:- Frequent accidents in construction projects are due to the lack of special attention to SMKK. So it is necessary to analyze the dominant factors that influence the implementation of SMKK. In addition, it is necessary to conduct a study on the implementation of the construction safety management system in the implementation of road projects by contractors. For this purpose, primary data was collected in the form of questionnaire results sourced from the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 and observations on the implementation of SMKK by contractors. The secondary data are in the form of project RKK documents and other documents needed in this research. The method used in the analysis is the Relative Importance Index (RII) analysis method on the questionnaire data obtained. From the research, it is known that occupational safety and health and public safety are the dominant factors in the implementation of the construction safety management system. There are observations on the implementation and implementation of the contractor on the implementation of the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 and observations on the Project Construction Safety Plan to review whether the results of the questionnaire are in accordance with the observations made. It is known that in general the contractors have implemented the SMKK well. The strategy for improving SMKK is based on the dominant factors that have been known from the research. The key word in the safety improvement strategy is regular coordination, monitoring, and evaluation by relevant parties such as owners, contractors, and supervisory consultants. This can be done during routine meetings by attaching documentation of the implementation of the SMKK in the form of a Construction Safety SOP, a checklist form and photos of the implementation of the SMKK. With the implementation of this, it is hoped that it can prevent or at least reduce the risk of work accidents on road construction projects.

Keywords:- *SMKK, RII, SMKK Improvement Strategy.*

I. INTRODUCTION

The Construction Safety Management System or SMKK is part of the construction work implementation management system in order to ensure the realization of Construction Safety. Occupational Health and Safety (K3) is a condition in a healthy and safe job both for the job, the company as well as for the community and the environment around the factory or workplace (Ridley, 1983 in Shiantosia, 2000). The purpose of K3 is to maintain the health and safety of the work environment. K3 also protects co-workers, workers' families, consumers, and other people who may also be affected by working environmental conditions.

In this regard, every company has your duty, namely in addition to earning profit for the company, it also has social responsibility for the company's internal environment. The company's internal environment includes guaranteed work security and decent wages. If this has been achieved, it will provide better business opportunities in the future so that the company will survive in facing various challenges (Yuli, 2005).

Occupational hazards are factors in an employment relationship that can lead to accidents. The hazard is said to be potential if these factors have not resulted in an accident, whereas if the accident occurs then the hazard is a real hazard (Suma'mur, 1996). Personal protective equipment is a tool used to protect oneself or the body against the dangers of work accidents. So personal protective equipment is one way to prevent accidents and technically PPE is not perfect to protect the body but reduces the severity of accidents that occur (Suma'mur, 1992).

The results of the evaluation of work accidents so far can be concluded that several factors causing accidents that have caused fatalities or injuries include: The absence of construction engineering experts, the use of inappropriate implementation methods, weak supervision of the implementation of construction in the field such as several a condition where workers do not use safety vests, where safety vests should be a mandatory attribute for every work in the field. And some workers have not fully implemented the existing provisions or regulations concerning K3, weak supervision and implementation of K3, inadequate both in quality and quantity of PPE availability, socio-economic and cultural environmental factors of workers and lack of discipline of workers in comply with the provisions regarding K3, including the use of work accident PPE (Construction

and Human Resources Development Agency, 2007). This explains that in construction work, there is a need for management in carrying out the K3 program to avoid the risk of accidents. The Occupational Safety and Health Management System (SMK3) is a very important part for the protection of workers by paying attention to the K3 aspect and preventing the occurrence of Occupational Accidents (KAK), Occupational Diseases (PAK) and pollution to the work environment and the surrounding environment.

Erwaniansyah (2019) has conducted a similar study with the main object of bridge construction with the title of reviewing the application of occupational safety and health in the implementation of construction project work with a case study on the bridge construction project of the Kalimantan Island - Laut Island bridge. Where several things that distinguish between previous research and research to be carried out include case studies that will be taken regarding road widening. Another differentiator from the K3 aspect of the Kalimantan Island and Laut Island Bridge Construction Project is more about the K3 of the project workers themselves, while the K3 aspect of the road widening project involves road users and workers because the existing road is still in use while the project is running.

Srisantyorini (2020) has conducted a research entitled Application of Occupational Health and Safety Management System in the Construction of the Jakarta-Cikampek 2 Elevated Toll Road. Yunika (2021) has conducted research on the Analysis of the Application of the OHS System on the Performance of the Section 2B Cijago Toll Road Project. Where the things that are different from the case studies to be investigated include different project locations which will lead to different analysis results. Toll road construction is a new road construction project with no local people passing through.

The Trans Kalimantan Handil Bakti Road is a link between the Provinces of South Kalimantan and the Provinces of Central Kalimantan. The road widening associated with the Alalak bridge construction project has been completed. Based on the traffic growth which has become congested, the number of heavy loads passing through, and the narrowing of the road due to the road widening project work which is running concurrently with the road widening project, the Trans Kalimantan Handil Bakti road is no longer available. accommodate heavy traffic.

The widening project is divided into 4 segments, there are several obstacles that can lead to work accidents including, the existing road that is still in use is experiencing a narrowing of the road body due to the simultaneous running of the project between road widening and bridge widening work, extreme weather conditions, such as rain accompanied by lightning, and lighting when working at night and potential hazards such as falling into dug holes. Based on this description, research will be conducted on the implementation of construction safety management systems and strategies for improving construction safety management systems in Road Construction projects.

II. METHOD

A. Primary Data Collection

The primary data required is the application of a construction safety management system obtained from a survey method using a questionnaire, observation and/or direct interview. The results of the questionnaire to obtain the dominant factor of the implementation of the construction safety management system. The results of the questionnaire will be clarified by observing the implementation of the Construction Safety Management System based on the regulation of the minister of public works and public housing number 21 of 2019 by the contractor. In addition, observations were also made on the implementation of the Construction Safety Plan by contractors.

B. Secondary Data Collection

Secondary data obtained from the documents of the contractor implementing PT. Dutasatrya Adhipersada. The data obtained is the Construction Safety Plan Document (RKK). The RKK document is used to observe whether the contractor has carried out the project implementation as stated in the RKK. And then it will be compared with the results of the questionnaire so that the results obtained which received less attention from the contractors to be the basis for formulating strategies.

C. Analysis and Discussion

- *Dominant factor*

The first analysis was conducted on the results of the questionnaire using the Relative Importance Index (RII) method to determine what dominant factors influence the implementation of the Construction Safety Management System in the implementation of Road Construction projects.

- *Implementation of the Construction Safety Management System (SMKK)*

Observations were made on the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 to find out how to implement the Construction Safety Management System. Observations were also made on the Construction Safety Plan (RKK) to find out whether the requirements stated in the RKK had been implemented by the contractor.

- *Strategy for Improvement of Construction Safety Management System (SMKK)*

The strategy is made after the results of the analysis using RII are known and what dominant factors influence the implementation of the Construction Safety Management System, and the results of observations on how the contractors implement the Construction Safety Management System. Then interviews will be conducted with project K3 experts to clarify whether the strategies that have been made can be implemented.

D. Strategy Determination

After obtaining the dominant factors from the implementation of the construction safety management system and the implementation of the construction safety management system. Furthermore, a strategy to improve the implementation of the construction safety management system will be made to answer the third objective. Strategy determination will be carried out based on the results of the analysis using the RII method and the results of observations of the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 as well as the results of observations on the implementation of the construction safety management system. After determining the strategy for improving the construction safety management system, interviews were conducted with the K3 experts of the Supervisory Consultant with the aim of knowing the opinions related to the strategies that have been formulated.

III. RESULTS AND DISCUSSION

A. Validity dan Reability Test

➢ *Validity Test*

For the results of variable validation can be tested by comparing the correlation coefficient of Spearman's rank with the critical value in question. The critical value referred to in 0.05 is 0.250. From the results of the first validity test on 62 respondents to the level of importance of occupational safety and health and the results of the first validity test to the level of importance of public safety. It is known that the value of the Spearman Rank correlation coefficient (R) is greater than the critical value (R0.05 = 0.250) so it can be concluded that there are 2 question items declared invalid. Questions that are declared invalid will be deleted and the validity test will be re-tested as shown in Table 3.1 Results of the second Validity Test on the level of importance of occupational safety and health and Table 3.2 Results of the second Validity Test on the level of importance of public safety.

Table 3.1 Validity Test Results of the two levels of importance for Occupational Safety and Health

No	Occupational safety and health as referred to in Article 4 paragraph (2) includes the fulfillment of:	Variable	*R*	conclusion
1	labor rights in the form of social protection of workers in the implementation of Construction Services in accordance with the provisions of laws and regulations;	1.a.1	0,573	Valid
		1.a.2	0,508	Valid
		1.a.3	0,671	Valid
2	guarantee and protection of the safety and health of workers through the prevention of work accidents and occupational diseases;	1.b.1	0,683	Valid
		1.b.2	0,577	Valid
		1.b.3	0,49	Valid
		1.b.4	0,348	Valid
3	prevention of the spread of disease outbreaks in the work environment and its surroundings;	1.c.1	0,711	Valid
		1.c.2	0,670	Valid
		1.c.3	0,539	Valid
4	HIV/AIDS prevention and control;	1.d.1	0,65	Valid
		1.d.2	0,753	Valid
		1.d.3	0,771	Valid
5	prevention of psychotropic use;	1.e.1	0,533	Valid
		1.e.2	0,601	Valid
		1.e.3	0,595	Valid
6	work environment security.	1.f.1	0,329	Valid
		1.f.2	0,337	Valid
		1.f.3	0,459	Valid
		1.f.3	0,296	Valid
		1.f.5	0,505	Valid
		1.f.6	0,408	Valid

ISSN No:-2456-2165

Table 3.2 Validity Test Results of the two levels validity test of the importance of Public Safety

No	Public safety as referred to in Article 4 paragraph (3) covers the fulfillment of:	Variable	*R*	Conclution
1	public safety standards in the vicinity of construction activities;	2.a.1	0,720	Valid
		2.a.2	0,526	Valid
		2.a.3	0,614	Valid
		2.a.4	0,620	Valid
2	efforts to prevent work accidents that have an impact on the community around the site of construction activities;	2.b.1	0,378	Valid
		2.b.2	0,336	Valid

➢ *Reability Test*

The reliability test was carried out by comparing Cronbach's alpha (α) with the minimum value of reliability. If the value of > 0.600 (Table of Reliability) is declared reliable. The reliability test was carried out with the data from the validity test results with the results stating that all question items were declared valid, namely in Table 3.1 and Table 3.2. The results of reliability testing can be seen in Table 3.3 and Table 3.4.

Table 3.3 Reliability Test Results Occupational Safety and Health importance

No	Occupational safety and health as referred to in Article 4 paragraph (2) includes the fulfillment of:	Variabel	*R*	Kesimpulan
1	labor rights in the form of social protection of workers in the implementation of Construction Services in accordance with the provisions of laws and regulations;	1.a.1	0,910	Reliable
		1.a.2	0,910	Reliable
		1.a.3	0,910	Reliable
2	guarantee and protection of the safety and health of workers through the prevention of work accidents and occupational diseases;	1.b.1	0,908	Reliable
		1.b.2	0,910	Reliable
		1.b.3	0,911	Reliable
		1.b.4	0,912	Reliable
3	prevention of the spread of disease outbreaks in the work environment and its surroundings;	1.c.1	0,907	Reliable
		1.c.2	0,908	Reliable
		1.c.3	0,910	Reliable
4	HIV/AIDS prevention and control;	1.d.1	0,907	Reliable
		1.d.2	0,906	Reliable
		1.d.3	0,905	Reliable
5	prevention of psychotropic use;	1.e.1	0,910	Reliable
		1.e.2	0,909	Reliable
		1.e.3	0,909	Reliable
6	work environment security.	1.f.1	0,913	Reliable
		1.f.2	0,914	Reliable
		1.f.3	0,912	Reliable
		1.f.3	0,913	Reliable
		1.f.5	0,911	Reliable
		1.f.6	0,913	Reliable

Table 3.4 Reliability Test Results of the importance of Public Safety

No	Public safety as referred to in Article 4 paragraph (3) covers the fulfillment of:	Variabel	*R*	Kesimpulan
1	public safety standards in the vicinity of construction activities;	2.a.1	0,907	Reliable
		2.a.2	0,910	Reliable
		2.a.3	0,909	Reliable
		2.a.4	0,090	Reliable
2	efforts to prevent work accidents that have an impact on the community around the site of construction activities;	2.b.1	0,913	Reliable
		2.b.2	0,912	Reliable

B. Interest Level Analysis Using the Relative Importance Index Method to find out the Dominant Factors of SMKK

Table 3.5 Result of Analysis Using RII Method of Occupational Safety and Health

No	Occupational safety and health as referred to in Article 4 paragraph (2) includes the fulfillment of:	Variable	Respondent's Answer					Total	RII	Conclution
			TP	KP	P	CP	SP			
1	labor rights in the form of social protection of workers in the implementation of Construction Services in accordance with the provisions of laws and regulations;	1.a.1	0	0	1	32	29	62	0,8903	**Very Important**
		1.a.2	0	0	4	18	40	62	0,9161	**Very Important**
		1.a.3	1	1	4	30	26	62	0,8548	**Very Important**
2	guarantee and protection of the safety and health of workers through the prevention of work accidents and occupational diseases;	1.b.1	0	0	3	22	37	62	0,9097	**Very Important**
		1.b.2	0	0	2	32	28	62	0,8839	**Very Important**
		1.b.3	0	0	3	22	37	62	0,9097	**Very Important**
		1.b.4	0	0	2	20	40	62	0,9226	**Very Important**
3	prevention of the spread of disease outbreaks in the work environment and its surroundings;	1.c.1	0	0	8	27	27	62	0,8613	**Very Important**
		1.c.2	0	0	6	35	21	62	0,8484	**Very Important**
		1.c.3	0	0	6	24	32	62	0,8839	**Very Important**
4	HIV/AIDS prevention and control;	1.d.1	0	9	11	30	12	62	0,7452	**Important**
		1.d.2	1	7	14	30	10	62	0,7323	**Important**
		1.d.3	1	6	15	27	13	62	0,7452	**Important**
5	prevention of psychotropic use;	1.e.1	0	5	9	29	19	62	0,8000	**Important**
		1.e.2	0	5	9	29	19	62	0,8000	**Important**
		1.e.3	0	3	12	25	22	62	0,8129	**Very Important**
6	work environment security.	1.f.1	1	1	3	41	16	62	0,8258	**Very Important**
		1.f.2	0	1	11	36	14	62	0,8032	**Very Important**
		1.f.3	0	1	10	26	0	37	0,7351	**Very Important**
		1.f.3	0	0	1	17	44	62	0,9387	**Very Important**
		1.f.5	0	0	5	37	20	62	0,8484	**Very Important**
		1.f.6	0	1	5	30	26	62	0,8613	**Very Important**

Table 3.6 Result of Analysis Using RII Method of Public Safety

No	Public safety as referred to in Article 4 paragraph (3) covers the fulfillment of:	Variable	Respondent's Answer					Total	RII	Kesimpulan
			TP	KP	P	CP	SP			
1	public safety standards in the vicinity of construction activities;	2.a.1	0	0	3	24	35	62	0,9032	**Very Important**
		2.a.2	0	0	2	24	36	62	0,9097	**Very Important**
		2.a.3	0	1	5	32	24	62	0,8548	**Very Important**
		2.a.4	0	1	7	26	28	62	0,8613	**Very Important**
2	efforts to prevent work accidents that have an impact on the community around the site of construction activities;	2.b.1	0	0	2	10	50	62	0,9548	**Very Important**
		2.b.2	0	0	1	10	51	62	0,9613	**Very Important**

Based on the results of the analysis using the Relative Importance Index (RII) method, it can be seen that the dominant factors for occupational safety and health are the rights of workers in the form of social protection for workers in the implementation of Construction Services in accordance with the provisions of the legislation; guarantee and protection of the safety and health of workers through the prevention of work accidents and occupational diseases; prevention of the spread of disease outbreaks in the work environment and its surroundings; and safeguarding the work environment. And the dominant factor for public safety is the standard of public safety in the vicinity of construction activities; and efforts to prevent work accidents that have an impact on the community around the site of construction activities.

Based on the results obtained from the questionnaire and analysis using RII, it can be concluded that occupational safety and health and public safety are the dominant and influential factors in the implementation of the construction safety management system. It can be seen based on the value of the RII analysis in the range of values from 0.8001 to

1.0000 which is stated to be very important. Furthermore, observations will be made regarding how the contractor implements the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 and the Construction Safety Plan to confirm whether the analysis carried out on the results of the questionnaire is in accordance with what was applied by the contractor. After obtaining the results from the analysis and observations, it is possible to make a strategy to improve the construction safety management system.

C. Observation of the Implementation of Construction Safety Management System

From the results of observations on the implementation of the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 by the contractor and observations on the implementation of the Construction Safety Plan by the contractor, it can be concluded that the contractor has implemented both well. It's just that in the implementation of the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 Occupational safety and health aspects as referred to in Article 4 paragraph (2) do not implement the form of labor rights in the form of social protection of workers in the implementation Construction service. As well as the absence of equipment such as light fire extinguishers (APAR), and organic and inorganic waste bins. Based on the aspect of public safety as referred to in Article 4 paragraph (3) has been implemented properly. Meanwhile, in the implementation of the RKK, there is no implementation and there is no routine schedule for workers' health checks.

D. Strategi Peningkatan Sistem Manajemen Keselamatan Konstruksi

Based on the results that have been obtained from the analysis of the level of interest in occupational safety and health, and the interest in public safety, the dominant factors that influence or need to be maintained and/or improved in the Construction Safety Management System in the implementation of road construction project work. And also obtained from the results of observations on the implementation of the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia 21/PRT/M/2019 and the results of observations on the implementation of the Construction Safety Plan (RKK). Based on the dominant factors and the implementation of the SMKK implementation, the following strategies can be made for contractors, owners and supervisors:

➢ *Kontraktor*

- Implement regular SMKK in accordance with the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia 21/TRP/M/2019 and the Construction Safety Plan.
- Fill in the checklist form controlled by the Project K3 Expert for all SMKK activities and SMKK completeness required on the project.
- Provide K3 induction or introduction to K3 for workers, especially new workers.
- Providing labor rights in the form of social protection for workers in the implementation of construction services such as the Work Accident Program, Death Insurance, Old Age Security, and Health Care Insurance.
- Installing Barricades or barriers between the work site of the widening project and existing roads that are still used by the community to cross.
- Arranging the place of material entering the project site and installing K3 signs and safety lines at a certain distance so that they can be seen clearly to prevent accidents at the project site.
- Safeguarding the Work Environment such as by providing Light Fire Extinguishers on all heavy equipment used as well as in the workers' gathering room.
- Provide examples from project supervisors for the implementation of SMKK.
- Provide sanctions to workers who do not obey and comply with project OHS regulations and reward workers who carry out K3 well.
- Using the SMKK budget wisely.
- Collaborate with the owner and supervisory consultant to make the SMKK run properly.

➢ *Owner*

The strategy that needs to be carried out by the owner to improve the construction safety management system has been confirmed that the strategy can be carried out by the owner. The strategies that need to be carried out by the owner include the following.

- Monitoring and evaluating SMKK run by contractors during routine meetings with contractors.
- Include the inspection/evaluation component of the implementation in the payment terms.
- Set an example for contractors and supervisory consultants to implement SMKK.
- There are Sanctions to Contractors and Supervising Consultants if they do not carry out and comply with the implementation of the SMKK with the stages of warning letter 1, warning letter 2, and delaying payment for K3/SMKK items.
- Monitor the suitability of the use of the SMKK Budget used by the contractor. Collaborate with contractors and supervisory consultants to make the SMKK run properly.

➢ *Supervising Consultant*

- Monitoring and evaluating the SMKK run by the contractor and submitting it to the owner during routine work meetings.
- Create a SMKK check list form that is carried out by the Contractor.
- Provide direct reprimand at the project site if someone does not implement the SMKK properly.
- Collaborate with contractors and owners to make the SMKK run properly.

Interviews were conducted with K3 experts from the supervisory consultant on the strategy for improving the construction safety management system (SMKK) and the results of the interviews stated that the strategy made for improving the construction safety management system was

good. Furthermore, how to apply it directly in the field to the parties directly involved at the project site. Starting from checking the health of workers before starting work in the morning, checking the use of PPE for all workers involved in the project, checking the condition of heavy equipment that will be used on the job. The use of good and complete PPE from related parties such as the owner, or field coordinator can be an example for workers at the project site. The implementation of sanctions for workers who do not comply with the SMKK and rewards for workers who comply and run the SMKK properly. And remind each other to continue implementing SMKK at project sites whenever and wherever.

It can be concluded that the strategy for improving the Construction Safety Management System is by coordinating, monitoring, and evaluating regularly by related parties such as owners, contractors, and supervisory consultants. This can be done during routine meetings by attaching documentation for the implementation of the Construction Safety Management System in the form of a Construction Safety SOP, Checklist Form. And Photos of the implementation of the Construction Safety Management System. With the implementation of this is expected to reduce the risk of work accidents for the project.

IV. CONCLUTION

- Based on the results of the analysis using the Relative Importance Index (RII) method, it can be seen that the dominant factor in occupational safety and health is the rights of workers in the form of social protection for workers in the implementation of Construction Services in accordance with the provisions of the legislation; guarantee and protection of the safety and health of workers through the prevention of work accidents and occupational diseases; prevention of the spread of disease outbreaks in the work environment and its surroundings; and safeguarding the work environment. And the dominant factor for public safety is the standard of public safety in the vicinity of construction activities; and efforts to prevent work accidents that have an impact on the community around the site of construction activities.
- From the results of observations on the implementation of the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 by the contractor and observations on the implementation of the Construction Safety Plan by the contractor, it can be concluded that the contractor has implemented both well. It's just that in the implementation of the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21/PRT/M/2019 Occupational safety and health aspects as referred to in Article 4 paragraph (2) do not implement the form of labor rights in the form of social protection of workers in the implementation Construction service. As well as the absence of equipment such as light fire extinguishers (APAR), and organic and inorganic waste bins. Based on the aspect of public safety as referred to in Article 4 paragraph (3) has been implemented properly. Meanwhile, in the implementation of the RKK, there is no application in terms of workers' health checks.
- The Strategy for Improvement of the Implementation of the Construction Safety Management System is carried out with regular coordination, monitoring, and evaluation by related parties such as owners, contractors, and supervisory consultants. This can be done during routine meetings by attaching documentation for the implementation of the Construction Safety Management System in the form of a Construction Safety SOP, Checklist Form. And Photos of the implementation of the Construction Safety Management System. With the implementation of this is expected to reduce the risk of work accidents for the project.

SUGGESTION

- In carrying out the work, the contractor should pay attention to the health of workers by conducting regular health checks to reduce the risk of work accidents at the project site.
- It is necessary to conduct research on the safety of construction engineering as referred to in Article 4 paragraph (1) and environmental safety as referred to in Article 4 paragraph (4).

REFERENCES

[1]. Arikunto, S. 2006, Manajemen Penelitian. Cetakan Ketujuh. Jakarta: PT. Asdi Mahasatya.
[2]. Erwaniansyah. 2019, Kajian Penerapan Keselamatan dan Kesehatan Kerja dalam Pelaksanaan Pekerjaan Proyek Konstruksi, Universitas Lambung Mangkurat: Banjarmasin.
[3]. Sukandarrumidi. 2006, Metodologi Penelitian, Petunjuk Praktis Untuk Peneliti Pemula. Yogyakarta: Gadjah Mada University Press.
[4]. Suma'mur. 1992, Keselamatan Kerja dan Pencegahan Kecelakaan. Jakarta: PT. Toko Gunung Agung.
[5]. Suma'mur. 1996, Higene Perusahaan dan Kesehatan Kerja. Jakarta: PT. Toko Gunung Agung.
[6]. Tarwaka. 2008, Keselamatan dan Kesehatan Kerja Manajemen dan Implementasi K3 di Tempat Kerja. Surakarta: Harapan Press.
[7]. Yuli. S. 2005, Manajemen Sumber Daya Manusia. Malan: UMM Press.
[8]. Yunika. 2021 Analisis Penerapan Sistem K3 Terhadap Kinerja Proyek Jalan Tol Cijago Seksi 2b. Depok :Universitas Gunadharma