Jurnal Teknik Sipil & Perencanaan vol (1) (2026) p 13 -18

JURNAL TEKNIK SIPIL & PERENCANAAN

https://doi.org/10.15294/jtsp.v28i1.47264

Impact of Work Accident Rate on Construction Safety Management System: A Case Study in Sidoarjo, Indonesia

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Abstract Zero Accident is a concept that aims to eliminate work accidents by implementing an effective Construction Safety Management System (CSMS) in accordance with applicable regulations. The CSMS is very important for creating safety and security for all parties involved, as well as the work environment. However, during implementation, many contractors do not adhere to the applicable rules and guidelines; therefore, this research was conducted to examine how the current occupational safety management system is implemented in the field. This study focuses on the results of the analysis of the accident work rate in the Sidoarjo Integrated Central Building construction project. Based on the results of the analysis, it was found that the contractor's commitment to implement the work safety plan had a great impact on the implementation of the construction safety management system of this project, even obtained, with 0 Frequency Severity Indicator per 1,000,000 working hours of people, successfully implemented by the contractor. This result allows the work to be implemented simultaneously in accordance with the plan, on time, with quality, and at cost, because there are no work accidents that affect it, and the contractor can avoid negative costs associated with them.

Keywords: Zero Accident, Construction Safety Management System, Accident Work Rate.

INTRODUCTION

Occupational Safety and Health (K3) is still often neglected in construction projects. The implementation of Occupational Safety and Health in a project is an effort to protect workers by making them safer, healthier, and more prosperous, and free from work accidents and diseases due to overwork, and to increase productivity, as stated in the Regulation of the Minister of PUPR RI No. 21 of 2021 concerning the Construction Safety Management System. This could go well if the parties concerned communicate and cooperate to prevent work accidents.

The occupational safety and health management system (K3) is very important because it aims to provide good working conditions and a safe, comfortable environment, and to help prevent accidents and occupational diseases. But the government's efforts cannot run without a response from companies and workers to solve problems and reduce occupational safety and health (K3) violations [1]. However, today's large projects often ignore the requirements and regulations of OSH law. This happens due to the lack of awareness of the company and the

workforce about the risks they may face. As happens in the field, a project must try to avoid economic costs, or K3 costs themselves [6][7][8]. So many project implementations ignore occupational safety and health because the laws and regulations on K3 are not balanced by strict, severe legal sanctions [14][15][16].

The lack of implementation of the company's occupational safety and health management system (OSH) program is the main cause of the high accident rate in construction projects, as well as the low awareness among workers of occupational safety and health (OSH) [2].

Objectives and Implementation of the Construction Safety Management System (CSMS) according to the International Labor Organization (ILO) [9][10][11] Occupational Safety and Health is a part aimed at developing and striving for the highest level of all employees in all forms such as physical, psychological, and social welfare in various types of work, prevention of occupational health disorders[12], protection of employees from all consequences caused by circumstances that can affect health, placement and maintenance of workers/laborers in the work area that are suitable for the physical and psychological conditions of employees, as well as realizing harmony between employees in carrying out their duties[3][5].

The Construction Safety Management System (CSMS) Implementation Performance Index, which can be an individual or a legal entity, is the party that accepts and carries out the responsibility for construction work in accordance with the plan, the description of regulations, and the costs set [12][13]. Performance, in this context, refers to the results and achievements of work produced during the implementation of a job. More than just reflecting the result of the work, performance also includes how it is executed throughout the process. Performance not only describes what has been achieved, but also how those achievements are performed. The contractor's performance, therefore, refers to the quality and quantity of work performed in accordance with the responsibilities assigned [1].

Current Research. In this study, the researcher discussed the results of implementing the construction safety management system for the construction project of the Integrated Central Building of Sidoarjo Hospital, based on analyses of the level of work accidents and the performance index of CSMS implementation for this project.

This case focuses on the Integrated Central Building Construction Project of the Sidoarjo Regency Regional General Hospital, one of the Grand Plans to support the medical services provided by the Sidoarjo Regional Hospital. This project has a construction cost of Rp. 62,791,626,000 and has its own complexity, especially with special building regulations for hospitals, so it requires a specialized construction management system as well.

Therefore, as a benchmark for assessing the company's compliance with applicable construction safety management system regulations, the researcher conducted a study of PT's construction safety management system implementation. CIPTA KARYA MULTI TEKNIK (CKMT) at the Integrated Center Building Construction Project, Sidoarjo Hospital.

METHODOLOGY

Based on the analysis of Occupational Accident Rates in "Analysis of accident injury-severity outcomes: The zero – inflated hierarchical ordered probit model with correlated disturbances"[4], it was found that the analysis of occupational accident rates affects the main hierarchy model of zero accidents.

Analysis of the level of work accidents can use quantitative methods to obtain the Frequency Severity Index value according to [2] as follows:

1. Frequency Rate (FR)

$$\mathbf{FR} = \frac{\sum \text{Accident with lost time work}}{\sum \text{Work Hour Manpower}} \; x \; 1.000.000 \qquad \textit{(a.)}$$

The injury frequency ratio is obtained by dividing the total number of injuries with lost work time by the number of person-hours worked, then multiplying by 1,000,000.

2. Severity Rate (SR)

$$\mathbf{SR} = \frac{\sum \text{Workday Lost Time}}{\sum \text{Work Hour Manpower}} \; x \; 1.000.000 \qquad \textit{(b.)}$$

After obtaining the results of the Frequency Rate, proceed to find the value of the Severity Ratio, which is obtained from the calculation of the total lost working days divided by the number of working hours of people, then multiplied by 1,000,000.

3. Average Time Lost Rate (ATLR)

$$\textbf{ALTR} = \frac{\sum \text{ Work Hour Lost}}{\sum \text{ Work Hour Manpower}} \; x \; 1.000.000 \qquad \textit{(c.)}$$

After obtaining the Severity Rate, the next step is to find the Average Loss of Working Time by dividing the total lost working hours by the number of working hours of people, then multiplying by 1,000,000.

4. (Incident Rate) (IR)

$$\textbf{IR} = \frac{\sum \text{Accident}}{\sum \text{ Exposed Manpower}} \; x \; 100\% \qquad \textit{(d.)}$$

After obtaining the Average Time Lost Rate, find the incident ratio by dividing the total incidents by the number of exposed workers, then multiplying by 100%.

5. Frequency Severity Indicator (FSI)

$$\textbf{FSI} = (\boldsymbol{FR \; x \; SR \; 1.000}) \qquad \textit{(e.)}$$

The Frequency Rate and Safety Rate are used to determine the Frequency Severity Indicator value.

RESULT AND DISCUSSION

The assessment of the construction accident rate is a quantitative assessment that is used to calculate the construction accident rate in construction work using the following formula:

a. Frequency Rate ***(a.)***

TABLE 1. Table of Frequency Rate Recap (Month of Construction)

NO	MONTH	MANPOWER		MAN HOURS					∑ ACCIDENT WITH LOST TIME WORK (A x G)	∑ WORK HOUR MANPOWER	FREQUENCY RATE
		EFFECTIVE DAY	DAY OVERTIME	TOTAL HOURS	OVERTIME HOURS	WORK HOUR	SUM	ACCIDENT			
		A	B	C	D	E	F	G	H	I	(H / I) x 1.000.000
1	June	30	0	144	0	8	3440	0	0	4320	0
2	July	42	0	136	0	8	7560	0	0	5712	0
3	August	62	0	136	0	8	14760	0	0	8432	0
4	September	96	0	144	0	8	22920	0	0	13824	0
5	October	135	0	152	0	8	32216	0	0	20520	0
6	November	116	0	152	0	8	26880	0	0	17632	0
7	December	135	0	152	0	8	17280	0	0	20520	0
	Total Man Hours					**125056**				**0**	

b. Severity Rate ***(b.)***

∑ ***Workday Lost Time*** for 7 months = 0 days.

Number of Workers for 7 months, Total 616 People, 8 Working Hours in 1 Day

∑ WorkHour Manpower for 7 months

Length of Work x Total Workers x Working Time 1 Day

(7 x 30) x 616 x 8 = 1,034.880 Hours

SR = (**0** / **1.034.880**) × 1,000,000 = **0** Days

Therefore, the injury severity ratio in 7 months of work is 0 days per 1,000,000 person-hours.

c. Average Time Lost Rate ***(c.)***

In calculating the Average Lost Time Rate, it is first necessary to know some of the following:

- Total Working Hours for 7 months = 1,034,880 Hours

- Number of Accidents for 7 months = 0 Cases

- Number of lost workdays = 0 Days

- Total working hours lost = 0 Hours

ALTR = (**0** / **1.034.880**) × 1,000,000 = **0** Hours

Therefore, the average lost work time over 7 months of work is 0 hours per 1,000,000 man-hours.

d. Incident Rate ***(d.)***

In calculating the Incident Rate, it is necessary first to know some of the following:

- Number of Accidents during 7 months = 0 Cases

- Number of Workers in the incident month = 0

IR = (**0** / **0**) × 100% = **0** %

So, the total percentage of work accidents over 7 months is 0%, indicating no accidents occurred during the construction period.

TABLE 2. Table Recap of Analysis Accident Rate

NO	MONTH	*MANPOWER*		*MAN HOURS*				ACCIDENT	∑ ACCIDENT WITH LOST TIME WORK (A x G)	∑ WORK HOUR MANPOWER	*FREQUENCY RATE*	*SEVERITY RATE*	*AVERAGE LOST TIME RATE*	*INCIDENT RATE*	*FREQUENCY SEVERITY INDICATOR*
		EFFECTIVE DAY	OVERTIME	TOTAL HOURS	OVERTIME HOURS	WORK HOUR	SUM								
1	June	30	0	144	0	8	3440	0	0	4320	0	0	0	0	0
2	July	42	0	136	0	8	7560	0	0	5712	0	0	0	0	0
3	August	62	0	136	0	8	14760	0	0	8432	0	0	0	0	0
4	September	96	0	144	0	8	22920	0	0	13824	0	0	0	0	0
5	October	135	0	152	0	8	32216	0	0	20520	0	0	0	0	0
6	November	116	0	152	0	8	26880	0	0	17632	0	0	0	0	0
7	December	135	0	152	0	8	17280	0	0	20520	0	0	0	0	0
Total Man Hours							**125056**				**0**	**0**	**0**	**0**	**0**

e. Frequency Severity Indicator ***(e.)***

In calculating the Frequency Severity Indicator, it is necessary to know in advance some of the following:

- Frequency Rate value = 0.0

- Severity Rate Value = 0.0

FSI = (**0,0** ***X*** **0,00**) x **1.000**)) = **0**

So, the frequency of severity in project work over 7 months is 0.

CONCLUSION

Conclusion of the research on the implementation of the construction safety management system (CSMS) by PT. Cipta Karya Multi Teknik (Case Study: construction project of the integrated center building of Sidoarjo Hospital) is:

1. Results of the performance index of the application of contractors in the implementation of development projects. The Integrated Central Building of Sidoarjo Hospital achieved 88.24%, so with this performance index, the contractor receives the title of good implementation in the construction safety management system (CSMS).
2. The results of the analysis of the work accident rate show that the Frequency Severity value, the Index (Severity Frequency Index) that occurs in the implementation of the Sidoarjo Hospital Integrated Center Building Construction Project, is 0 per 1,000,000 working hours.
3. Contractors' commitment to realize the absence of work accidents occurs so that the implementation of work carried out by contractors can be carried out properly in terms of time, quality, and cost, and avoid the sanction of work accidents and negative costs that arise if work accidents occur. Based on the analysis, the contractor has directly created a safe working environment for the public and workers and ensured the smooth implementation of construction engineering. The implementation carried out by contractors on paper receives a good CSMS implementation predicate index and successfully realizes 0 work accidents, demonstrating the impact of the commitment to the work safety plan in accordance with applicable laws and regulations.
4. This study shows that the implementation of construction work can realized with 0 work accidents with the implementation of a good occupational safety management system, however there is still a lot that can be improved from the implementation of this CSMS, including in the self-evaluation that needs to be carried out by the contractor to ensure the future implementation of the company's CSMS remains a focus to protect all lives participating in construction implementation activities. Contractors can implement the latest innovations based on the results of this research.

REFERENCES

[1] Almustofa, R., & Rahardja, E. (2014). Pengaruh Lingkungan Kerja, Motivasi Kerja, Disiplin Kerja Terhadap Kinerja Pegawai (Studi Pada Pegawai Perum Bulog Divisi Regional Jakarta) (Doctoral dissertation, Fakultas Ekonomika dan Bisnis).

[2] Badaruddin, S. et al. (2024) 'Penerapan Sistem Manajemen Keselamatan Konstruksi Pada proyek renovasi Gedung Kelas internasional Fakultas Kedokteran Universitas Hasanuddin', Journal of Applied Civil and Environmental Engineering, 3(2), pp. 42– 53. doi:10.31963/jacee. v3i2.4620.

[3] Defila, S., S, K., & S, K. (2023). The Effect of Implementation of Construction Safety Management Sytem on The Level of Work Accidents. LOGIC: Jurnal Rancang Bangun dan Teknologi. https://doi.org/10.31940/logic.v23i2.68-76.Ihsan, T., Hamidi, S. A., & Putri, F. A. (2020). Penilaian risiko dengan metode HIRADC pada pekerjaan konstruksi gedung kebudayaan Sumatera Barat. Jurnal Civronlit Unbari, 5(2), 67-74.

[4] Fountas, Grigorios & Anastasopoulos, Panagiotis & Abdel-Aty, Mohamed. (2018). Analysis of accident injury-severities using a correlated random parameter ordered probit approach with time variant covariates. Analytic Methods in Accident Research. 18. 57-68. 10.1016/j.amar.2018.04.003.

[5] Latuconsina, J. H. (2021). Analisis Pengaruh Penerapan Keselamatan Dan Kesehatan Kerja Terhadap Kinerja Pekerja Konstruksi Pada Proyek Pembangunan Terminal LPG Pressurized Wayame Ambon.

[6] Maretnowati, Reszzah & Azizi, Amris & Anjarwati, Sulfah. (2020). ANALISIS PELAKSANAAN KESELAMATAN DAN KESEHATAN KERJA (K3) PADA PROYEK PEMBANGUNAN GEDUNG K UNIVERSITAS MUHAMMADIYAH PURWOKERTO. CIVeng: Jurnal Teknik Sipil dan Lingkungan. 1. 10.30595/civeng. v1i2.9298.

[7] Martino, P., Rinawati, D. I., & Rumita, R. (2015). Analisis Identifikasi Bahaya Kecelakaan Kerja Menggunakan Job Safety Analysis (JSA) Dengan Pendekatan Hazard Identification, Risk Assessment and Risk Control (HIRARC) di PT. Charoen Pokphand Indonesia Semarang. Industrial Engineering Online Journal, 4(2).

[8] Muflihah, A.Muflihah & Nurazizah, & Wahyu, Atjo & Yusbud, Mahfuddin & Abadi, Muh. (2024). IMPLEMENTASI SISTEM MANAJEMEN KESELAMATAN KONSTRUKSI (SMKK) PADA PROYEK PEMBANGUNAN RS UPT VERTIKAL MAKASSAR TAHUN 2023. Public Health and Medicine Journal. 2. 63-70. 10.59583/pama. v2i2.110.

[9] Pangestika, Elza. (2023). Implementasi Peraturan Keselamatan dan Kesehatan Kerja (K3) pada Proyek Pembangunan Perumahan di Wilayah DIY. Jurnal Hukum Sasana. 9. 31- 40. 10.31599/sasana. v9i1.1245.

[10] Putra, W., & Saraswati, R. (2023). Analisis Implementasi Sistem Manajemen Keselamatan Konstruksi (SMKK) (Studi Kasus Pembangunan Gedung Kantor Pengadilan Negeri Sungguminasa Kelas 1a). Journal on Education. https://doi.org/10.31004/joe.v5i3.1546.

[11] R. A. Saraswati and W. D. Putra, "Analisis Pengaruh Pengetahuan K3 terhadap Perilaku Pekerja Konstruksi (Studi Kasus: Proyek Preservasi Jalan dan Jembatan Ruas Jalan Perintis Kota Makassar)," J. Educ., vol. 5, no. 4, pp. 11734–11739, 2023, doi: 10.31004/joe. v5i4.2130.

[12] R. O. P. Ningsih, "Analisis Penerapan Keselamatan Dan Kesehatan Kerja (K3) Pada Proyek Konstruksi Bangunan Tinggi di Wilayah Kecamatan Banyumanik," Skripsi Progr. Stud. Tek. Sipil, Jur. Tek. Sipil, Fak. Tek. Univ. Negeri Semarang, pp. 1–48, 2020.Safitri, S. (2021). Analisis Penerapan Audit Sistem Manajemen Keselamatan dan Kesehatan Kerja (SMK3) di PT United Tractors Tbk Surabaya (Doctoral dissertation, Stikes Bhakti Husada Mulia Madiun).

[13] Saputra, C. D., & Surahmi, M. (2022). Tanggung Jawab Para Pihak Dalam Kontrak Kerja Konstruksi Menurut Undang-Undang Tentang Jasa Konstruksi. Repertorium: Jurnal Ilmiah Hukum Kenotariatan, 11(2), 186-195.

[14] Soputan, G. E., Sompie, B. F., & Mandagi, R. J. (2014). Manajemen Risiko Kesehatan Dan Keselamatan Kerja (K3) (StudI Kasus Pada Pembangunan Gedung Sma Eben Haezar). Jurnal Ilmiah Media Engineering, 4(4).

[15] Toaha, A., Yulia, M., Babo, D. H. P., Okvitasari, A. R., Hudha, M. I., Aprilliani, C., ... & Mansida, A. (2023). Sistem Manajemen K3. Get Press Indonesia

[16] V. Zulkarnain, D. A. Saputra, N. H. Yahya, M. S. Aditya, and D. O. Radianto, "Analisis Penerapan Manajemen Keselamatan dan Kesehatan Kerja (K3) Pada Proyek Konstruksi Di Indonesia," J. Student Res., vol. 1, no. 4, pp. 157–167, 2023, [Online]. Available: https://ejurnal.stie-trianandra.ac.id/index.php/jsr/article/view/1480/1248