

# Evaluation of Implementation of Norms, Standards, Procedures, and Criterias Related to Construction Safety Management Systems in Building Construction Projects During the COVID-19 Pandemic

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**Abstract**— The Covid-19 pandemic is a “black swan” for the Indonesian Economy. Indonesia already has regulations regarding handling a pandemic issue by the relevant Ministries and Institutions, in practice several aspects are difficult to apply to the construction sectors. The project experienced obstacles ranging from providing capital, raw material difficulties, price increases, changes in contract values, conflicting regulations and policies from the regions at the construction site related to handling a pandemic, as well as an increased risk of COVID-19 transmission. For this reason, it is necessary to evaluate the application of Norms, Standards, Procedures, and Criteria (NSPC) related to Construction Safety Management Systems (CSMS). This research was conducted to evaluate the suitability and gaps in the application of NSPC related to CSMS in building construction projects. The objects of this research are buildings with high work complexity, which are projects affected by the pandemic in Indonesia, both directly and indirectly. This study was designed as a quantitative study with descriptive statistical analysis of data collected from respondents who answered a set of closed questionnaires. The results of this study indicate that the evaluation of the suitability of the application of NSPC and CSMS is said to be appropriate. Furthermore, the results of the average evaluation of the gaps in the implementation of NSPC and CSMS show that it is frequently done. The results of this study have positive implications, namely by providing safety performance assessment information that can be used as an illustration of construction implementation.

**Keywords**— Safety performance, Covid-19 pandemic, construction sector, NSPC, CSMS.

## I. INTRODUCTION

Occupational safety is a major aspect of the success of an operational work or organization. The achievement of high health and safety in the workplace is the right of everyone involved in it in addition to other normative rights [1]. Accident studies on construction projects by the National Level Construction Service Development Agency (LPJKN) in 2010 showed that the not yet optimal enforcement of laws and regulations in the form of NSPC indicated as one of the main factors causing accidents. Indonesia already has a Construction Safety NSPC tool to respond to the need for accident prevention starting from the law up to the CSMS. CSMS is part of the overall system which includes organizational structure, planning, responsibilities, implementation of procedures, processes, and resources needed for developing, implementing, achieving, reviewing, and maintaining occupational safety and health policies in the context of controlling risks related to work activities to create a safe, efficient and productive workplace. The application of CSMS aims to guarantee the safety and health of workers and other

people in the workplace, sources and production processes, and a safe and healthy work environment [2].

One of the causes of construction accidents is because it is complicated and complex [3, 4, 5]. The results of statistical analysis in several countries have concluded that the risk of work accidents in the construction industry is much higher than the average for all sectors [6]. Occupational safety and health issues in general in Indonesia have not received attention from various parties. Problems related to work safety in Indonesia are not only about the quality of policies governing work safety in the construction industry but also the extent to which these policies have been implemented in construction work in the field [7].

In a study conducted with field investigations, interviews, and questionnaires regarding the implementation of NSPC in 30 building projects in Jakarta, 6 civil projects, and 5 installation projects as well as focus group discussions with experts and construction safety practitioners carried out to identify the existence of construction safety facilities and

programs by the company; review the NSPC; identify the construction company's commitment to implementing NSPC in the aspects of people (workers), equipment, workplace (work environment), organization and management; analyze the relationship between company and client categories of construction projects with the characteristics of the implementation of the NSPC; and identify obstacles and views of construction companies in implementing NSPC. Of the 30 building projects consisting of 17 projects by state-owned construction companies, only the average application of NSPC elements was 60% of the 65 NSPC elements. For 11 projects by national private companies, the application of the NSPC elements was only 48%, while for 2 projects carried out by foreign private contractors it was very good at implementing almost all of the NSPC elements (99%) [8]. The results of statistical analysis in several countries concluded that the risk of work accidents in the construction industry is much higher than the average for all sectors (Suraji et al., 2000). The impact of work accidents is quite large, apart from loss of life and decreased quality of life for workers, work accidents in construction projects also cause project delays, increase project costs, medical expenses, and other negative consequences (Rafindadi et al., 2022). Occupational safety and health issues in general in Indonesia have not received attention from various parties [8]. Problems related to work safety in Indonesia are not only about the quality of the policies governing work safety in the construction industry but also the extent to which these policies have been implemented in construction work.

This research reviews projects in general according to the zoning of areas affected by Covid-19 in Indonesia. In the course of the research process, it was determined that there were 5 ongoing construction projects during the Covid-19 pandemic in Indonesia which were used as reference objects for research validation, but only 2 projects expressed approval to research these projects.

Occupational safety evaluation is mandatory for every construction company. However, this is not a rigid scheme, in which developments continue to be made to increase the effectiveness of safety performance in the construction sector. During the Covid-19 pandemic, the world made work adjustments to reduce the risk of transmission of the coronavirus [9]. The same goes for building construction companies. Therefore, it is considered necessary to specifically study how the safety performance and cost performance of

construction companies can survive carrying out building construction during the Covid-19 pandemic.

Several journals discuss the increase in work safety risks in building construction companies, especially related to the transmission of the coronavirus in fieldwork areas [10, 11, 12, 13]. Cost performance was also one of the factors affected during the Covid-19 pandemic. Increases in raw material prices, additional expenses related to the procurement of personal protective equipment, and various other adjustments also affect cost performance [14, 15].

The complexity of the problems in the building construction sector is inseparable from the socioeconomic aspects that occurred as a result of the entry of Covid-19 into Indonesia. The Covid-19 pandemic has become a "black swan" phenomenon for the Indonesian economy. Many infrastructure developments are facing capital difficulties due to frozen investments, raw material difficulties due to export-import disruptions at the start of the pandemic, price hikes, and clashes in regulations and policies from regions in construction sites. These various problems ultimately made some projects fail to deal with conditions due to the pandemic while others tried to survive by stopping the construction process for a while and trying to make adjustments by changing work contracts [16].

The description above shows that the phenomenon of the Covid-19 pandemic in Indonesia has had a significant impact on the construction sector. One of the most pronounced impacts is the emergence of obstacles that are difficult to overcome during project implementation in the field. The workers in several projects are not facilitated for their daily needs, so they still have to leave the project location to get logistics and consumption. Some of these daily workers live in the same location, without barriers between rooms, thereby increasing the risk of transmission [11, 12, 17, 18, 19, 20, 21].

Based on the problems that occurred as explained earlier, it is necessary to evaluate the suitability and gaps in the application of NSPC related to CSMS in building construction projects. This study focuses on evaluating the suitability and gaps in the application of NSPC related to CSMS in building construction projects. This research is limited to construction objects that will be examined, namely only building construction. This

research has positive implications, namely by providing safety performance assessment information that can be used as an illustration of construction implementation.

## II. METHODOLOGY

### A. Research Design

This research is quantitative. The quantitative approach in this study is intended to find out the respondent's data regarding the implementation of the NSPK in the field in real terms and can be proven scientifically which has

been accepted for truth to be used as a reference in seeking further truth.

### B. Variables

The variables of this study consist of 2 variables namely NSPC (X1) and CSMS (X2). Variable X1 consists of 4 indicators Norms, Standards, Procedures, and Criteria. The variable X1 in this study is presented in Table 1 below:

Table 1. NSPC Variables (X1)

Variable		Indicator		References
Code	Variable Name	Code	Indicator	
X1	Norms, Standards, Procedures, and Criteria (NSPC)	X.1.1	Norms	UU No 2/2017 about Construction Services, Article 59, Paragraph 2
		X.1.2	Standards	UU No 2/2017 about Construction Services, Article 59, Paragraph 3
		X.1.3	Procedures	Permen PUPR No. 21/PRT/M/2019 about Guidance of CSMS, Paragraph 7
		X.1.4	Criteria	UU No. 1/1970 about Occupational Safety, Paragraph 3

Variable X2 consists of 5 indicators Leadership and Workers' Participation, Construction Safety Planning, Construction Safety Support, Construction Safety

Operation, and Performance Evaluation of CSMS Implementation. The variable X2 in this study is presented in Table 2. below:

Table 2. CSMS Variables (X2)

Variable		Indicators		Reference
Code	Variable Name	Code	Indicators Name	
X2	Construction Management Safety Systems (CSMS)	X.2.1	Leadership and Workers' Participation	Permen PUPR No. 10/2021 about Guidance of CSMS, paragraph 7
		X.2.2	Construction Safety Planning	Permen PUPR No. 10/2021 about Guidance of CSMS, paragraph 8
		X.2.3	Construction Safety Support	Permen PUPR No. 10/2021 about Guidance of CSMS, paragraph 9
		X.2.4	Construction Safety Operations	Permen PUPR No. 10/2021 about Guidance of CSMS, paragraph 10
		X.2.5	Performance Evaluation of CSMS Implementation	Permen PUPR No. 10/2021 about Guidance of CSMS, paragraph 11

### C. Stage of The Research

The stages of the research carried out were starting with conducting a literature study, then compiling a questionnaire, conducting expert validation, and surveying respondents. After the data is collected, the data is then processed and analyzed.

### D. Data Resources

The data in this study are primary data taken directly from experts and respondents.

### E. Research Objects

This research reviews projects in general according to the zoning of areas affected by Covid-19 in Indonesia. In the course of the research process, it was determined that there were 5 ongoing construction projects during



the Covid-19 pandemic in Indonesia which were used as reference objects for research validation, but only 2 projects expressed approval to research these projects. The two projects that are willing to be used as validation objects in this study are the construction of the Sheikh Zayed Grand Mosque project in Solo and the construction project of The Newton 2 Apartments in Ciputra World 2 Jakarta.

The two projects are considered to be quite representative as objects of research validation, in addition to a general review through a quantitative approach to all construction projects affected by the Covid-19 pandemic, both ongoing and completed. In the assessment through interviews, it is known that there are obstacles to the implementation of construction in the field due to the impact of the Covid-19 pandemic which had not been predicted.

#### **F. Experts and Respondents**

The sampling technique used is NonProbability Sampling which is a sampling technique that does not provide equal opportunities/opportunities for each element or member of the population to be selected as a sample [22].

In line with the Project Management Institute which requires Expert Judgment as one of the Tools and Techniques in determining Project Performance [23].

Considering the explanation from the Project Management Institute, in this study, each expert respondent must-have conditions to be used as a research sample. The provisions for experts consulted in the data collection phase 1 are as follows:

1. Respondents are experts/experts in the number of three to five people.
2. Respondents have a minimum education degree in engineering.
3. Respondents are experienced experts in the field of building construction and construction safety
4. Respondents are academics, professional associations, and practitioners in the field of building construction and have at least 15 years of professional experience.
5. Respondents have work skills certificates and or mid-level professional engineers.

Furthermore, the requirements for respondents who will be involved in answering the questionnaire are as follows:

1. The respondents were 100 people.
2. Respondents have a minimum education diploma in engineering.
3. Respondents are experienced experts in the field of building construction and construction safety
4. Respondents are academics, professional associations, and practitioners in the field of building construction and have at least 5 years of professional experience.
5. Respondents have certificates of work skills at the junior level and or professional engineers at the primary level.

#### **G. Analysis**

The data analysis method that will be used at this stage to answer research questions is the Delphi analysis method, to obtain accurate results from the opinions of experts.

The primary data obtained from the variable measurement results are nominal, so a descriptive analysis is carried out with location size in the form of data mode and variation size, namely in the form of frequency according to the category in relative and absolute terms. In the survey of respondents, the results of the analysis will be carried out descriptively analysis to provide an overview of the gaps in the implementation of NSPC and CSMS.

### **III. RESULT AND DISCUSSION**

#### **A. The Suitability in The Application of NSPC**

The suitability in the application of NSPC related to CSMS is judged by the experts or expert judgment [23]. The experts come from practitioners who work for the government, construction companies or contractors, and construction professional associations.

The positions of experts in the places where they work are General Managers, Presidents, Experts from the Ministry of Public Works and Public Housing, as well as experienced managers of construction companies. The length of their work experience varies from 15 years to 35 years.

Their minimum education is a bachelor's degree, then a master's degree to a doctoral degree. Table 3. below describe the profiles of the experts.

**Table 3. Experts Profile**

No	Institution	Position	.Work. Exp	.Edu
P1	Contractor	General Manager HSE	Years 29	Master Degree
P2	Professional Association	President	Years 30	Bachelor Degree
P3	Government	Executive Expert	Years 34	Doctoral Degree
P4	Government	Senior Expert	Years 15	Doctoral Degree
P5	Contractor	Site QHSE Manager	Years 15	Bachelor Degree

The results of the analysis show that each indicator, be it Norms, Standards, Procedures, and Criteria on the NSPC variable (X1) shows mode 1 with a frequency of 100%. This means that 100% of experts think that the NSPC is following its implementation. The same thing is also shown in the analysis of CSMS variables (X2). Each indicator on this variable, namely Leadership and Workers' Participation, Construction Safety Planning, Construction Safety Support, Construction Safety Operation, and Performance Evaluation of CSMS, shows mode 1 with a frequency of 100%. This means that 100% of experts agree and think that these indicators are following their implementation. The complete analysis results are presented in Table 4 below.

The Indonesian government has issued Regulation of the Minister of Public Works and Public Housing No. 21/PRT/M/2019 as an effort to regulate CSMS. This is important in its application in companies as a form of labor rights and the creation of a healthy work atmosphere and environment. CSMS is an important part that cannot be separated in the labor protection system, especially construction workers. CSMS can minimize loss of working hours, morale, especially avoiding work accidents and improve labor safety in carrying out work, especially in the construction sector. Ministerial Regulation No. 21/PRT/M/2019 of 2019 concerning CSMS Guidelines are required by the Government to implement this.

**Table 4. Results of Suitability Analysis**

Variable		Indicator		Mode	Frequency	Conclusion
Code	Name	Code	Name			
X1	Norms, Standards, Procedures, and Criteria (NSPC)	X.1.1	Norms	1	100%	Yes
		X.1.2	Standards	1	100%	Yes
		X.1.3	Procedures	1	100%	Yes
		X.1.4	Criteria	1	100%	Yes
X2	Construction Safety Management Systems (CSMS)	X.2.1	Leadership and Workers' Participation	1	100%	Yes
		X.2.2	Construction Safety Planning	1	100%	Yes
		X.2.3	Construction Safety Support	1	100%	Yes
		X.2.4	Construction Safety Operations	1	100%	Yes
				1	100%	Yes
X.2.5	Performance Evaluation of CSMS	1	100%	Yes		

### B. The Gaps in The Application of NSPC

Data analysis was carried out based on the results of a survey of 100 respondents with different backgrounds. Based on the survey results, 4 respondents had diploma degrees, 58 bachelor's degrees, 36 master's degrees, and 2 doctoral degrees. The job position category shows 45 people as managers, 6 people as assistant managers, and 49 people as supervisors or equivalent. The experience of the respondents also varied, starting from 5-10 years

for as many as 29 people, 11-20 years for as many as 66 people, and more than 20 years for as many as 5 people. The profile of respondents based on their background category is presented in Table 5. below. The survey results of 100 respondents were analyzed descriptively. Descriptive analysis was carried out to find the average conclusion for each indicator and variable. The results of the analysis show that the data are not normally

distributed, so the median value is taken as a determinant of conclusions based on the assessment category.

Occupational safety issues in the construction industry have been regulated by the government in several policy products. National policy is a series of rules that can be in the form of NSPC determined by the Government as a procedure for administering government affairs based on PP No. 38/2007 article 1. Norms are rules or provisions regarding a matter. Standard is a reference used as a benchmark for these conditions. A procedure is a method or procedure for determining something. A criterion is a measure used to judge something. In the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia No. 21/PRT/M/2019 concerning Guidelines for Construction Safety Management Systems it states that Construction Work Supervisors are a support team appointed/assigned by Service Users who are responsible for supervising Construction Works and compliance with norms, standards, procedures and criteria.

Next, the NSPC mapping will be presented in the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia No. 10/2021 concerning Guidelines for Construction Safety Management Systems, Circular Letter No. 10/SE/M/2022 concerning Guidelines for Orderly Operational Implementation of Construction Safety at the Ministry of Works Public and Public Housing, and

Instruction of the Minister of Public Works and Public Housing No. 02/IN/M/2020 concerning Protocols to Prevent the Spread of Corona Virus Disease 2019 (Covid-19) in the Implementation of Construction Services which are mapped based on each aspect.

The results of the analysis of 100 survey respondents on the NSPC variable (X1) consisting of 4 indicators show that the Norms indicator produces an average of 4.51 or a median of 5.00 so it can be concluded that these indicators are constantly implemented. The Standards indicator shows an average of 4.24 and a median of 4.00 so it can be concluded that these indicators are implemented frequently. Indicator Procedures show an average of 4.47 and a median of 5.00 so it can be concluded that these indicators are constantly implemented. The Criteria indicators show an average of 4.22 and a median of 4.00 so it can be concluded that these indicators are implemented frequently.

Safety management systems are comprehensive and systematic business methods for managing safety risks. It should contain safety policies, planning, control, communication, training, and incentives for employee participation [24, 25]. The most dangerous part of the construction industry is due to the nature of the work resulting from the integration of the environment, tools, and various human factors [26]. Construction projects have one of the highest accident incidence rates compared to other industries [27].

*Table 5. Respondents Profile*

No	Respondent Category	Number of Respondents
<b>A</b>	Educational Background	
1	Diploma	4
2	Bachelor Degree	58
3	Master Degree	36
4	Doctoral Degree	2
<b>Total</b>		100
<b>B</b>	Position	
1	Manager	45
2	Assistant Manager	6
3	Supervisor	49
<b>Total</b>		100
<b>C</b>	Working Experience	
1	5 - 10 Years	29
2	11 - 20 Years	66
3	> 20 Years	5
<b>Total</b>		100

*Table 6. Results of Gaps Analysis*

Variable		Indicator		Descriptive Analysis							Conclusion
Code	Name	Code	Name	N	Min	Max	Sum	Mean	Med	Mo	
<b>X1</b>	Norms, Standards, Procedures, and Criteria (NSPC)	X.1.1	Norms	100.00	3.00	5.00	451.00	4.51	5.00	5.00	Constantly
		X.1.2	Standards	100.00	3.00	5.00	424.00	4.24	4.00	4.00	Frequently
		X.1.3	Procedures	100.00	2.00	5.00	447.00	4.47	5.00	5.00	Constantly
		X.1.4	Criteria	100.00	3.00	5.00	422.00	4.22	4.00	4.00	Frequently
<b>X2</b>	Construction Safety Management Systems (CSMS)	X.2.1	Leadership and Workers' Participation	100.00	3.00	5.00	436.00	4.36	4.00	5.00	Frequently
		X.2.2	Construction Safety Planning	100.00	2.00	5.00	417.00	4.17	4.00	4.00	Frequently
		X.2.3	Construction Safety Support	100.00	2.00	5.00	418.00	4.18	4.00	4.00	Frequently
		X.2.4	Construction Safety Operations	100.00	2.00	5.00	411.00	4.11	4.00	4.00	Frequently
		X.2.5	Performance Evaluation of CSMS	100.00	3.00	5.00	410.00	4.10	4.00	4.00	Frequently

Many studies have shown the possibility of reducing (by 40% to 60%) or even eliminating risks and accidents by addressing safety through the design and concept design stages for construction safety [24]. In addition, the previous research states that by applying design concepts for construction safety, the benefits that can be obtained increase productivity, and minimize work costs and significant risks [24].

Furthermore, the results of the analysis on the CSMS variable (X2) with 5 indicators. The Leadership and Workers Participation indicators show an average of 4.36 and a median of 5.00 so it can be concluded that these indicators are frequently implemented. The Construction Safety Planning indicator shows an average of 4.17 and a median of 4.00 so it can be concluded that these indicators are implemented frequently. The Construction Safety Support indicator shows an average of 4.18 and a median of 4.00 so it can be concluded that the indicator is implemented frequently. The Construction Safety Operations indicator shows an average of 4.11 and a median of 4.00 so it can be concluded that the indicator is implemented frequently. And the last indicator Performance Evaluation of CSMS shows an average of 4.10 and a median of 4.00 so it can be concluded that this indicator

is implemented frequently. The results of the analysis of variables 1 and 2 are presented in Table 6.

#### IV. CONCLUSION

Based on the results of the analysis, 2 main points can be concluded, namely:

1. The results of the evaluation of the suitability of the application of NSPC and CSMS in building construction projects show that the application of NSPC and CSMS is following Government Regulations in building construction projects during the pandemic.
2. The results of evaluating the gaps in the implementation of NSPC and CSMS in building construction projects show that the application of NSPC and CSMS is appropriate compared to Government Regulations in building construction projects during the pandemic.

This research can be used as a reference by the government, consultants, contractors, and the construction service community for the application of NSPC and CSMS in other similar construction projects. However, due to limited resources in this study, this research cannot be generalized to cases of other construction projects such as roads, bridges,



waterworks, and others. This research can also be developed for types of construction other than buildings. This research can be developed by creating a comprehensive model so that it can thoroughly know the root of the problem and a good follow-up plan.

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