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IMPLEMENTATION OF CONSTRUCTION SAFETY MANAGEMENT SYSTEM ON CONSTRUCTION PROJECTS IN INDONESIA (CASE STUDY: BRIDGE REPLACEMENT IN BANGKA REGENCY, BANGKA BELITUNG PROVINCE)

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Abstract: **The Construction Safety Management System is part of the construction work implementation management system to ensure the realization of construction safety, security, safety, health and sustainability standards which are technical guidelines for security, safety, construction workplace health and labor social protection and local environment and environmental management in the implementation of construction services. Safety targets or objects consist of the work environment, the project affected environment, the natural environment and the built environment. The analysis of the Construction Work Plan for Service Providers on Bridge Replacement Works in Bangka Regency, Bangka Belitung Province which is reviewed in this discussion is that the identification of the level of risk that has been stated in the Construction Work Plan Document for Bridge Replacement Works has been detailed and can be used as a reference in the implementation in the field. so that the fulfillment of security, safety, health and sustainability standards that ensure the safety of construction engineering, labor safety and health, public safety and environmental safety can be maintained. An assessment of the implementation of Construction Safety on Bridge Replacement Works by Service Users has been carried out, from the results of the assessment there are still things that need to be improved continuously. Implementation of Construction Safety on Bridge Replacement Work has been carried out in accordance with the mandate of the legislation, but it still needs to be continuously improved so as to get maximum results.**

I. INTRODUCTION

Background

The policy direction for developing strategic areas through accelerating the growth of regional economic centers by maximizing the benefits of agglomeration, exploring regional potentials and advantages makes the development of the construction world increasing day by day. Transportation connectivity can create smoothness and convenience for the community so that it will stimulate economic growth, therefore construction companies must further improve the achievement of work success in terms of cost, quality, time and ensure that the construction safety management system is an inseparable part of the process. the implementation of the contract can be carried out in accordance with the mandate of the legislation.

Construction safety is an activity to guarantee and protect the safety and health of workers through the prevention of work accidents and occupational diseases. Companies or organizations that will or have implemented a Construction Safety Management System are expected to increase the effectiveness of planned, measurable, structured and integrated occupational safety and health protection which can then prevent and reduce work accidents and occupational diseases by involving elements of management and workers and can create a safe, comfortable and efficient workplace to boost productivity.

The Construction Safety Management System is part of the construction work implementation management system to ensure the realization of construction safety. security, safety, health and sustainability standards which are technical guidelines for security, safety, health in the construction workplace and social protection of workers as well as local environmental management and environmental management in the implementation of construction services [1].

Construction safety is all engineering activities to support construction work in realizing the fulfillment of security, safety, health and sustainability standards that ensure construction engineering safety, labor safety and health, public safety and environmental safety. Safety targets or objects

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consist of the work environment, project affected environment, environmental only nature and the built environment.

Problem Formulation

To realize the fulfillment of security, safety, health standards and to ensure the safety of construction engineering, labor safety and health, public safety and environmental safety for construction contract work, service providers must prepare a construction work plan that contains elements of the Construction Safety Management System consisting of leadership and workforce participation in construction safety, construction safety planning, construction safety support, construction safety operations and performance evaluation of the implementation of the Construction Safety Management System. In this regard, the formulation of the problem to be described is:

1. Has the risk level identification been carried out?
2. How do Service Users evaluate the implementation of the Construction Safety Management System?
3. Has Construction Safety been implemented in accordance with the statutory mandate?

Research Objectives

Analysis of the implementation of the Construction Safety Management System aims to:

1. Knowing the level of risk in Bridge Replacement Works;
2. Knowing the assessment of the implementation of Construction Safety Management System on Bridge Replacement Works;
3. Knowing whether the Construction Safety Management on Bridge Replacement Works has been carried out in accordance with the mandate of the legislation.

II. LITERATURE REVIEW

Construction work is the whole or part of the activities that include the construction, operation, maintenance, demolition and rebuilding of a building. The implementation of construction services aims to provide a direction for the growth and development of construction services in order to create a strong, reliable, highly competitive business structure and quality construction service results, to create an orderly operation of construction services that ensures equality of position between service users and service providers in exercising their rights and obligations. obligations and improve compliance in accordance with the provisions of laws and regulations, realize increased public participation in the field of construction services, organize a construction service system that is able to realize public safety and create a comfortable built environment, ensure good governance for the implementation of construction services and create added value integration from all stages of the implementation of construction services [8].

Every worker has the right to be protected for his safety in doing work for the welfare of life and increasing national production and productivity, for this that everyone who is in the workplace needs to be guaranteed his safety, every source of production needs to be used and used safely and efficiently [10]. Referring to the foregoing, workers/laborers can apply for termination of employment in the case of employers if they provide work that endangers the life, safety, health, and morals of workers/laborers while the work is not stated in the work agreement [7]. Occupational health is organized to realize optimal work productivity which includes occupational health services, prevention of occupational diseases and occupational health requirements, therefore every workplace is obliged to provide occupational health [9].

Laws and regulations have established work safety requirements to prevent and reduce accidents, prevent, reduce and extinguish fires, prevent and reduce the danger of explosions, provide opportunities or ways to save yourself during fires or other dangerous events, provide assistance in accidents, provide personal protective equipment to workers, prevent and control the emergence or spread of temperature, humidity, dust, dirt, smoke, steam, gas, wind gusts, weather, light or radiation, sound and vibration, prevent and control occupational diseases both physical and psychological, poisoning, infection and transmission, obtaining adequate and appropriate lighting, maintaining a good temperature and humidity of air, conducting adequate air freshening, maintaining cleanliness, health and order, obtaining harmony between the workforce, work tools, the environment, ways and processes of work, securing and protecting smooth transportation of people, animals, plants or goods, secure and maintain all types of buildings, secure and expedite loading and unloading work, treatment and storage of goods, prevent exposure to dangerous electric currents, adjust and improve security in jobs where the danger of accidents increases. [10].

The determination of the level of risk and the rating of the business scale is obtained based on the assessment of the level of danger and the potential for the occurrence of hazards. The hazard level assessment is carried out on aspects of health, safety, environment and/or resource utilization and management. The hazard level assessment is carried out by taking into account the type of s business activities, criteria for business activities, location of business activities, limited resources and/or risk of volatility. The assessment of the potential for a hazard to occur includes almost impossible, unlikely, probable, and almost certain. Based on the assessment of the hazard level and the assessment of the potential for hazards, the risk level and business scale rating of business activities are determined to be low-risk business activities, medium-risk business activities, and high-risk business activities [4]

III. RESEARCH METHODS

The research was carried out on Bridge Replacement Works at the location of Ridding Panjang Village, Belinyu Regency, Bangka Belitung Province, which has a contract on March 14, 2022 and the implementation period ends on December 31,

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2022. This research was carried out for 4 months, starting in March 2022 until July 2022.

The data used in this study are in the form of primary data and secondary data, primary data obtained from observations or direct observations at the project site and interviews with the UKK (Occupational Safety Unit) leadership. For secondary data in the form of organizational structure, standards/procedures and regulations regarding construction safety and a list of Personal Protective Equipment (PPE) used at the research site as well as literature study used as supporting data.

The stages and research procedures to be carried out are the preparation stage for the implementation of the research, starting with a site survey to review cases that occur in the field, then formulating the research background, research problems and research objectives, then conducting a literature study which is used as material and guidelines for this research. Next is the stage of collecting location survey data, collecting data and documents regarding guidelines/standards and regulations regarding Construction Safety Management System applied at the project site as well as conducting a literature study as supporting data and conducting data analysis. Data analysis methods are carried out by compiling, discussing and evaluating data. -data and results of interviews/observations regarding the Construction Safety Management System at the project site.

The identification of the level of risk is contained in a detailed table regarding occupational risks, hazard specifications and their effects on labor, equipment, materials, public and the environment [1].

An audit is an effort to find discrepancies in the system to measure the effectiveness of the implementation of the management system through an internal audit containing procedures and/or internal audit work instructions signed by the relevant expert or the Person in Charge of Construction Safety and the Management Representative.

Table -1 Inspection Sheet for Service Providers – Contractors Safety Consctruction Plan Documents

No.	Criteria	Observation Result	Category Findings		
			Fit to	Minor	Major
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	Leadership Of Worker Participation In Construction Safety				
2	Construction Safety Planning				
3	Construction Safety Support				
4	Construction Safety Operation				
5	Construction Safety Performance Evaluation				

*Source: Ir. Lazuardi Nurdin (Chairman of the Association of Indonesian Construction Safety Experts – PAKKI)

Internal audits are carried out and determined periodically by the Construction Work Executor by involving an independent auditor. Internal audit is carried out at least 1 time in 1 construction work implementation following the applicable laws and regulations.

Table -2 Recapitulation of the Assessment Results of the Contractors Safety Consctruction Plan Inspection of Service Providers – Contractors

No.	Element	Assessment Quality (%)	Value (%)
(1)	**(2)**	**(3)**	**(4)**
1	Worker Leadership and Participation in Construction Safety	25	20
2	Construction Safety Planning	20	18
3	Construction Safety Support	15	11
4	Construction Safety Operation	30	25
5	Construction Safety Performance Evaluation	10	5
		Total	**79**

*Source: Ir. Lazuardi Nurdin (Chairman of the Association of Indonesian Construction Safety Experts – PAKKI)

Implementation of Construction Safety on Bridge Replacement Work must be carried out in accordance with the mandate of the legislation, the implementation of the Construction Safety Management System is carried out optimally as outlined in the Construction Safety Plan report

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that has been checked and approved by the Work Supervisor and Service User [1].

Table -3 Construction Safety Report Approval Sheet

Services Provider	Services Supervisor	Services User
Created by ---------- (Job Title) signature ---------- (Full Name) (Signed by the highest rank chief of Services Provider)	Verified by ---------- (Job Title) signature ---------- (Full Name) (Signed by the highest rank chief of Services Supervisor)	Approved by, Services User (Person In Charge of Activities) signature ---------- (Full Name) Employee Reg. No…….. (Signed by the Services User after giving approve at the pre construction meeting)

IV. RESULTS AND DISCUSSION

The Bridge Replacement Work Location is a busy traffic flow that connects Belinyu Regency on the Lumut - Tanjung Gudang Road to Bangka Regency and the Capital City of Pangkalpinang, for this the Service Provider has committed to implementing a Construction Safety Management System and participating in construction safety. The Service Provider has determined internal and external issues that may affect the implementation of the Construction Safety Management System, namely:

1. An indication of work delays if the process of mobilizing tools and materials to the location is not on time, their wishes and expectations are that these activities are carried out according to a predetermined schedule and the equipment that arrives at the location is in good condition (internal issue).
2. The outbreak of the Covid-19 outbreak that has an impact on the health of workers so that it will result in work delays, for this every worker must follow health protocols by keeping a distance, using masks, washing hands and always maintaining health (external issues).
3. The occurrence of traffic obstacles due to the narrowing of the road due to development activities so that there is a risk of accidents, this must be done adequate traffic control and signs to avoid congestion so that public activities are not disturbed (external issue).

To realize the implementation of construction safety, the Service Provider has established a Construction Safety Management System management organization, the Service Provider appoints the person in charge of the Construction Safety Management System manager who has competence in his/her field to be responsible for the administration and operational management of construction safety, where the head of the Construction Work Unit in charge has been assigned. prepare construction safety targets and programs set by the Director, in addition the Service Provider carries out construction safety handling, prepares plans for socialization, training and simulations as a follow-up to the implementation of construction safety programs, prepares emergency response procedures, is responsible for carrying out daily construction safety inspections and coordinating implementation of construction safety to all lines of the organization.

As a form of construction safety policy, the service provider has made a construction safety commitment which has been signed by the highest leadership of the service provider and has been communicated to all stakeholders, both internal and external stakeholders, the contents of the construction safety commitment include:

1. Comply with the provisions of Construction Safety;
2. Using a certified competent workforce;
3. Using equipment that meets eligibility standards;
4. Using materials that meet quality standards;
5. Using technology that meets eligibility standards;
6. Implement Standard Operations and Procedures (SOP);
7. Meet the 9 (nine) cost components of the implementation of the Construction Work Management System.

The Service Provider has determined hazard identification, risk assessment, control and opportunity as well as conducting

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a review in the event of a work accident, both minor, moderate and serious accidents as well as communicating to all employees and construction workers regarding the construction safety targets that have been set, identifying the hazards of Bridge Replacement work. is as follows:

1. Work of digging channels for sewers, identification of danger is being hit by heavy equipment which results in minor injuries and serious injuries;
2. Structural excavation work, hazard identification is being hit by heavy equipment and being crushed by a pile which results in minor injuries and serious injuries;
3. Cleaning and stripping work, identification of hazards is being hit by heavy equipment which results in minor injuries and serious injuries;
4. Aggregate Foundation Layer work of class A, class B, class S, the identification of hazards is being exposed to heavy equipment and exposed to air pollution which results in minor injuries, serious injuries and shortness of breath;
5. In the work of adhesive and bonding layers, the identification of hazards is exposure to prime coat, takecoat splashes and air pollution which causes burns and shortness of breath;
6. Asphalt work, the identification of hazards is being exposed to heavy equipment, exposed to air pollution, hot asphalt splashes resulting in minor injuries, serious injuries and shortness of breath and polluted the surrounding environment;
7. Concrete work with quality fc' 30, fc' 20, fc' 15 and fc'10, identification of hazards is being exposed to heavy equipment, exposed to concrete mixtures that cause skin irritation, visual impairment and blindness;
8. Reinforcing steel work, the identification of hazards is being pierced by an iron tip, hitting the head and legs being hit by steel which results in serious injuries, minor injuries and sprains;
9. The work of piling the culm wood hazard identification is exposed to heavy equipment which results in minor injuries and serious injuries;
10. Concrete drill pile work, diameter 800 mm, hazard identification is exposed to heavy equipment and air pollution which results in minor and serious injuries;
11. Stone masonry work, hazard identification is being hit by heavy equipment which results in minor injuries and serious injuries;
12. In the work of masonry, the identification of danger is being hit by heavy equipment which results in minor injuries and serious injuries;
13. Concrete demolition work, hazard identification is exposed to tools that cause minor injuries;

Construction safety targets at each function and stage of construction work are made to be consistent with construction safety policies and can be measured, implemented in the field by communicating to all employees and construction workers regarding the established construction safety targets and evaluating the construction safety targets that have been set. and ensure the construction safety program is implemented, the communication program is as follows:

Table -4 Communication Program and Employee Participation

No	Communication Media	Discussion	Schedule /Period	Participant/Audienc /Target	Officer /Leader	Place
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
1	Poster,banner K3	The jargon of enthusiasm to maintain awareness of the importance	During the implementati on period Jobs	All workers and visitors	Safety Officer	Strategic places that are easy to see
2	Safety Morning Talk	about the dangers in carrying out work and the importance of continuing to use PPE during work for safety at work	every Monday morning for 5 - 15 minutes	All foremen, builders, workers, operators.	Safety Officers, Main Foreman,Subc ontractors	Meeting Point equipped with speakers
3	Toolbox Meeting	Dangers and ways to deal with work accidents in certain jobs	At any time Setiap saat diperlukan	a group of workers is needed for certain types of work	Safety Officer, Main Foreman, Subcontractors	Meeting Point equipped with speakers

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Identification of the implementation of construction safetjiky regulations and standards in the implementation of the Construction Safety Management System related to the procurement of Personal Protective Equipment (PPE) and Work Protective Equipment is carried out continuously and there are resources that support the implementation, maintenance, and continuous improvement of the Construction Safety Management System. The Service Provider has provided competent and certified construction safety personnel and has trained Emergency Response Officers and First Aid officers. Construction safety communication procedures based on safety communication SOPs are carried out according to schedule during construction activities. Documented work procedures and instructions related to construction safety operations as well as controlling construction safety risks by eliminating hazards, replacing processes, operations, materials, or equipment with non-hazardous ones, performing technical engineering, performing administrative controls and using adequate personal protective equipment, providing PPE, APK according to the hazard conditions and the number of workers in the field, placing signs based on the hazard and level of construction safety risk and making safe and sturdy temporary construction related to the prevention of environmental hazards.

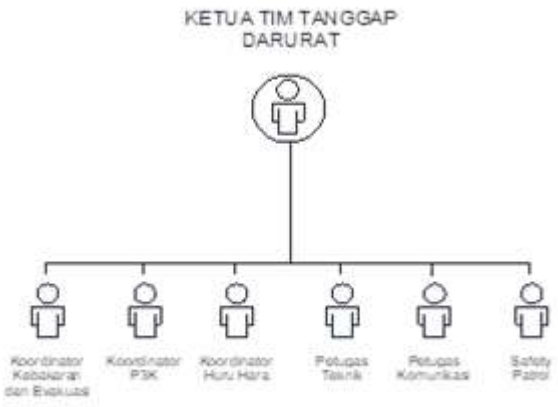

Fig. 1. Emergency Response Organization

In operating heavy equipment in the field, they have a valid operating license (SILO) and a competent operator (have SIO and have photos of workers attached to the equipment). The Service Provider provides and prepares first aid for accidents (P3K) and first aid kits, conducts monitoring related to the implementation of construction safety and evaluation of compliance and ensures that all equipment that requires accuracy in measurements is calibrated to ensure measurements are in accordance with applicable standards.

Fig. 2. First aid kit

To ensure the Construction Safety Management System runs according to the laws and regulations, an internal audit related to the implementation of construction safety is carried out and a construction safety management review for continuous improvement, an audit by conducting construction safety inspections and construction safety patrols is carried out during the implementation period as the person in charge of activities. Construction K3 Expert, with the following schedule.

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Table -5 . Inspection Schedule

No.	Activities	Leader In Charge	Months									
			1	2	3	4	5	6	7	8	9	10
(1)	**(2)**	**(3)**	**(4)**									
1	Construction Safety Inspection K3	K3 Constructio n Expert										
2	Construction Safety Patrol K3 Expert Construction	K3 Constructio n Expert										
3	Internal audit Construction K3 Expert	K3 Constructio n Expert										

The Service User is obliged to always conduct a review of the implementation of construction safety both in the field and to submit evidence of the implementation of the activity in the form of a report equipped with time and documentation of activities. On this matter, an assessment has been made based on the criteria and the results of observations that have been made.

Table -6. Construction Safety Management System Examination Sheet

No.	Criteria	Observation Result	Category Findings		
			Fit to	Minor	Major
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	**LEADERSHIP OF WORKER PARTICIPATION IN CONSTRUCTION SAFETY**		v		
1.1	The leadership's concern for internal and external issues		v		
1.2	Construction Safety Commitment		v		
2	**CONSTRUCTION SAFETY PLANNING**		v		
2.1	Hazard identification, risk assessment, controls and opportunities		v		
2.2	Action plan (target and program)		v		
2.3	Standar and Support		v		
3	**CONSTRUCTION SAFETY SUPPORT**			v	
3.1	Resource		v		
3.2	Competency		v		
3.3	Concern		v		
3.4	Communication		v		
3.5	Dokumented Information			v	
4	**CONSTRUCTION SAFETY OPERATION**		v		
4.1	Construction Safety Planning		v		
5	**CONSTRUCTION SAFETY PERFORMANCE EVALUATION**		v		
5.1	Monitoring, Measurement and Evaluation			v	
5.2	Internal Audit			v	
5.3	Management Review		v		

The assessment is based on the results of the implementation of the Construction Safety Management System which consists of leadership and worker participation in construction safety, construction safety planning, construction safety

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support, construction safety operations and evaluation of construction safety performance. Based on the results of a good assessment do document and implementation in the field, the service provider has carried out the Safety Consctruction Plan implementation procedure but still needs improvement, as follows:

1. Documented information; Service Providers are required to have manuals, procedures, work drawings, Work Instructions, and documents needed at the workplace, for this the service provider has not submitted work instructions, and the work instructions are not prepared at the Keet Board of Directors.
2. Monitoring Measurement and Evaluation; Service providers are required to carry out monitoring related to the implementation of construction safety and evaluation of compliance. The service provider must ensure that all required equipment, accuracy in measurements are calibrated. The service provider ensures that the construction safety performance is carried out according to the applicable standards, in this regard the service provider has not documented the results of monitoring and measurement as well as reports related to the monitoring and evaluation there are still corrections.
3. Internal Audit Service providers are required to conduct an internal audit related to the implementation of construction safety and the results of the internal audit are documented, related to this, there are still corrections to the monitoring and evaluation reports and documentation.

Assessment of each element with the following values:

1. For an assessment with a result of 80 < total value < 100 is a satisfactory category
2. For an assessment with a result of 60 < total value < 80 is a good category
3. For an assessment with a total score of <60 is bad

Table -7. Construction Safety Management System Assessment Sheet

No.	Elemen	Bobot Penilaian (%)	Nilai (%)
(1)	(2)	(3)	(4)
1	Worker Leadership and Participation in Construction Safety	25	20
2	Construction Safety Planning	20	18
3	Construction Safety Support	15	11
4	Construction Safety Operation	30	25
5	Construction Safety Performance Evaluation	10	5
		Total Nilai	**79**

The results of the examination of the Construction Safety Management System document are stated in weights per element which is an assessment of the performance of service providers on the implementation of the Construction Safety Management System, where in this Bridge Replacement package the total assessment is 79% in the Good category. The Construction Safety Management System document has been checked by the Supervision and Service Provider Consultant and has been signed with the assumption that the document is in accordance with the Regulation of the Minister of Public Works and Public Housing Number 10 of 2021 concerning Guidelines for Construction Safety Management Systems

V. CONCLUSION

From the results of the analysis of the implementation in the field and the analysis of the Construction Work Plan document of the Service Provider for Bridge Replacement Works, it can be concluded as follows:

1. Identification of the level of risk that has been stated in the Construction Work Plan Document for Bridge Replacement Work has been detailed and can be used as a reference in the implementation in the field so that the fulfillment of security, safety, health and sustainability standards that ensure the safety of construction engineering, labor safety and health, public safety and environmental safety can be maintained.
2. An assessment of the implementation of Construction Safety on Bridge Replacement Works by Service Users has been carried out, from the results of the assessment there are still things that need to be improved continuously, namely:

a. The implementation of construction safety is carried out during the implementation of work in the field but is not well documented.
b. The service provider has not submitted work instructions and work instructions are not prepared at the keet directors.
c. The service provider is obliged to carry out monitoring related to the implementation of construction safety and evaluation of compliance and must ensure all required equipment, accuracy in measurements that have been calibrated.
d. The service provider must also ensure that the construction safety performance is measured according to the applicable standards and the service provider is required to document the results of monitoring and measurement, related to this for monitoring and evaluation reports there are still evaluations and corrections.

3. Implementation of Construction Safety on Bridge Replacement Work has been carried out in accordance with the mandate of the legislation, but it is still necessary to make continuous improvements so as to get maximum results.

VI. SUGGESTION

Regarding the implementation of Bridge Replacement Work, there are suggestions that can be used as a reference so that the implementation of Construction Safety Management System can be carried out in accordance with applicable regulations and can minimize the risk of construction work accidents, as follows:

1. Analysis of the implementation in the field requires an evaluation of the development and improvement of the Construction Safety Management System activities in the field that have been carried out previously, the evaluation activity is an effort to continuously improve the implementation of the Construction Safety Management System. The method that can be done is the PDCA method (plan, do, check, act) where the Service Provider has carried out the planning stage by identifying problems, in the field implementation of the identification of problems that have been identified. to be used as a reference so that work accidents can be reduced with the smallest risk, then re-evaluation is carried out whether the identification of problems can be carried out as expected and continuous improvements will be made;
2. Emergency Response Officers and First Aid Officers are officers who have been given training as evidenced by training certificates, so that prior to the commencement of work in the field, Emergency Response Officers and First Aid Officers have been confirmed to be able to provide training to workers in the field

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