Developing Standard Operational Procedures for Maintenance and Repair of Mechanical and Electrical Component in Government Building to Improving Safety Planning

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Abstract. To develop maintenance and repair procedures for mechanical and electrical components of government building to improve safety planning. Method of the research using content and construct validation, pilot survey and respondent survey which is then validated using Delphi Method by experts. Result of this research are In developing the maintenance and repair procedures for mechanical and electrical components of government buildings, stages are carried out in the form of identifying the organizational forms and job descriptions of the institution, identifying the components and activities of mechanical and electrical maintenance and maintenance of the building, identifying the person in charge and implementing work activities, establishing the flow of communication, identify risk events in the activity, analyse the highest risk, identify the highest risk response, and develop procedures with the addition of risk response activities. OHS planning developed in this study is risk based so that it can reduce the adverse impacts on occupational health and safety (OHS) by referring to Minister of Public Works Regulation No. 05 of 2014. This research is about how to develop standard operational procedures for mechanical and electrical components in government buildings. The current government building is a building that has a fairly old age, resulting the condition of the building has a lot of damage in various components, for instance mechanical and electrical components. If ignored, these conditions will lead to decrease the quality of the building and may eventually lead to the destruction of the building. Building maintenance and repair work is one of the solutions to maintain the reliability of the building remains functional. However, the absence of proper procedures on government buildings in one of the government agencies becomes obstacles to the implementation of the work. This causes maintenance and repair activities to be ineffective and inefficient, in addition to affecting the results obtained.

1. Introduction
In supporting the fulfillment of the functions of a building required facilities and infrastructure that can support these functions. Facilities and infrastructure contained in this building in the form of important components that are interrelated with one another in order to achieve the function of the building to provide comfort and security for its users. One important component in the building is mechanical and electrical components. Where this component becomes very vital because all facilities contained in the building are supported by these components. In
addition, the use of mechanical and electrical components can be harmful to humans and the environment if not done carefully, so that these mechanical and electrical components must be safe and in their use must comply with applicable regulations and standards so there is no damage that could endanger their users [1].

Government buildings in Institution X that exist today are buildings that have had a fairly old age, resulting in the condition of the building has a lot of damage in various aspects, one of which is the mechanical and electrical components of the building. This condition if left unchecked will result in a decrease in quality and ultimately can cause damage to the building [2]. This is evidenced by the occurrence of a fire in the Institution X building caused by an electrical short circuit. In reducing the risk and damage to the building it is necessary to have an effort to overcome the problems that occur. One effort that can be used as a solution is the maintenance and maintenance of mechanical and electrical components in government buildings. However, maintenance and maintenance activities of government buildings are currently not equipped with standards or guidelines so that the results obtained are not optimal. In addition, poorly regulated communication lines cause maintenance and maintenance activities of state buildings to be ineffective and inefficient. This of course greatly affects the results obtained from these activities.

Therefore, this maintenance and maintenance activity needs a guideline in carrying out it so that it can be well directed, wherein the guideline is in the form of Standard Operating Procedures (SOP). According to [3] the use of standard operating procedures can minimize the possibility of discrepancies and improve quality through consistent procedures. Considering the importance of Standard Operating Procedures, the manufacturing process needs to be done appropriately and correctly to adjust the system of government organizations in it.

2. Research Objectives
The aim of this study has 5 objectives in addressing these problems,

(i) Identify the organizational scheme, roles and responsibilities of each stakeholder related to the technical procedures for carrying out the maintenance and maintenance of government buildings.

(ii) Identifying mechanical and electrical components in the maintenance and maintenance work of government buildings.

(iii) Establish communication channels for the technical procedures for carrying out maintenance and maintenance work for mechanical and electrical components of government buildings in Jakarta.

(iv) Identifying the preparation of maintenance procedures and maintenance of mechanical and electrical components.

(v) Recommendations for OHS planning using risk-based maintenance and maintenance procedures.

3. Literature Review
According to Minister of Public Works Regulation No. 45 of 2007 state buildings are buildings for official purposes that become / will become state-owned assets such as office buildings, school buildings, hospital buildings, warehouses, and state houses, and are held with funding sources that originate from APBN funds, and / or other legal acquisition. Buildings are used to support the achievement of objectives and main functions of an organization of its users optimally, and are expected to be able to follow the changes that can occur in the user organization [4]. The state building itself is used to facilitate state officials in carrying out their duties. With this function, the state building needs to always have good quality and performance.
Each building owner certainly wants the quality of the building owned to be able to provide good, safe, and comfortable services [5]. To support this achievement, it is necessary to manage all aspects of the building’s facilities so that they can be used properly and optimally. Where the most important activities in the management of a building are maintenance and maintenance activities [6]. Maintenance and repair work is important to ensure ease of service and security of the facilities built [7]. The purpose of maintenance and repair activities in the management of a building is to minimize the cost of repairs, increase user satisfaction, increase the efficiency of activities, minimize the cost of energy use, and minimize potential safety problems [8].

Minister of Public Works Regulation No. 45 of 2007 defines maintenance of building maintenance as an activity of maintaining the reliability of buildings and their infrastructure and facilities so that buildings are always worthy of function, while building maintenance is an activity of repairing and / or replacing building parts, components, building materials, and / or infrastructure and facilities so that buildings are still worthy of function. According to [9], maintenance and repair are a combination of actions taken to maintain a thing or return it to an acceptable standard according to the standard. In achieving these standards, of course, a guide is needed to guide workers in order to reduce the risks that can occur in the job [10].

Standard Operating Procedure is defined as a guideline that becomes the standard and reference in carrying out activities within an organization so that the process can run optimally and the goals of the organization can be achieved [11]. In its making, SOP has the aim to be able to facilitate and equate the perception of all parties who use it [12, 13]. In the AP SOP preparation guidelines in Institution X there are principles that must be possessed by an SOP and can be used to measure the performance of the SOP. These principles consist of ease and clarity, efficiency and effectiveness, harmony, measurement, dynamic, user-oriented or party served, and legal compliance. In addition, the existence of SOPs on building maintenance and maintenance work is expected to guarantee the safety and health of workers during the process of carrying out a job.

Occupational safety and health in an occupation are very important to consider. This is demonstrated by the implementation of the K3 program which has been implemented as part of efforts to create a work environment that is safe, healthy and free from work accidents. According to [14] the causes of work accidents consist of workers themselves, construction methods, equipment, and management factors. Work safety planning or better known as a safety plan is a plan document that contains a practical safety program that aims to avoid the potential for danger [15]. Work safety planning (safety plan) can be used as a guide or guideline in the management and implementation of a project in terms of occupational safety and health so as to protect the workforce for their rights and safety in carrying out a job, improving the performance of the work, ensuring the safety of others who located in the work area, and can maintain a safe and efficient source of production. Previous research has explained that SOPs apply to every aspect and are essential for an effective management system to help implement preventive measures for errors and facilitate corrective actions [16]. According to [17] the use of SOPs can help the implementation process of building maintenance and maintenance management become more uniform and directed, and the steps in each process become clearer so as to reduce deviations that occur. [18] concluded that through a proactive maintenance management system involving procedures in it can optimize building maintenance in Malaysia. According to [19] one of the important processes in the development of SOPs is in regulating the flow of communication in it, so as to produce quality improvements in the implementation of the SOP to achieve good performance for its users. To produce an effective and efficient system, it is necessary to develop an appropriate procedure by taking into account several important aspects in the form of user organization, the right path, targets (objects), completeness, and the methods used [20, 21]. In this research, development of procedures for maintenance and building maintenance will be carried out in order to improve the performance of effective and efficient
development of SOPs is in regulating the flow of communication in it, so as to produce quality improvements in the implementation of the SOP to achieve good performance for its users. To produce an effective and efficient system, it is necessary to develop an appropriate procedure by taking into account several important aspects in the form of user organization, the right path, targets (objects), completeness, and the methods used (Fitsimmons, 2012). In this research, development of procedures for maintenance and building maintenance will be carried out in order to improve the performance of effective and efficient procedures in its implementation.

4. Method
This study uses the Delphi method in analysing the data obtained, and conducted a survey using a questionnaire instrument and interviews with experts who have experience in building maintenance and maintenance. In addition, a case study was conducted at one of the government buildings in Jakarta as an object of research and implementation of the developed procedures. See Figure 1.

5. Result and Discussion
Based on 5 existing problem formulations with 7 stages of data collection and analysis, the research results obtained are described in the tabulation as shown in Table 1.

From this research, organizational structure forms that have been adapted to the needs of the Institution X organization in building maintenance and maintenance. Figure 2 shows the form of organization that has been adjusted.

In addition, based on validation and data analysis, there are 10 mechanical components and 2 electrical components in building maintenance and repair. Each component has 239 activities for mechanical components and 267 activities for electrical components. From these activities a communication flow can be established by identifying the person responsible and implementing those activities.

The final results obtained from this study in the form of risk-based SOPs and OHS planning based on the identified risk responses in accordance with Regulation of Ministry Public Work No. 05 of 2014. Figure 3 shows an example of SOP for Maintenance of Vertical Elevator Transportation System Components that have been developed based on risk. In this SOP, it can be seen that activity is an additional activity based on the identified risk response.

From the results of the development of risk-based SOPs obtained, then used as input for OSH planning recommendations in the maintenance and maintenance work of mechanical and electrical components of the building.

6. Conclusion
(i) Based on the results of this study, it is found that the division of work roles is not balanced in each function in Institution X, for this reason it is necessary to adjust the organizational structure and job descriptions in the Bureau of State Property Management Institution X.
(ii) There are 10 mechanical components and 2 electrical components identified with each of them having 239 activities and 267 activities in the maintenance and maintenance work of government buildings.
| RQ | Research Activity | Input and Analysis                                                                 | Result                                                                 |
|----|-------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| 1  | Initial Expert Validation (Forms of Organization & Job desk) | Regulation of the General Secretariat No.6 2015 concerning Organization and Administration of Institutions X | Form of organization and job description in accordance with organizational needs of Government Institutions X |
| 2  | Expert Validation (Component) | 9 mechanical components in building maintenance and maintenance (literature & archive analysis) | 2 electrical components in the building maintenance and maintenance stage |
|     | Expert Validation (Activity) | 2 electrical components in building maintenance and maintenance (literature & archive analysis) | 239 activities in mechanical components agreed upon by experts |
|     | Expert Validation (Responsible and Implementing) | 209 activities in mechanical components (literature study & archive analysis) | Person in charge and executor of activities agreed upon by the experts |
|     | Compilation of Communication Flow | 166 activities in the electrical component (literature study & archive analysis) | 37 mechanical component communication flowcharts and 29 electrical component communication flowcharts |
| 3  | Expert Validation (Procedure Performance) | 29 identified risk events (expert validation) | 66 procedures fulfill 7 procedural criteria based on SOP Preparation Guidelines within Government Institution X |
| 4  | Respondents Questionnaire (Risk Assessment) | Components and activities of maintenance and maintenance of mechanical and electrical components of the building (expert validation) | 2 high level risk events in mechanical components |
|     | Expert Validation (Risk Response) | Person in charge and executor of activities agreed upon by the experts (expert validation) | 7 causes of risk events |
|     | Procedure Development | 29 risk events | Procedure for maintaining and maintaining risk-based mechanical and electrical components of the building |
|     | Expert Validation (Development of Procedures) | 29 identified risk events | Safety planning recommendations for vertical lift transportation system maintenance work and diesel generator set maintenance work |

From this research, organizational structure forms that have been adapted to the needs of the Institution X organization in building maintenance and maintenance. The following is the form of organization that has been adjusted.
6. CONCLUSION

1) Based on the results of this study, it is found that the OHS plan in Institution X needs to be reviewed, with the addition of risk response activities.

2) Supervisory activities are carried out in the form of identifying the components and activities, responsible and organizational forms and job descriptions of the maintenance and maintenance of the building, identifying the organizational forms and job descriptions of the government buildings, stage of working group lift and implementing are needed, so that the division of work roles is not balanced in each department.

3) In determining the effective communication flow is formed in the maintenance and maintenance work of government buildings.

4) There are 10 mechanical components and 2 electrical components of the building identified with each of them having 239 activities and 267 activities in electrical components identified with each of them. But, the maintenance and maintenance work of them have not resulted in good mechanical and electrical components, which is evidenced by the reduction of accidents and related injuries. As a result, the technical drawing and work procedures for the maintenance and maintenance of good mechanical and electrical components can be carried out with the help of risk control responses, the technical drawing and work procedures for the maintenance and maintenance of good mechanical and electrical components can be carried out with the help of risk control responses, the technical drawing and work procedures for the maintenance and maintenance of good mechanical and electrical components can be carried out with the help of risk control responses. Precautionary actions from the results of this study, it is found that the OHS plan in Institution X needs to be reviewed, with the addition of risk response activities.

5. Supervise and implement the OHS plan in Institution X. For this reason, it is necessary to adjust the organizational structure and work description, relevant to the formulation process.

6. Oversee the safety of OHS security in the form of railing/handling, including:

   1. Conduct OHS socialization
   2. Use PPE in the form of safety shoes
   3. Supervise work procedures
   4. Evaluate and improve work procedures
   5. Supervise related emergency departments
   6. Oversee the safety of OHS security in the form of railing/handling

Table 2: Improving Safety Plan

| No | Job Description | Hazard Identification | Risk Assessment | Priority Scale | Risk Control | PIC |
|----|-----------------|-----------------------|----------------|---------------|-------------|-----|
|    |                 |                       | Frequency      | Severity       | Risk Level  |     |
| 1  | Checking pit lift components including counterweight ratings, monkey ladders, pit bottom cleanliness, final limit switches and directional limit switches | Overwritten material and diesel generator set | 0.391 | 0.301 | 0.119 | 2 | 1. Conduct OHS socialization 2. Use PPE in the form of safety shoes 3. Supervise work procedures 4. Evaluate and improve work procedures 5. Supervise related emergency departments 6. Oversee the safety of OHS security in the form of railing/handling | Working Group Lift |

Figure 2: Improving Standard Organization
(iii) In determining the effective communication flow, organizational scheme and work description, components and activities, responsible and implementing are needed, so that the communication flow is formed in the maintenance and maintenance of good mechanical and electrical components of the building.

(iv) With the addition of activities based on the identification of risk responses, the technical procedures for the maintenance and maintenance of mechanical and electrical components can reduce the potential for accidents as evidenced by 12 supervisory activities as follows.

(a) Preventive Actions
- Oversee work procedures for workers
- Oversee workers’ understanding of work procedures
- Oversee the implementation of work procedures
- Evaluate work procedures
- Improve / develop work procedures

(b) Corrective action
- Oversee the availability of the emergency team
- Oversee the parties involved in the emergency department
• Oversee the process of handling the emergency department
• Oversee the handling of coordination with the Hospital
• Oversee the handling of complaints from victims / victims’ families
• Evaluate work schedules
• Review work schedules / replace HR

(v) In developing the maintenance and repair procedures for mechanical and electrical components of government buildings, stages are carried out in the form of identifying the organizational forms and job descriptions of the institution, identifying the components and activities of mechanical and electrical maintenance and maintenance of the building, identifying the person in charge and implementing work activities, establishing the flow of communication, identify risk events in the activity, analyse the highest risk, identify the highest risk response, and develop procedures with the addition of risk response activities.

(vi) OHS planning developed in this study is risk based so that it can reduce the adverse impacts on occupational health and safety (OSH) by referring to Minister of Public Works Regulation No. 05 of 2014.

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