
Optimization Of Implementation Of Crane Certification In Contruction Service Companies

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ABSTRACT

Purpose: This study aims to analyze the effect of accelerating the implementation of work and the costs needed for the job of occupational safety and health certification in the Construction services company in East Java province.

Design/methodology/approach: This study used a survey method carried out on 20 crane units in 4 construction service companies by analyzing data using Critical Path Method (CPM), resulting in an acceleration of inspection and testing of crane up to 37% with cost efficiency of 36 %.

Findings: The results of this study are expected to provide an overview of Crane's reliability as early as possible to users to anticipate operational failures through regular maintenance and repairs.

Research limitations/implications: This study can also determine the timing of inspection and testing in the context of implementing the Crane Occupational Safety and Health certification so that the use of resources can be optimized.

Practical implications: With the implementation of inspection and testing, certification can be fulfilled before the certification period ends.

Originality/value: This paper is original

Paper type: Research paper

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I. INTRODUCTION

Based on BPJS Employment data in East Java Province, in 2016 to July, there were 1,390 incidents and data from the Ministry of Public Works and Public Housing (KEMPUPR), there have been 14 crane accidents throughout the years 2017-2018. This event is very detrimental to all parties. Therefore, employees in a company and things that may be directly or indirectly affected by workplace activities really need to involve health and safety protection (Umeokafor et al., 2014).

Tom Peters, opened in Pursuit of Wow (New York: Vintage books, 1994) defines all work in a project as new economic growth, so that every project must always provide added value and added value is a unique business

Inspection and testing in the framework of certification of cranes is an early detection effort to prevent accidents by eliminating sources of danger on cranes so that it is safe for people involved in operations and other people who are around the appointment and facilities and the environment. in addition to providing assurance that the crane operated has met the requirements of the laws and regulations of the Government of the Republic of Indonesia relating to occupational safety and health.

In order to carry out inspection and testing in the framework of certification of cranes, the company can generally hand over the implementation of the inspection to the occupational safety and health services company (PJK-3), because the inspection method is a specific work and requires special expertise in their field.

To be able to succeed in the implementation of inspection and testing in the framework of the certification, a networking scheduling method is needed to optimize cost integration and scheduling implementation in the general mining area. The method used is Critical Path Method (CPM), while the inspection of heavy equipment to be studied is a crane in the work area of a construction service companies.

Crane certification carried out in construction service companies is the application of applicable laws and regulations. The implementation of crane certification carried out by PJK-3 in construction projects requires a more measurable management starting from planning, implementation, control and monitoring so as to satisfy the stockholders as the management of a project in general.

II. LITERATURE REVIEW

A. Certification of Cranes

Law of the Republic of Indonesia No. 1/1970 concerning Occupational Safety, Chapter III article (4) Work Safety Conditions, in this article contains scientific technical principles into a collection of provisions that are arranged in a clear and practical scientific manner that covers the field of testing and certification to ensure safety equipment, labor safety and workplace safety. A stage of scientific implementation is also needed to ensure that the machine being operated provides safety to the machine itself, everyone who operates it and the installation and environment in which the machine is operated.

Minister of Manpower Regulation No. Per. 05 / MEN / 1985 Regarding material handling for lifting and transportation, Article (5) and (138), what is meant by material handling for lifting and transportation is a tool used to lift and transport not limited to cranes, forklifts, trucks, gondolas, conveyor, excavator.

Each material handling for lifting and transportation before use must be examined and tested in advance according to the predetermined test standards, and proof load tests must be carried out more than 100% rated load and not more than 125% safe work. Periodic certification is carried out at least 2 years after the first certification and subsequent re-examination is not later than 1 year.

ASME B30.5 (2014), This inspection and testing is carried out by competent people and occupational safety and health experts in the field of lift and transport and or safety supervisors work from the labor agency. PJK3 can carry out the inspection and testing because it has an occupational safety and health expert in the material handling section for lifting and transportation.

B. Definition Of Network Planning

Definition of Network Planning Project and networking planning analysis are a series of activities that aim to produce products and can only be done within a certain period of time (temporary).

According to Gray et al. (2007) Project Management, Managerial Processes in principle are dependency relationships between work parts (Variables) that are described / visualized in a network diagram. Thus it is known which parts of the work should take precedence, if necessary (added costs), which work is waiting for the completion of other jobs, which work does not need to rush so that the tools and energy can be shifted to another place for efficiency.

The stages in project analysis include planning, scheduling and controlling the execution of all activities. This stage of planning a project requires defining what can distinguish the types of activities involved in it. In addition, the determination of the estimated time needed to process each activity in affirming the relationship between activities on a project. The relationship between activities in a project can be a preceding relationship, parallel relationships and relationships preceded. Once all three of these are met, an appropriate network model can be used to analyze the implementation schedule of all project activities.

The network model allows it to be used here, given the definition of the project itself, that is, a project is actually an activity consisting of a series of smaller, different activities that start from an initial traction and end at one endpoint so that a network diagram the project can be guided by all activities that have no precursor will start from a starting point and all activities that have no continuation will end at an end point.

Next to indicate when an activity starts and when it ends it can be done by drawing an arrow that starts at a point and ends at another point so that an activity is identified with (I, J). These points are in a circle with a number label in the middle called Event.

C. Network Planning

Each project consists of various activities involving the use of equipment, materials and labor. These activities form interrelated networks and interdependence between previous activities and activities afterwards. Mansyur (2012), In networking planning there are several things that need to be considered in optimizing the

work network, namely 1). preparation of project work schedule, 2). Duration of project work, 3). determine the critical trajectory. 4) Project cost savings without sacrificing quality.

Each activity in this project is marked with an arrow symbol, while the interrelationship between activities is determined by the arrow before and after, the improvement of activity is marked by a small circle that describes the activity before and after. Overall, this activity is coordinated to achieve the desired end result, namely creating a product or completing a project. So as to optimize the implementation of crane certification in construction projects.

D. Benefits of Network Planning

The certification service project activity is a series that is interrelated with each other dan repetitive activity, Critical Path Method (CPM) aim to prevent delay as well as more effective and efficient resource management. Kerzner (2013) 1 can be concluded that project planning is one of the project management processes which includes initiation, planning, execution, monitoring and control, in project planning carried out by considering all alternatives, existing field conditions and method that will be used for The certification service project activity is a series that is interrelated with each other. Certification service projects have repetitive activities, CPM scheduling aims to prevent delays as well as more effective and efficient resource management.

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E. Identify Critical Paths

CPM is a method of identifying critical work paths or items. To make it can be manually mathematical. Quite complicated especially the many and complex work items. But now a lot of software that provides facilities to get CPM.

CPM is a derivative product from Bar Chart. CPM is more rarely used in projects compared to S-Curve. In fact, many project actors (Contractors, Supervisors, and Owners) are not familiar with this one tool except for those who already have adequate education, training and experience. But the amount is still not much.

The use of CPM is limited to the conditions that must be submitted by the contractor in the auction. After that, it was almost never used. The CPM that should have been made at the time of the tender has become the baseline in monitoring the implementation of the project.

CPM illustrates late or not projects in the form of project end time. CPM contains job descriptions that are on the critical path. Jobs in the critical path must be maintained by the Project Team. Start-Finish-Duration work items that are on the critical path must not be missed because it will cause the execution time to be delayed.

III. METHODOLOGY

This research is a survey research method. According to Kerlinger (2004) explained that survey research is a study conducted on large and small populations, but the data studied is data from the population, so that relative events and distributions are found.

The population in this study is a crane that has been installed and is being used to build toll roads and apartments by 4 construction service companies totaling 20 cranes in east java province.

The data analysis technique in this study uses an analytical method that can provide a simultaneous analysis process associated with Critical Path Method software. Critical Path Method is a critical path is determined by identifying the longest stretch of dependent activities and measuring the time required to complete them from start to finish.

The research analysis of the costs and timing of the implementation of this certification used scheduling techniques with the work network method with CPM, in this case there are several stages, namely data collection, job implementation evaluation, time and cost analysis, job implementation schedule, network diagram making work activities, calculation implementation costs, cost distribution calculations.

IV. RESULTS AND DISCUSSION

Crane Management related to the implementation of heavy equipment certification work must verify and ensure that maintenance, inspections and audits have been carried out according to predetermined requirements.

The results of this verification are used to determine whether the crane can be certified or not. Reports on the results of verification, maintenance, inspections, audits and follow-up of repairs due to damage must be documented.

The inspection and testing must refer to the standard operating procedure (SOP) and the use of periodically calibrated inspection tools, inspectors carry out inspections must pass the competency test and have a competency certificate from the inspector crane issued by the Indonesian professional certification authority (BNSP). The authority of personnel to carry out inspections and tests as crane safety and health experts is appointed by the Ministry of Manpower.

Inspection and testing of cranes in carrying out certification work, Crane Management Construction services companies surrender to business units to manage work partners or contractors in this case PJK3 that will work related to the implementation of crane certification work starting from work contracts so that they can do the work. Reports on the results of inspection and testing of heavy equipment in the framework of certification will be submitted to crane management.

The constraints on the implementation of inspection and testing are the contradictions between standard norms and the fact that the field of implementation of certification work requires time that can hinder the progress of the project work.

To solve the obstacles encountered in carrying out inspection and testing for crane certification, researchers hypothesized that by using the Critical Path Method. Optimization of the implementation of crane certification work could be carried out so that slowing down of inspection and testing could be avoided.

Inspection and testing work in the framework of crane certification of construction service companies spread in various places, based on the progress report that has been reported then produces analysis with the following details:

Table 1. List of duration of crane inspection and testing

<i>Activity</i>	<i>Job descriptions</i>	<i>Last of activities</i>	<i>Next of activities</i>	<i>Days</i>
<i>A</i>	<i>Meeting of job safety analysis</i>	-	<i>B,C</i>	<i>1</i>
<i>B</i>	<i>Visual of inspection</i>	<i>A</i>	<i>D</i>	<i>6</i>
<i>C</i>	<i>Apply NDE</i>	<i>B</i>	<i>D</i>	<i>4</i>
<i>D</i>	<i>Setting of test load</i>	<i>C</i>	<i>E,B</i>	<i>11</i>
<i>E</i>	<i>Proof of load testing</i>	<i>C</i>	<i>F</i>	<i>10</i>
<i>F</i>	<i>Analysis and reporting</i>	<i>C,D</i>	-	<i>6</i>

Based on table 1. It shows that the implementation of crane inspection and testing requires a duration of 38 working days, so that the duration of this work is concluded to hinder the progress of the project work.

The following is the duration of the crane inspection and testing by applying a network with the Critical Path Method can be seen in figure 1:

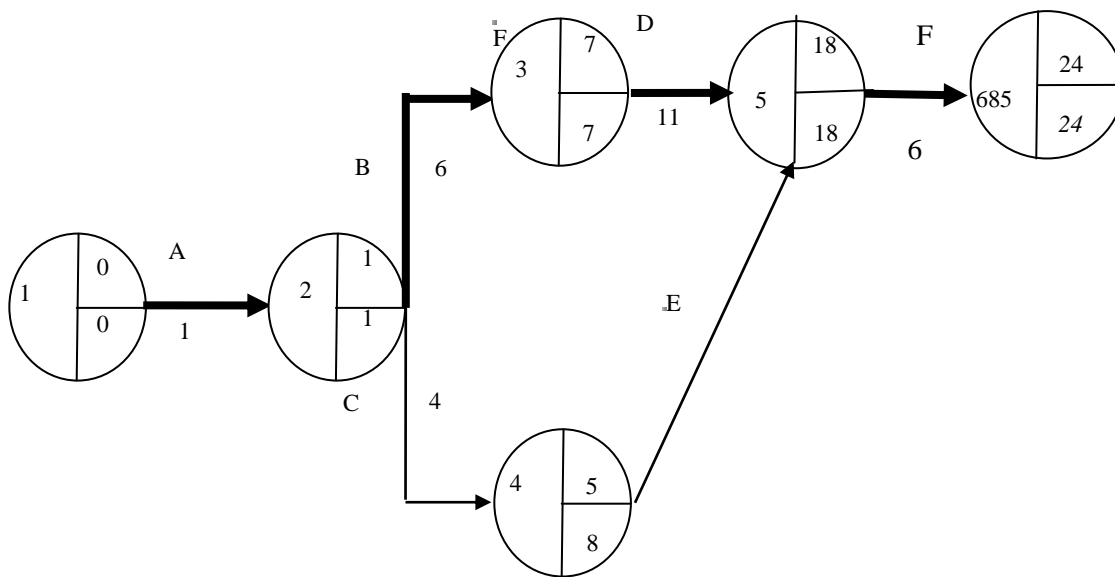


Figure 1. Network of crane inspection and testing.

Figure 2, showing the network diagram after calculating forward and backward, then the time needed to complete the inspection and testing of the crane is 24 days and 14 days faster than the previous time, or the acceleration of work implementation is 37%.

A. Visual Inspection and measurement of critical component dimensions.

Before the inspection carried out the crane inspector will hold a technical meeting with crane management to discuss the stages of crane inspection and testing as well as inspection technical planning covering the duties and authority of the inspector and the standard operating procedures implemented.

Job safety analysis is an important stage in the implementation to avoid occurrence of events by identifying hazards and hazard control from each stage of the work that is directly related to the task of the crane inspector and the workers who are around the crane that will be inspected and the workplace.

Visual inspection is a method simple but most reliable method for detecting defects in crane components. If the visual method does not make it possible to identify defects, the crane inspector can use high-tech tools. Currently detecting defects can use non-destructive examination (NDE) the Magnetic Particle Inspection method. Torkar & Arzenšek (2002) wire rope hoist and pendant lines of examination use a wire rope tester.

Critical components must be examined in detail and measured due to friction on the hoist brake lining to avoid failure during operation, the actual measurement results should not be smaller than the minimum limit permitted by the manufacturer of crane.

B. Proof of load testing

Load testing is an important stage of crane inspection aimed at knowing the reliability of crane operations. Beginning with dynamic testing carried out without test load aims to determine the reliability of the safety device, then testing the load is less than 100% safe work load. Test load testing is more than 100% and less than 125% safe working load by means that the test load is lifted off the runway and then hung for 10 minutes to determine the reliability of crane construction, the crane inspector will assess the visible and affordable crane components.

Load cell is a tool for testing over load, this tool can be used when the test load is unknown in weight but can be assumed to be heavier than 125% safe working load. Load testing is carried out by holding the test load and the load cell will provide loading information that occurs on the crane.

C. Inspection and testing costs

Calculation of the details of costs needed for inspection and testing as a standard cost required for any visual inspection work activities, NDE use, load testing and reports, is used to measure the weight of each activity (Table 2)

Table 2, demonstrates that the activities of each visual inspection activity, the use of NDE, load testing and reports, have detailed costs according to the resource requirements of each activity.

Visual inspection requires an honor fee for crane inspectors and measuring instruments used, personnel who have NDE level II qualifications with magnetic particle inspection methods using yoke, 7HF and WCP2

Tabel 2. Inspection and testing cost

<i>Activity</i>	<i>Job descriptions</i>	<i>Cost (rupiah)</i>	<i>Wiegth (%)</i>	<i>Days</i>
<i>A</i>	<i>Meeting of job safety analysis</i>	<i>1.175.000,00</i>	<i>2</i>	<i>1</i>
<i>B</i>	<i>Visual of inspection</i>	<i>11.400.000,00</i>	<i>16</i>	<i>6</i>
<i>C</i>	<i>Apply NDE</i>	<i>16.100.000,00</i>	<i>22</i>	<i>4</i>
<i>D,E</i>	<i>Setting of test load and proof of load testing</i>	<i>39.600.000,00</i>	<i>55</i>	<i>21</i>
<i>F</i>	<i>Analysis and reporting</i>	<i>3.800.000,00</i>	<i>5</i>	<i>6</i>

Proof of load testing is the highest cost because the test load used is not available, so it requires costs to rent test loads, load cells, and rigging gear. Putting the test load and rigging gear settings so that the load does not swing when lifted takes time, the inspector crane, rigger, crane operator, government supervisor are involved in carrying out this activity.

Tabel 3. Cost of inspection and testing cranes of applying CPM

<i>Activity</i>	<i>Job descriptions</i>	<i>Cost (rupiah)</i>	<i>Wiegth (%)</i>	<i>Days</i>
<i>A</i>	<i>Meeting of job safety analysis</i>	<i>1.175.000,00</i>	<i>3</i>	<i>1</i>
<i>B</i>	<i>Visual of inspection</i>	<i>11.400.000,00</i>	<i>25</i>	<i>6</i>
<i>C</i>	<i>Apply NDE</i>	<i>9.800.000,00</i>	<i>21</i>	
<i>D,E</i>	<i>Setting of test load and proof of load testing</i>	<i>19.800.000,00</i>	<i>43</i>	<i>11</i>
<i>F</i>	<i>Analysis and reporting</i>	<i>3.800.000,00</i>	<i>8</i>	<i>6</i>

Table 3. Shows that the cost of inspection and testing with the application of CPM can reduce the cost of Rp. 26,100,000.00. Simultaneous visual inspection activities with NDE application activities and simultaneous load test settings with proof load testing can skip 36% cost. Simultaneous activities can increase the performance of resources used.

IV. CONCLUSIONS

This study suggest that construction service companies must be critical path method for the successful implementation of crane inspections and testing so that certification can be fulfilled. While other findings indicate that the cost of carrying out inspections and testing can be more efficient by applying CPM.

Implicit advantages optimize resources by increasing the concern of operating crane operator in accordance with the application of standards and manufacturing references, while periodic maintenance will increase the reliability of crane operations..

A high level of security will make crane operations more reliable so that the objectives of construction service companies to prevent accidents at work can be achieved.

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