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THE PREVENTIVE PRIORITY PLAN BASED ON THE CAUSALITY ANALYSIS OF THE CONSTRUCTION ACCIDENT A CASE STUDY: CONSTRUCTION PROJECT OF KENTUNGAN UNDERPASS

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ABSTRACT

case of construction accident that occurred mid-2019 and seized a lot of attention in surrounding community is a construction accident on implementation of underpass construction project located in Yogyakarta. underpass excavation wall in this project collapsed n led two vehicles are fall. Although types of accidents are almost identical to each project, it does not mean that same reason causes accidents. Various methods can carry out efforts to prevent work accidents, one of which is with assessment method and risk analysis using Analytical Hierarchy Process (AHP) which subindicators are determined using Fault Tree Analysis (FTA). method conducted with a review in site by referring to Ministerial Regulation No. 21 year 2019 about SMKK (Construction Safety Management System) guidelines. This research was conducted to identify factors and indicators of management of supervisory consultant and contractor. y had a significant influence and contribution to implementation of Yogyakarta Kentungan Underpass construction project. results of this early-stage study served into two outcomes. First, accuracy of implementation of construction safety management system based on assessment of contractor is 85.938% and percentage level of accuracy of supervisory consultant is 97.29%. Both percentages fall into category of Satisfactory Implementation Assessment because valuation range is included between 85% to 100%. Second, after analyzing risk using AHP method, indicator that is used as a reference priority for construction safety system of underpass construction projects and has highest risk level that can causean underpass project construction accident from contractor's point of view is sub-indicator of supporting facilities and infrastructure with a risk level value of 0.042 whereas from supervisory consultant' perspective is sub-indicator about to measuring dimensions of road building installed in site with a risk level value of 0.052.

Keywords: *Assessment, FTA, Causality, Construction Accident, AHP.*

INTRODUCTION

Based on empirical facts in 2019, re have been cases of construction accidents which not only caused losses of workers (people) such as severe injuries to death, but also losses of community (public), property (prosperity), economic and environment. One of cases that occurred was an accident in implementation of Underpass construction project located in Yogyakarta. underpass excavationwall in this projectcollapsed and lead 2 vehicles are fall. wall collapsed caused by failure of slope stability. Although types of accidents that occur are almost identical to each project,it does not mean that accidents are caused by same reason.

Efforts to prevent work accidents can be carried out by various methods, one of which is with assessment conducted with a review at construction sites. This activity can bedone when project is in preparation, implementation, or when project has been completed as described in Government Regulation Number 50 of 2012 concerning SMK3

(Occupational Safety and Health Management System) Construction in Public Works Sector. More details about implementation of construction work are also explained in guidelines.

Developed a model of risk factors for accidents in construction operations, distinguished between problems with workers' actions, site conditions and construction practices (proximalcauses), and linked se to project, contractor and process management influences, data derived from existing accident reporting schemes and caused bias. To get perspectives from contractor and consultant are required perspectives are guidelines by Government regulation Number 50 of 2012.

analysis used are refers to method presented by Government Regulation Number 50 of 2012. In addition, data can be used to determine level of performance priority of contractors and supervisory consultantson project. If results did not conform with what has happenedat sites, n it should continue by ano r analysis to fur r about causality on risk of construction accidents using fault tree analysis method. This analysis aims to find basic event and its risk control.

RESEARCH METHOD

Data processed based on results of site assessments with reference to PP No. 50 of 2012 concerning Occupational Safety and Health, fur r causalityreview is carried out with Fault TreeAnalysis (FTA) approach which is used to determine chances of mostimportant event appearing in a system and to obtain root cause of problem. In addition, root of problem is used to correct priority of problem in system which lead analysis by using Analytical Hierarchy Process (AHP) method finding out highest to lowest risk indicators that caused construction accidents in Kentungan Underpass construction projects. Fur rmore, in Fault Tree Analysis (FTA) approach, enumeration graph will illustrate how problems can occur using Boolean symbols as shown in Figure 1. variable is used on analysis describes from Regulation, discussion with experts also adapted from sites condition.

RESULT AND DISCUSSION

average of implementation assessmentlevel of Occupational Safety Management System which is integratedwith ISO 45001: 2018 and PP No. 50 year 2012 standard regarding SMK3. regulations implemented by Kentungan Yogyakarta Underpass Construction Project according to point of view of contractor and supervisory consultant successively is 85.938% and 97.29%where se values are included in level of Satisfactory Implementation. After obtaining assessment value from evaluation of performance achievement of contractors and supervisory consultants, where shows satisfactory results but construction accidents still occur, n thing that can be done is to carry out fur r analysis in form of causality analysisto find main cause of problem thathas occurred using fault tree analysis method.

Fault Tree Analysis (FTA) Method of Underpass Kentungan Construction Accident

Fault Tree Analysis method is a deductive analysis and a technique to identify failure of system and it is often used to identify potential failure and loss for analyzing possible source of risk before losses occur.

peak event equation obtained by substitution using Boolen's Algebra.

Basic Event of Fault Tree Analysis (FTA) of Underpass Construction Accident of Contractor's Point ofView

Based on causality analysis using FTA method that continued basic event search using a combination of Boolen's Algebra orem 1a and definition 1a obtained basic events where results cannot be described and simplified again. basic event from contractor's point of view canbe seen inTable 1 and while for results of combination of Boolen's Algebra is as follows:

A = (C1+C2+C3+C4+C8+C18+ C20 +C48+C60+C61+C62+C63+C64+D1 +D2+ D3+D4+D5+D6+D7)

Basic Event of Fault Tree Analysis (FTA) Underpass Construction Accident of Supervisory Consultant's Point of View

Based on causality analysis using FTA method that continued basic event search using a combination of Boolen's Algebra orem 1a and definition 1a obtained basic events where results cannot be described and simplified again. basic event from supervisory consultant points of view can be seen in Table 2 and while for results of combination of Boolen's Algebra, as follows:

A = (D1+D2+D3+D4+D5+D6+D7+D8)

Basic Event of Fault Tree Analysis (FTA) of Underpass Construction Accident of Contractor's Point ofView

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Basic Event of Fault Tree Analysis (FTA) Underpass Construction Accident of Supervisory Consultant's Point of View

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A = (D1+D2+D3+D4+D5+D6+D7+D8)

Risk Analysis Using Analytical Hierarchy Process (AHP) Method from Contractor and Supervisory Consultant Points of View

In conducting a data analysis using AHP method, first action to do is to compare between a pair of objects, so that if re are (n) objects, a comparison will be made. For comparison between a pair of objects, AHP method providesa standard value for comparison betweentwo objects in form of value data, where data are a form of quantitative and comparative syntax starting from highest value (9: highly preferred) to lowest value (1: equivalent). following data values are in accordance with table 3.

first step of analyzing data is tocreate a paired matrix that is obtained based on assessment of each of its criteria specified in accordance with table 3. result of filling matrix value of comparison is based on results of Focus Group Discussion (FGD) and include probability value and impact value that will be used to findrisk level value and risk rank. pairedmatrix table of risk indicators from contractor's point of view can be seen intable 4 and paired matrix table of risk indicators from perspective of supervisory consultant can be seen in table 5.

next step after making a paired comparison matrix table is to determine matrix weighting. matrix weighting result is obtained from priority value of each matrix element. After gaining weight of each element, calculate its priority value by dividing number of element weights per row by number of elements. Do samething to next row so that matrix weighting can be seen in table 6 for contractor's point of view and table 7 for supervisory consultant's point of view.

To find out consistency level of user's fill, AHP method must be equipped with a Consistency Index calculation. After obtaining Consistency Index, results are compared with Random Consistency Index (RI) for every n objects. Table 8 shows RI values for each object (2 <= n <= 10). Prof. Saaty compiled RI Table obtained from an average consistency index of 500 matrices. CR (Consistency Ratio) is result of a comparison between Consistency Index (CI) and Random Index (RI). If CR <= 0.10 (10%), it means that user's answer isconsistent so that resultingsolution isoptimal. For contractor points of view, Index Ratio (RI) value is usedbecause number n = 10 is 1.49, n Consistency Index (CI) value is as follows:

CI = (λ maks-n)/(n-1) CI
= 0.049

After obtaining Consistency Index (CI) value, next step is to calculate Random Consistency Index (CR) value.

CR = CI/RI
CR = 0.046/1.49
= 0.03108
= 3.1 %

Because CR value obtained is 3.1

% less than 10% n hierarchy is considered consistence and has a high accuracy.

For supervisory consultant’s perspective, index ratio value (RI) is used because number n = 9 is 1.45, n value of Consistency Index (CI) is as follows:

CI = (λ maks-n)/(n-1) CI
= 0.011

After obtaining Consistency Index (CI) value, next step is to calculate Random Consistency Index (CR) value.

CR = CI/RI
CR = 0,00682/1.45
= 0.0047
= 0.47 %

Because CR value obtained is 0.47% and less than 10% n hierarchy is considered consistent and has a high accuracy.

After analyzing data of each sub-performance indicator from contractor's point of view using Analytical Hierarchy Process method and it concluded that hierarchy obtained is consistent and has a high level of accuracy, n next step is to perform risk level analysis and risk rank of each sub indicator. value of this risk level is obtained by multiplying probability and impact values. probability value is obtained from existing quotient value and impact value is obtained from weightvalue of each sub-indicator. risk ranking value is obtained by sorting value of risk level from smallest to largest. highest risk level value of sub-indicator has highest risk level of causing construction accident at underpass construction project. Fur rmore, it is also used as an indicator of priority reference for construction safety system of Underpass construction project.

From contractors' perspective, indicator that has highest risklevel value is sub-indicator of availability of supporting facilities and infrastructure with a risk level value of 0.042 and indicator that has lowest risk level value is sub- indicator of design change based on results of subgrade or basic soil investigation with a risk level value of 0.0024, while from supervisory consultant points of view of, indicator that has highest risk level value is sub-indicator of measuring dimensions of road building installed in site with a risk level valueof 0.052 and indicator that has lowest risk level is sub indicator of material for internal supervisory meetings with a risk level value of 0.0015.

CONCLUSION

achievement rate of contractorsand supervisory consultant's performance assessment on Kentungan Underpass construction project of occupies figures of 85.938% and 97.29% in which this value is included in level of Satisfactory Implementation Assessment. level of satisfactory does not indicate cause of accident. It could be accident occurred due to o r variables that have not included in analysis.

Through analysis using Fault Tree Analysis method, it is found that several basic events that have potential to cause construction accidents on Yogyakarta Kentungan Underpass project accident are basic events causedby personal and administrative factors, such as limited work experience, negligence of archiving, carelessness of labor, disobeying work procedures, negligence of workforce, lack of knowledge order workforce, lack of workforce skills, and refusal of related parties. Indicator that is used as a reference priority for constructionsafety system of underpass constructionprojects andhave highest risk level that can cause an underpass project construction accident from road contractor's point of view is sub-indicator of supporting facilities and infrastructure with a risk level value of 0.042, while Indicator that is used asa reference priority for construction safety system of underpassconstruction projects and have highest risk level that can cause an underpass project construction accident from supervisory consultant's perspective of is sub-indicator measuring dimensions of roadbuilding installed in site with a risk level value of 0.0548.

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