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Research Paper

Risk Management Of Road Segment Long Preservationon Time Performance

(Case Study : The xxx Bridge Road Preservation Project (SYC) – and the xxx Road Preservation Project (MYC))

Fitri Suryani, Dwi Dinariana, Adria Febrian*

Department of Civil Engineering, Faculty of Engineering, Universitas Persada Indonesia Y.A.I Jl. Salemba Raya No 8-9A, Central Jakarta,

ABSTRACT
The success of a project preservation of long segment roads is determined by the time conformity specifiedin the contract document. With the variety of components involved in a long road segment preservationproject, the risk of delays in work is very large. If there is a delay in completion of the project will harm many parties including the project owner (owner), contractor, user. So the risk management of delays in long roadsegment preservation projects is very important. This research aims to determine the dominant risk that causes delays in long road segment preservation projects to time performance. Starting with the identification of risk through expert vaidasi to obtain risk variables to time performance, followed by the dissemination of questionnaires to owners, supervisory consultants, bantek consultants and service users. Data is processed using SPSS 22.00 to conduct validity and reliability tests, descripttip analysis to find mean and mode values and risk evel analysis using risk SNI so as to obtain risk factors and risk categories of each risk variable. Theresults showed that the dominant risk variables that affect time performance were Variable X10: Tool Damage, Variable X23: Existing Condition Problems (utility relocation: pipes, cables, etc.), and Variable X27: Making changes to the design with a high category: >0.7. Furthermore, Risk Mitigation for Dominant Risk Variables with Delphi Technique.
Keywords: Risk management, Project Delay Risk, Long Road Segment Preservation Project, Time, Descriptive Analysis.

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I. INTRODUCTION

Road preservation is carried out to maintain the condition of the road in standard and steady service.Road preservation activities consist of routine maintenance, periodic maintenance, rehabilitation andrecontrusion of roads as well as road complementary buildings. Long segment is a road preservation activitywithin the limitation of one continuous segment length (can be more than one segment) that is carried outwith the aim of getting uniform road conditions, namely steady and standard roads throughout the segment. The purpose of this study is as follows:

1. To analyze and mitigate the risk of delays /delays in time on the Bridge Road Preservation Project xxx (SYC) and the Road Preservation Project xxx (MYC).
2. To find out the factors that cause time delays in Bridge Road Preservation Project xxx (SYC) and Road Preservation Project xxx (MYC).

The benefit of this study is to obtain the dominant risk variable that causes delays in long road segmentpreservation projects to time performance. As well as knowing the risk management carried out on longsegment road preservation projects for the dominant risk variable.

II. THEORETICAL FOUNDATION

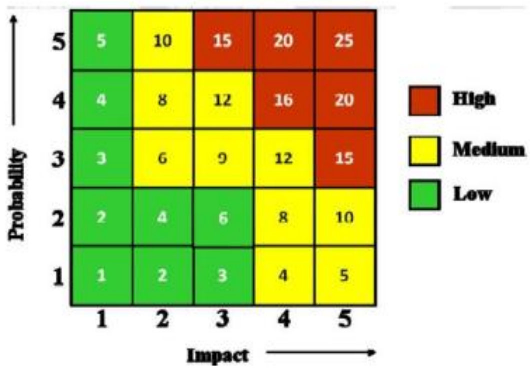
Project risk is the effect of uncertainty on the project as a whole, arising from all sources of uncertaintyincluding individual risk, which represents stakeholder exposure to the implications of variation in projectoutcomes, both positive and negative. (PMBOK, 6th edition, 2017).

Project risk management includes the process of conducting risk management planning, identification,analysis, response planning, response implementation, and risk monitoring on a project. (PMBOK, 6th edition, 2017), Risk management is the process of measuring or assessing risk and developing itsmanagement strategies. Strategies that can be taken include transferring risk to others, avoiding risk,reducing the negative effects of risk, and accommodating some or all of the consequences of certain risks(Sukaarta, 2012). Vaughan in Dewi (2013). Risk management is an organization that identifies andmeasures risk and the development, selection and selection of activities in dealing with risk. Riskmanagement is part of a defined project activity, but is one of the technical aspects of the management program (Joni I. G., 2012).

The seven stages in risk management according to PMBOK, the 6th edition, 2017 are:

1. Plan Risk Management
2. Identify Risks
3. Perform Qualitative Risk Analysis
4. Perform Quantitative Risk Analysis
5. Plan Risk Responses
6. Implement Risk Responses
7. Monitoring Risks

In risk analysis, a scale is set for the determination of probability and impact of the risksidentified above. (Godfrey, 1996) in this case we can see from the chart below.



Source:Godfrey,1996

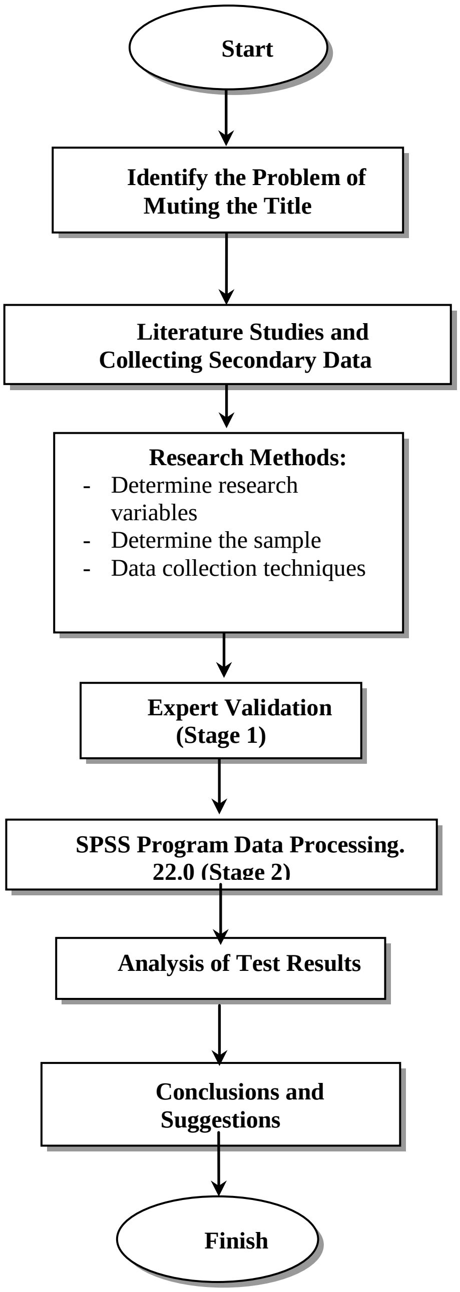
According to PMBOK, the 6th edition, 2017 of quantitative risk analysis is the process of numericallyanalyzing risks regarding the effects of identified risks on the overall project objectives. The process ofquantitative risk analysis is carried out on risks that have been ranked on qualitative risk analysis.Quantitative risk analysis is done after risk planning and risk identification.Risk Response Planning It is an action that is a process, technique, and strategy to combat risks that may arise. Responses can be risk-averse actions, actions to prevent losses, actions to minimize negative impacts and actions to exploitpositive impacts. The response included procedures to improve understanding and awareness ofpersonnel in the organization (PMBOK, 6th edition, 2017).

Project time management includes the processes required to manage the timely completion of a project, project scheduling provides a detailed plan that represents how and when the project will deliver the products, services, and outcomes specified within the scope of the project and serves as a tool for communication, managing stakeholder expectations, and as a basis for performance reporting. The project management team chooses scheduling methods, such as critical paths or agile approaches. Then, project-specific data, such as activities, planned dates, duration, resources, dependencies, and constraints, are fed into scheduling tools to create a schedule model for the project. (PMBOK, 6th edition, 2017)

III. RESEARCH METHODS

Research begins with problem identification, title assignment, data collection, analysis and processing, expert validation and conclusions. Primary data is an interview to obtain risk variables that occur in the long preservation project of the road segment and from the validation of experts and then carried out the dissemination of questionnaires to owners, supervisory consultants, bantek consultants and service providers. Secondary data is conducting a literature study on Long Segment Road Preservation Project Risk Management and previously conducted research on managing project delay risk. From primary data collection and secondary data collected all risk variables causing project delays in long segment road preservation to time performance. Risk variables are arranged in the form of questionnaires.

For more details the research steps can be described in the flow chart below:



Picture. 3.1 Methodology/Research Flow Chart

In this study used 2 (two) types of variables, namely independent variables (free) and dependent variables (bound). Independent /free variable (X) in the form of risk factors that occur at the preservation stage of long segment road and dependent / bound variable (Y)

Table 3.1 Independent Variables

Variable	Types of Risk	Reference
1	**Material**	
X1	Delay in Material Delivery	Marzouk, M. M. & Rasas, T. E. 2013, Ruqaishi, M. & Bashir, A. H. 2013.

X2	Changes in material specifications during construction	Marzouk, M. M. & Rasas, T. E. 2013, Ruqaishi, M. & Bashir, A. H. 2013.
X3	Limited amount of material on the market	Marzouk, M. M. & Rasas, T. E. 2013.
X4	Late submission of examples of materials	Marzouk, M. M. & Rasas, T. E. 2013.
X5	Increase in Material Prices	Nurgraheni (2012)
X6	Material Quality Is Not In Accordance With Specifications	Idzurnida Ismael, 2013
X7	Material buildup at the project site.	Idzurnida Ismael, 2013
X8	Inaccuracy of the time of ordering materials.	Idzurnida Ismael, 2013
2	**Tool**	
X9	The quality of the equipment used is not good.	Idzurnida Ismael, 2013
X10	The tools used do not match the specifications.	Idzurnida Ismael, 2013
X11	Damage to the tool.	Idzurnida Ismael, 2013
X12	The amount of equipment is less than needed.	Idzurnida Ismael, 2013
X13	Lack of efficient use of heavy equipment	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787
3	**Workforce**	
X14	Lack of Labor Availability	Marzouk, M. M. & Rasas, T. E. 2013, Ruqaishi, M. & Bashir, A. H. 2013.
X15	Low Labor Productivity	Marzouk, M. M. & Rasas, T. E. 2013, Ruqaishi, M. & Bashir, A. H. 2013, Fallahnejad, M. H. 2013..
X16	Less Competent Workforce	Marzouk, M. M. & Rasas, T. E. 2013, Ruqaishi, M. & Bashir, A. H. 2013.
4	**Others**	
X17	Lack of organization	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787
X18	Influence of erratic weather factors	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787
X19	Lack/slow coordination between agencies	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787
X20	Incomplete work requirements	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787
X21	Lack of quality control of project implementation	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787
X22	There is a security disruption	Project Team
X23	There is a traffic disruption	Project Team
X24	Existing Conditions Problems (relocation of utilities: pipes, cables, etc.)	Project Team
X25	Lack of communication and understanding of the project.	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787
X26	The method of carrying out the work is not appropriate.	Idzurnida Ismael, 2013
X27	Late payment by the project owner	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787
X28	Make changes to the design.	Idzurnida Ismael, 2013
X29	Project administration system	Dewi, N. P. (2013). Risk Analysis at Klating Beach Safety Work in Tabanan Regency. Journal of Scientific Media, Vol. 7, No. 1, ISSN No. 1978-3787

5	**Time Performance**	
Y1	Communication between team members	Zulfaika, Vol. 3 No. 4 April 2017, Team Performance Relations and Construction Project Success, Department of Civil Engineering Cut Nyak Dhien University of Science – Langsa.
Y2	Able to cope with all the changes that arise on the ground	Zulfaika, Vol. 3 No. 4 April 2017, Team Performance Relations and Construction Project Success, Department of Civil Engineering Cut Nyak Dhien University of Science – Langsa.
Y3	Leadership must be able to start and direct the team from the top.	Zulfaika, Vol. 3 No. 4 April 2017, Team Performance Relations and Construction Project Success, Department of Civil Engineering Cut Nyak Dhien University of Science – Langsa.
Y4	Organizational structure of the company	Zulfaika, Vol. 3 No. 4 April 2017, Team Performance Relations and Construction Project Success, Department of Civil Engineering Cut Nyak Dhien University of Science – Langsa.
Y5	Environmental conditions of the organization	Zulfaika, Vol. 3 No. 4 April 2017, Team Performance Relations and Construction Project Success, Department of Civil Engineering Cut Nyak Dhien University of Science – Langsa.

Table 3.3 Frequency Value Scale Against Time Performance

Scale	Category	Description
1	Very Low	Rarely, only on certain cons
2	Low	Sometimes it happens under certain conditions.
3	Currently	Occurs under certain conditions
4	High	It often occurs in every condition.
5	Very High	It always happens under certain conditions.

Table 3.4 Impact Value Scale on Time Performance

Scale	Category	Description
1	Very Low	In accordance with the plan
2	Low	Late 1 day to 15 calendar days
3	Currently	Late 16 days to 30 calendar days
4	High	Late 31 days to 45 calendar days
5	Very High	Late 46 days to 50 calendar days

The comparison process can be proposed by the arrangement of variable scales. In the preparation of this interest scale is used the following table benchmark.

Table 3.5 Value Comparison Scale

Level of Importance	Definition
1 3 5 7 9 2,4,6,8	It's just as important as the others. Moderate importance compared to others Strong importance compared to others Very important than others Extremes are more important than others. Value between two adjacent assessments. If element i has any of the above numbers when compared to element j, j has the opposite value when compared to element i.

Two equally important elements will produce the number 1, while in two elements will apply reciprocal axioms, meaning "if element I is judged 2 times more important than element j, then element j will be judged opposite of element I, which is 1/2". If there are 10 elements, a pairwise comparisson matrix will be obtained measuring 10 x 10. So if there is n element, it will be obtained pairwise comparisson matrix n x n.

Thus the weighting matrix produced for each criterion is required in the two tables below:

Table 3.6 Weighting Matrix For Sub-criteria Of Frequency

	Almost Always	Often	Quite often	Sometimes	Impossible
Almost Always	1	2	3	5	7
Often	0,5	1	2	3	5
Quite often	0,333	0,5	1	2	3
Sometimes	0,2	0,333	0	1	2
Impossible	0,143	0,2	0,333	0,5	1

Source: Saaty, 2008

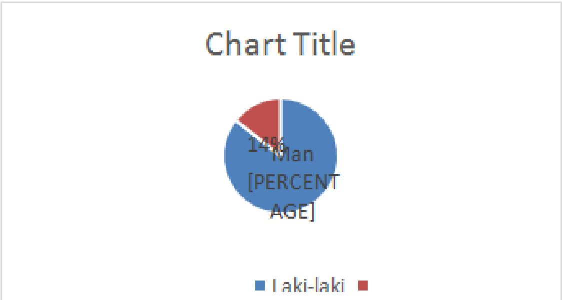
Table 3.7 Weighting Matrix For Sub-criteria From Impact

	Very bad	Often	Quite often	Sometimes	Impossible
Very bad	1	3	5	7	9
Bad	0,333	1	3	5	7
Keep	0,2	0,333	1	3	5
Small	0,143	0,2	0,333	1	3
It doesn't matter	0,111	0,143	0,2	0,333	1

Source: Saaty, 2008

IV. IMPLEMENTATION OF RESEARCH

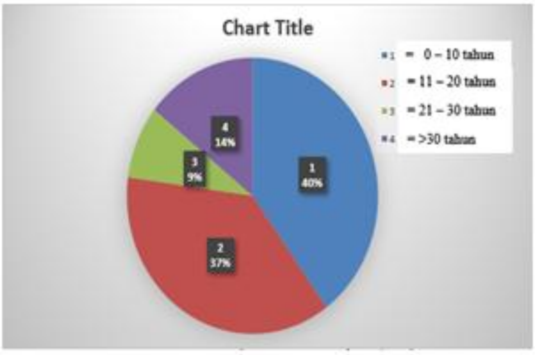
Of the 35 respondents. Men dominate with a percentage of 85% or 30 respondents. While the respondents were female as much as 15% or 5 respondents. Below is the gender distribution of respondents.



Ficture 4.1 Pie diagram for gender category(source: authordocumentation, 2021)

Of the 35 respondents. For the working period divided into 4 categories, among others:

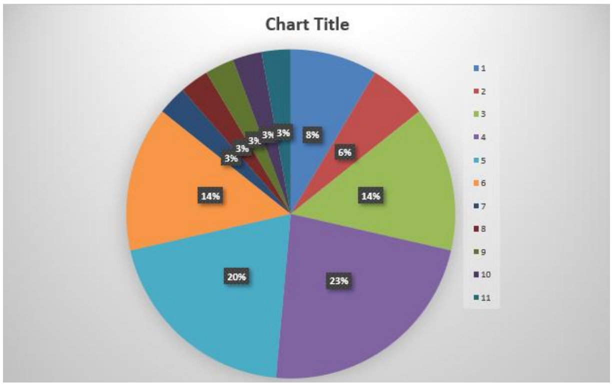
- 0 - 10 years = 40.00%
- 11 - 20 years = 37.00%
- 21 - 30 years = 9.00%
- > 30 years = 14.00 %



Ficture 4.2 Pie diagram for respondents' working period categories(source: author documentation, 2021)

Of the 35 respondents with the following details:

- PPK of = 8,00%
- Sub. Koor of = 6,00%
- Asisten of = 14,00%
- Kaur. TU, Analis JJ, JF JJ AP of= 23,00%
- Tenaga Ahli of = 20,00%
- Staf Teknik, Penata Teknik, Korlap of= 14,00%
- Kepala Proyek of = 3,00%
- Site Operasional Manajer (SOM) of = 3,00%
- Quantity Engineer of = 3,00%
- Inspector Engineer of = 3,00%
- Surveyor of = 3,00%



Ficture 4.3 Pie diagram for the Respondent's Department category(source: author documentation, 2021)

V. DATA ANALYSIS

In the results of the first stage of data collection, namely by interviews with experts / experts, experts provide responses, corrections, inputs, additions and subtractions on each initial variable requested to their opinion.

In this stage, experts provide responses, improvements and inputs to 29 research variables. After the interview is completed from the 3 experts, then improvements and comments from all experts are compared, if there is a variable that is not approved by the expert, then the variable will be discarded and not used at the second stage of data collection for the questionnaire submitted to the respondent. The results of verified data collection interviews, expert clarifications and validations are contained in the appendix. A total of 29 variables, of which there is 1 variable that is eliminated. The number of variables in the research questionnaire was 28 variables.

VALIDITY TEST

A question is declared valid when r Calculate is greater than r Table and declared invalid if r CountissmallerthanrTable.

RThe table is based on the number of respondents (N) and the level of significance. The number of respondents was as many as 35 respondents with a significance level for the two-way test of 0.05 or 5%. r The table can be seen in appendix section 35 of this final task research.

From the table it is found that the value of the tabler is 0.3338.

Measuring the level of validity can be done by correlated between the score of the question item with the total construct score or variable. The correlation result between the question item score and the total construct score will be compared to the calculated r value with a minimum correlation limit of 0.3338. All questionnaire items that achieved a correlation coefficient of at least 0.3338 distinguishing power were considered satisfactory. While items that have a correlation coefficient value below 0.3338 are considered invalid and invalid items can be omitted.

Effect of Project Risk on Time Performance

As for the results of the test the validity of the effect of risk on the Road Preservation Project on time performance, presented in the following table:

Table 4.9 Test validity of the effect of project risk on time performance

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X1	98,257	935,961	,795	,979
X2	97,971	966,852	,540	,980
X3	98,229	948,887	,770	,979
X4	98,143	950,714	,757	,979
X5	98,371	958,358	,674	,979
X6	98,143	957,008	,608	,979
X7	98,286	946,034	,772	,979
X8	97,971	943,558	,812	,978
X9	97,886	938,516	,812	,978
X10	97,429	961,782	,611	,979
X11	97,686	950,045	,810	,978
X12	98,171	944,911	,800	,979
X13	97,714	946,916	,822	,978
X14	97,686	944,987	,905	,978
X15	97,800	936,165	,852	,978
X16	98,000	952,235	,719	,979
X17	97,800	948,165	,884	,978
X18	98,000	951,529	,836	,978
X19	98,257	940,961	,826	,978
X20	97,914	953,022	,782	,979
X21	98,143	942,538	,791	,979
X22	98,171	952,146	,666	,979
X23	97,571	949,370	,741	,979
X24	98,171	941,793	,811	,978
X25	98,000	940,529	,829	,978
X26	98,143	938,655	,774	,979
X27	97,543	964,197	,580	,979
X28	98,257	963,255	,719	,979

The value of the table r for n = 35 is 0.3338. In the table above it is seen that the validity index value of each statement item is greater than 0.3338 so that the variable is considered valid.

REHABILITATION TEST

Reliability test is a tool for measuring a questionnaire that is an indicator of a variable or construct. A questionnaire is said to be reliable or reliable if a person's answer to a statement is consistent or stable over time (Ghozali, 2005). Reliability measurement is done by one shot or one-time measurement with SPSS tool Cronbach Alpha statistical test (α). A construct or variable is said to be reliable if it gives a Cronbach Alpha value > 0.60 (Sendiko Pramayoga in Ghozali, 2005). Here are the results of the calculation using SPSS 22.

Table 4.10 Rehabilitability Test Influences Project Risk on Time Performance

Reliability Statistics

Cronbach's Alpha	N of Items
.979	35

Source: Processed SPSS 22, 2021

The reliability value of statement items on risk event data that has an impact on project time performance is greater than 0.60. This result indicates that the questionnaire items used in retrieving data are reliable or reliable.

DESCRIPTION ANALYSIS OF TIME PERFORMANCE

The purpose of the descriptive analysis of time performance is to analyze the data based on the mean and mode values of the level of impact and frequency of risk derived from therespondent's data. The mean and mode values are obtained by first adding up all respondents' answers for the level of frequency and impact on each variable.

Table 4.11 Frequency Value Scale Against Time Performance

Scale	Category	Description
1	Very low	Rarely, only on certain cons
2	Low	Sometimes it happens under certain conditions.
3	Currently	Occurs under certain conditions
4	High	It often occurs in every condition.
5	Very high	It always happens under certain conditions.

Source: Homemade, 2021

Tabel 4.12 Skala Nilai Dampak Terhadap Kinerja Waktu

Scale	Category	Description
1	Very low	In accordance with the plan
2	Low	Late 1 day to 15 calendar days
3	Currently	Late 16 days to 30 calendar days
4	High	Late 31 days to 45 calendar days
5	Very high	Late 46 days to 50 calendar days

Source: Homemade, 2021

The table of mean and mode for frequency and impactis as follows:

Table 4.13 Results of Risk Descriptive Analysis of Time Performance for Frequency Levels.

Variable		Risk Type	Frequency					Descriptive Analysis	
			1	2	3	4	5	Modus	Mean
1	X1	Material Delivery Delay	10,00	5,00	6,00	5,00	9,00	1,00	2,9429
2	X2	There is a change in material specifications during construction	11,00	12,00	7,00	4,00	1,00	2,00	2,2000
3	X3	Limited number of materials on the market	14,00	7,00	9,00	4,00	1,00	1,00	2,1714
4	X4	Late submission of samples of material	9,00	9,00	11,00	5,00	1,00	3,00	2,4286
5	X5	Material Price Increase	11,00	13,00	8,00	1,00	2,00	2,00	2,1429
6	X6	Material Quality Not In Accordance With Specifications	10,00	7,00	9,00	8,00	1,00	1,00	2,5143
7	X7	Inaccuracy in ordering materials.	13,00	7,00	7,00	7,00	1,00	1,00	2,3143
8	X8	The quality of the equipment used is not good.	9,00	9,00	10,00	6,00	1,00	3,00	2,4571
9	X9	The tools used are not in accordance with the specifications.	11,00	4,00	15,00	4,00	1,00	3,00	2,4286
10	X10	Tool damage.	1,00	12,00	12,00	7,00	3,00	3,00	2,9714
11	X11	The number of equipment is less than required.	9,00	4,00	12,00	8,00	2,00	3,00	2,7143
12	X12	Inefficient use of heavy equipment	12,00	6,00	8,00	7,00	2,00	1,00	2,4571
13	X13	Lack of Labor Availability	6,00	11,00	10,00	6,00	2,00	2,00	2,6286
14	X14	Low Labor Productivity	3,00	14,00	8,00	8,00	2,00	2,00	2,7714
15	X15	Incompetent Workforce	6,00	13,00	6,00	8,00	2,00	2,00	2,6286
16	X16	Unprepared organization	12,00	5,00	9,00	8,00	1,00	1,00	2,4571
17	X17	Natural and Weather Disturbances	4,00	7,00	15,00	8,00	1,00	3,00	2,8571
18	X18	Coordination across owners/contractors/suppliers/other agencies	4,00	8,00	17,00	5,00	1,00	3,00	2,7429
19	X19	Completeness of Contract Documents	12,00	5,00	12,00	6,00	.	3,00	2,3429
20	X20	Adequacy of Quality Control	7,00	8,00	15,00	3,00	2,00	3,00	2,5714
21	X21	There is a Security Disruption	11,00	8,00	8,00	8,00	.	1,00	2,3714
22	X22	Traffic Disturbance	9,00	9,00	7,00	10,00	.	4,00	2,5143
23	X23	Existing Condition Problems (relocation of utilities: pipes, cables, etc.)	5,00	9,00	11,00	7,00	3,00	3,00	2,8286
24	X24	Lack of project communication and understanding.	6,00	14,00	5,00	8,00	2,00	2,00	2,6000
25	X25	The method of carrying out the work is not appropriate.	9,00	7,00	8,00	10,00	1,00	4,00	2,6286
26	X26	Late payment by project owner	14,00	3,00	9,00	6,00	3,00	1,00	2,4571
27	X27	Make changes to the design.	3,00	10,00	12,00	8,00	2,00	3,00	2,8857
28	X28	Project administration system	4,00	15,00	9,00	5,00	2,00	2,00	2,6000

For example for the variable (X4), The results of the questionnaire that provides answers to the frequency derived from the respondent's data are: 5 = 1 respondent, 4 = 5respondent,3 =11respondent, 2=9 respondent, 1 = 9respondent.
For Analysis value *Diskripti*f *modus* is as big as 3.00, where = the value of the respondent with the frequency that occurs frequently.

For Analysis value *Diskriptifmean*is as big as 2,4286where the sum of all respondents' answers for the frequency of each variable.

=(1 x5)+(5 x4)+(11 x3)+(9 x2) +(9 x1)

35
=2,4286

So Variable Descriptive AnalysisX4risk frequency level =**2.4286**is classified as **low.**
Table 4.14 Results of Descriptive Analysis of Risk on Time Performance for Impact Level.
For example for the variable (X23), The results of the questionnaire that provide answers to the impact derived from the respondent's data are:5 = 11 respondent, 4 = 15respondent,3 =7respondent, 2=1 respondent, 1 =1 respondent.

For the Descriptive Analysis mode value is 4,00, where = value of the respondent whose level of influence often appears.
For the value of Descriptive Analysis the mean is equal to 3,9706, where summing up all respondents' answers to the impact on each variable.
=(11 x5)+(15 x4)+(7 x3)+(1 x2) +(1 x1)

35
=3,9714

PAIRED MATRIX COMPARISON
The matrices were created for pairwise comparisons of matrices, for each frequency and impact. Then proceed with pairwise comparisons so that as many as 5 elements are compared. Below is a paired matrix for impact and frequency.

Table 4.15 Scale Comparison of Values

Level of Importance	Definition
	It's just as important as the others.
1	Moderate importance compared to others
3	Strong importance compared to others
5	Very important than others
7	Extremes are more important than others. Value between two adjacent assessments.
9	If element i has any of the above numbers when
2,4,6,8	compared to element j, j has the opposite value when compared to element i.

Source: Saaty, 2008

Two elements that are equally important will result in the number 1, while the two elements will apply the reciprocal axiom, meaning "if element I is rated 2 times more important than element j, then element j will be valued differently than element I, namely ". If there are 10 elements, then a pairwaise comparisson matrix of size 10 x 10 will be obtained. So if there are n elements, then an n x n pairwaise comparisson matrix will be obtained.

So that the resulting weighting matrix for each criterion is shown in the two tables below:

Table 4.16 Paired Matrix for Frequency

	Very often	Often	Sometimes	Seldom	Very rarely
Very low	1	3	5	7	9
Low	0.33	1.00	3.00	5.00	7.00
Currently	0.20	0.33	1.00	3.00	5.00
High	0.14	0.20	0.33	1.00	3.00
Very high	0.11	0.14	0.20	0.33	1.00
Amount	1.79	4.68	9.53	16.33	25.00

Source: Processed Results,2021

Table 4.17 Paired Matrix for Impact

	Very often	Often	Sometimes	Seldom	Very rarely
Very low	1	3	5	7	9
Low	0.33	1.00	3.00	5.00	7.00
Currently	0.20	0.33	1.00	3.00	5.00
High	0.14	0.20	0.33	1.00	3.00
Very highi	0.11	0.14	0.20	0.33	1.00
Amount	1.79	4.68	9.53	16.33	25.00

Source: Processed Results,2021

Elemental Weight Comparison

The calculation of element weights for each element in the matrix for both frequency and impact can be seen in the table below.

Table 4.18 Elemental Weight Calculation for Frequency

	Very often	Often	Sometimes	Seldom	Very rarely	Seldom	Seldom	Seldom
Very low	0.560	0.642	0.524	0.429	0.360	2.514	0.503	100.00 %
Low	0.187	0.214	0.315	0.306	0.280	1.301	0.260	51.75%
Currently	0.112	0.071	0.105	0.184	0.200	0.672	0.134	26.72%
High	0.080	0.043	0.035	0.061	0.120	0.339	0.068	13.48%
Very high	0.062	0.031	0.021	0.020	0.040	0.174	0.035	6.93%
Amount	1.000	1.000	1.000	1.000	1.000	5.000	1.000	1.000

Source: Processed Results,2021

Tabel 4.19 Bobot Elemen Frekuensi

	Very often	Often	Sometimes	Seldom	Very rarely
Amount	1.000	0.5175	0.2672	0.1348	0.0693

Source: Processed Results,2021

sama dengan perhitungan bobot elemen frekuensi, yang diperlihatkan pada tabel dibawah ini:

Tabel 4.20 Perhitungan Bobot Elemen Untuk Dampak

	Very often	Often	Sometimes	Seldom	Very rarely	Seldom	Seldom	Seldom
Very low	0.560	0.642	0.524	0.429	0.360	2.514	0.503	100.00%
Low	0.187	0.214	0.315	0.306	0.280	1.301	0.260	51.75%
Currently	0.112	0.071	0.105	0.184	0.200	0.672	0.134	26.72%
High	0.080	0.043	0.035	0.061	0.120	0.339	0.068	13.48%
Very high	0.062	0.031	0.021	0.020	0.040	0.174	0.035	6.93%
Amount	1.000	1.000	1.000	1.000	1.000	5.000	1.000	1.000

Source: Processed Results,2021

Table 4.21 Weights of Impact Elements

	Very often	Sering	Kadang-Kadang	Jarang	Sangat Jarang
Amount	1.000	0.5175	0.2672	0.1348	0.0693

Source: Processed Results,2021

Matrix and Hierarchy Consistency Test

The weight matrix from the results of pairwise comparisons must have a diagonal of one value and be consistent. To test the consistency, the maximum eigen value (λmax) must be close to the number of elements (n) and the remaining eigen value is close to zero.

Proof of the consistency of the paired matrix is carried out by dividing the elements in each column by the number of columns in question, the matrix is obtained as follows:

0.560	0.642	0.524	0.429	0.360
0.187	0.214	0.315	0.306	0.280
0.112	0.071	0.105	0.184	0.200
0.080	0.043	0.035	0.061	0.120
0.062	0.031	0.021	0.020	0.040

Then the average for each row is taken, namely 0.50; 0.26; 0.13; 0.07; and 0.03. The column vector (average) is multiplied by the original matrix to produce a value for each row, which is then divided by the corresponding vector value:

1.00	3.00	5.00	7.00	9.00		0.503		2.74	:	0.503	=	5.46
0.33	1.00	3.00	5.00	7.00		0.260		1.41	:	0.260	=	5.43
0.20	0.33	1.00	3.00	5.00	x	0.134	=	0.70	:	0.134	=	5.20
0.14	0.20	0.33	1.00	3.00		0.068		0.34	:	0.068	=	5.03
0.11	0.14	0.20	0.33	1.00		0.035		0.18	:	0.035	=	5.09
										Sum		26.21

The number of elements in the matrix (n) is 5, then max = 26.21 / 5, so we get max of 5.24, thus because the value of max is close to the number of elements (n) in the matrix, which is 5 and the remaining eigenvalue is 0.24 which means it is close to zero , then the matrix is consistent. The paired matrices for impact and frequency are the same according to tables 3.6 and 3.7, so these results are the same for impact and frequency, ie each matrix is consistent.

Table 4.22 Random Value Consistency Index (CRI)

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

Source: Saaty, 2008

To test the consistency of the hierarchy and the level of accuracy, for the impact and frequency with the number of elements in the matrix (n) is 5, the CRI for n=5 according to table 4.39 is 1.12 then CC = max – n)/(n-1) so that we get CCI is 0.061. Furthermore, because CRH = CCI/CRI, then CRH = 0.060/1.12 = 0.05. The CRH value obtained is quite small or below 10%, meaning that the hierarchy is consistent and the level of accuracy is high.

Risk Value Analysis Using SNI Risk

After obtaining the average value of the impact and frequency of risk, the analysis is continued by looking for the value of the Risk Factor. The risk factor equation is defined as the product of the magnitude of the impact and the probability of a risk event, which is calculated from the following equation, namely:

FR= L+ I –(L xI),

with the understanding:
FR=Risk factors, with a scale of 0 - 1
L=*the probability of a risk event,*
I=The magnitude of the risk
Source: SNI Risk, 2006

For example, for the X10 variable, the average value of the Risk Event Frequency is: 0.3290, for the Risk Event Impact value it is 0.4865, then the risk factor is:
FR X10= 0.3290 + 0.5763– (0.3290 x 0.5763)
FRX10=0.7157

From the final value of risk factors on time performance that has been obtained from the table above, then these values will then be used in the risk level analysis using the 2006 SNI Risk

Risk Level Analysis Using SNI Risk

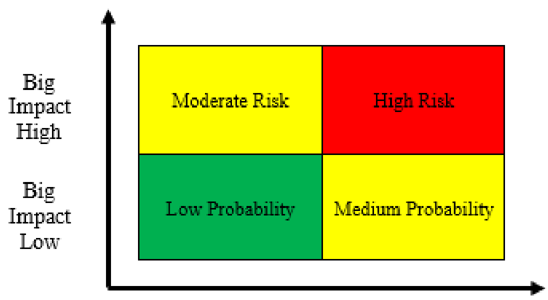
Risk Categorization is a way to determine risk categories into groups based on the level of risk. To determine the category of these variables, the risk categorization table refers to the 2006 SNI Risk as follows:

Table 4.26 Risk Categorization

FR Value	Category	Handling Step
> 0.7	High Risk	There must be a reduction in risk to a lower level
0.4 – 0.7	Moderate Risk	Corrective steps are needed in certain period of time
< 0.4	Low Risk	Corrective steps when allow

Source: SNI Risk, 2006

By using Ficture 4.4 the risk categorization above is then determined the category of each risk event, where:
- low risk, is a risk that can be accepted or ignored
- Medium risk, ie risk with high probability but low impact or low probability but high impact.
- high risk, is a risk that has a high probability of occurrence and a large impact.



Ficture 4.4 Risk Categorization Matrix

Source: SNI Risk, 2006

Analysis of Risk Level Against Time Performance

Table 4.27 Analysis of Risk Levels on Time Performance

Variable		Risk Type	Risk Factor	Category
1	X1	Material Delivery Delay	0,6108	Currently
2	X2	There is a change in material specifications during construction	0,5026	Currently
3	X3	Limited number of materials on the market	0,4164	Currently
4	X4	Late submission of samples of material	0,4780	Currently
5	X5	Material Price Increase	0,4228	Currently
6	X6	Material Quality Not In Accordance With Specifications	0,5067	Currently
7	X7	Inaccuracy in ordering materials.	0,4634	Currently
8	X8	The quality of the equipment used is not good.	0,5130	Currently
9	X9	The tools used are not in accordance with the specifications.	0,5340	Currently
10	X10	Tool damage.	0,7157	High
11	X11	The number of equipment is less than required.	0,5831	Currently
12	X12	Inefficient use of heavy equipment	0,4973	Currently
13	X13	Lack of Labor Availability	0,5710	Currently
14	X14	Low Labor Productivity	0,5775	Currently
15	X15	Incompetent Workforce	0,5792	Currently
16	X16	Unprepared organization	0,5119	Currently
17	X17	Natural and Weather Disturbances	0,5559	Currently
18	X18	Coordination across owners/contractors/suppliers/other agencies	0,5133	Currently
19	X19	Completeness of Contract Documents	0,4566	Currently
20	X20	Adequacy of Quality Control	0,5188	Currently
21	X21	There is a Security Disruption	0,4816	Currently
22	X22	Traffic Disturbance	0,4971	Currently
23	X23	Existing Condition Problems (relocation of utilities: pipes, cables, etc.)	0,7239	High
24	X24	Lack of project communication and understanding.	0,5119	Currently
25	X25	The method of carrying out the work is not appropriate.	0,5394	Currently
26	X26	Late payment by project owner	0,5325	Currently
27	X27	Make changes to the design.	0,7260	High
28	X28	Project administration system	0,4639	Currently

The results of the analysis of the level of risk on time performance indicate that the risk variable that is categorized as low does not exist. The risk variables categorized as moderate are X1, X2, X3, X4, X5, X6, X7, X8, X9, X11, X12, X13, X14, X15, X16, X17, X18, X19, X20, X21, X22, X24, X25, X26, X28, which are categorized as high are X10, X23, and X27 variables on time performance.

Determination of Dominant Risk Factors

Referring to the 2006 SNI Risk, the type of risk that has a high category is a risk that has a high probability of occurrence and a large impact.

VI. CONCLUSIONS AND SUGGESTIONS

6.1 Conclusion

From the results of the analysis that has been done, it can be concluded several things as follows:

1. Based on the results of the literature review, there are 29 variables that can affect the performance of the project implementation time. The next stage is to verify, clarify and validate the three experts to determine the variables that greatly affect the time performance of the xxx Road Preservation Project (MYC). Based on the results of expert validation, 28 variables were very influential and 1 variable had no effect, these variables were used to distribute questionnaires to the owner, supervisory consultant, bantek consultant and service provider to

determine the dominant risk factor.

2. From 35 respondents, 30 respondents, 86% of respondents were male and 14% of respondents were female. The working period of respondents is between 0 s.d.10 years as much as 40.00% of respondents, 11 s.d. 20 years as many as 37.00% of respondents, and 21 s.d. 30 years as many as 9.00% of respondents, 30 years by 14.00%. For work, the PPK is 8.00%, Sub. Chorus of 6.00%, Assistant of 14.00%, Kaur. TU, Analyst JJ, JF JJ AP by 23.00%, Experts by 20.00%, Technical Staff, Technical Advisor, Coordinator of 14.00%, Project Head by 3.00%, Site Operations Manager (SOM) by 3.00%, Quantity Engineer at 3.00%, Inspector Engineer at 3.00%, Surveyor at 3.00%.

3. The dominant risk factors are obtained from the results of data processing that occurs in the XXX Road Preservation Project (MYC) which affects time performance using risk rating analysis and the risk level of SNI with a high weight.

The results are as stated below:

There are 3 dominant risk factors that affect project time, namely:

- X10:Tool damage
- X23:Existing Condition Problems (relocation of utilities: pipes, cables, etc.)
- X27:Make changes to the design.

4. The results of the questionnaire validation test resulted in 28 variables having r count greater than r table, namely 0.3338, which means 28 valid variables. For reliability test results, 28 variables have Cronbach's Alpha values greater than r table, which is 0.3338, so that 28 variables are reliable;

5. The dominant risk resulting from the analysis, with the following results:

a. Causes and impacts that occur on the dominant risk.

- Tool damage (X10) on the job, lack of equipment maintenance according to procedures, delays in delivery / supply of equipment materials,
- Existing Condition Problems (relocation of utilities: pipes, cables, etc.) (X23), the lack of response from the owner of the utility building and the slow transfer of utility poles, both PLN, PDAM pipes, and other planted power cables.
- Make changes to the design (X27)caused by, planning and implementation time that is too far away and planning errors and has the impact of reviewing the planning design, incomplete identification of the type of work, work sequence plans that are not well structured/integrated, inaccurate determination of work time duration, owner's work plan that changes frequently, Wrong or inappropriate construction/implementation methods.

b. Preventive and corrective responses that occur in dominant risks.

- Preventive and corrective responses that occur in dominant risks to time performance.

- Tool damage (X10) has a preventive response in the form of ensuring the condition and readiness of equipment, especially the Asphalt Mixing Plant (AMP) in the Instruction Letter (SI) as well as corrective response in the form of clarifying and reviewing the basecamp at each appearance of the Instruction Letter (SI).
- Existing Condition Problems (relocation of utilities: pipes, cables, etc.) (X23) have a preventive response in the form of ensuring instructions or requests for moving utility buildings and others in the Instruction Letter (SI) or request as well as corrective responses in the form of clarifying each appearance of the application letter and Instruction Letter (SI) regarding the transfer of utility buildings and others, so that it does not happen.
- Make changes to the design (X27) has a preventive response in the form of ensuring contractual change instructions in the Instruction Letter (SI) as well as corrective response in the form of clarifying each appearance of the Instruction Letter (SI) changes to the work design.

6. Based on the results of this study, the standard risk of accepting a different job, intervention or intervention by the owner, design changes is a risk and is the responsibility of the owner, namely PPK. To anticipate the risks that may occur during the execution of the work, so the owner (PPK) should come from an engineering education background and have experience in the field of road and bridge implementation. owner, changes to finished construction and design changes are risks that are the responsibility of the owner, namely PPK. To anticipate possible risks occurs during the implementation of the work, so the owner (PPK) should come from an engineering education background and have experience in the field of road and bridge implementation.

7. Based on the severity/impact assessment, there are 8 (minor) severity levels, which means low impact and can be handled easily, 3 (moderate) severity.

8. As many as 25 risks which mean moderate impact, can result in reduced effectiveness and efficiency of project implementation, and affect time, the severity of 4 (major) as many as 3 risks which means broad/severe impact and affects project delays.

6.2 Suggestions

Suggestions that can be given for this research are:

6.1.1 Conduct a similar study by analyzing the risk of the xxx Road Preservation Project (MYC) on cost performance and quality performance.

6.1.2 To continue further research specifically the risk response for the dominant risk factors that have been identified in this study.

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