PROC. INTERNAT. CONF. SCI. ENGIN.
Volume 4, February 2021
Page 192-196

ISSN 1504607797
E-ISSN 1505707533

Model of the Influence of Construction Management Components on the Achievement of Road Preservation Quality with Long Segment Schemes on National Roads in West Kalimantan

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Abstract. West Kalimantan is the fourth largest province after Papua, East Kalimantan, and Central Kalimantan with a land area of 146.807 km². The length of the national roads in this province is 2.117,17 km with road stability rating of 93,88%. The characteristics of construction quality and the contribution of the construction management component to quality achievement need to be identified and analyzed, so that road preservation work can be carried out effectively and efficiently. This study aims to obtain the desired quality characteristics in road preservation with a long segment scheme, as well as the contribution of construction management components to the intended quality achievement. The questionnaire was distributed to stakeholders of National Road network preservation in West Kalimantan Province. Results show that both owners and service providers agree that (1) design accuracy, (2) understanding of method, schedule and design, and (3) quality accuracy are the highest rank components of construction management. Multiple linear regression formulates that X5 – Design and Supervision is the variable with the most impact on quality of road preservation with long segment scheme.

Keywords: construction management, road preservation, long segment, reliability test, frequency analysis, RII analysis, Rank Spearman analysis, multiple linear regression.

Abbreviations: RII (Relative Importance Index).

Running title: Construction Management Components on Road Preservation.

INTRODUCTION

The implementation of road preservation is influenced by various things, one of which is from the aspect of road management. Good construction management will greatly determine the quality of work results, therefore each component of construction management must be managed effectively and efficiently. The influence of each component of construction management on achieving road preservation quality needs to be known in order to achieve effective and efficient construction management. This is useful for determining the next action: how to manage all components of construction management in order to get good quality work results.

Long segment is the method handling of road preservation within the limit of one continuous segment length (can be more than one segment) which is carried out with the aim of obtaining uniform road conditions, namely a steady and standard road (the standard is in accordance with PERMEN PU No. 19/PRT/M/2011). The long segment includes several scopes of activity (output), namely road widening, reconstruction, rehabilitation and maintenance.

The construction management components in long segment activities must be well managed in order to achieve good quality work. The contribution of each component to quality achievement is also important to be identified, so that work can be carried out in the most optimum way. This study aims to obtain the amount of contribution referred to in the long segment preservation work.

The scope of this research area is the national road network in West Kalimantan Province. Research respondents are stakeholders who play a role in handling national roads in the region. Decree of the Minister of Public Works and Housing of the Republic of Indonesia Number: 248/KPTS/M/2015 concerning the Designation of Roads in the Primary Road Network According to Functions as Arterial Roads (JAP) and Collector-1 Roads (JKP-1) states the total length of roads in the province of West Kalimantan is 2.117,17 Km. The entire national road segment is handled by 6 Working Units (Work unit) and 24 Commitment Making Officials (The Commitment Officer /PPK) in West Kalimantan Province. Road preservation with a long segment scheme began to be implemented in 2016. The fundamental difference between long segment contracts compared to conventional contracts is that there is a combination of several road handling outputs which are the responsibility of one service provider with the aim of obtaining uniform road conditions, namely a steady road and meeting standards along the segment. This of course has an effect and results that need to be investigated further in relation to work implementation, construction management, and the expected quality achievements. The relatively young age of the long segment scheme is also the basis for the author to evaluate its implementation. The purpose of conducting this research is to answer the formulation of the problem to be studied, namely (1) knowing the components of construction management that affect the quality achievement of the long segment preservation and (2) knowing the components of construction management

that predominantly affect the quality achievement of the long segment preservation.

MATERIALS AND METHODS

Study Area

The data used in this study are primary data, in the form of questionnaires distributed to respondents who play a role either directly or indirectly in the National Road maintenance project in West Kalimantan. These parties are the Owner (Kasatker, PPK, Supervisor) and Service Providers (Contractors, Design Consultants, and Supervision Consultants). The respondents are divided into two respondent groups namely owner group which consists of 15 respondents and service providers group which consists of 39 respondents.

Reliability Test

The reliability test is used to collect data once and to analyze questionnaires which scale is not 0 or 1, the Cronbach Alpha formula is used, where an instrument is said to be reliable if the Cronbach Alpha value is > 0.6 (Arikunto, 2010). The reliability of the questionnaire is determined based on the Cronbach Alpha value, where if the value is > 0.6 then the questionnaire is said to be reliable and if not, the questionnaire needs to be redesigned.

Frequency Analysis

Frequency analysis is used to determine the number of respondents' answers for each characteristic factor that contributes to the successful implementation and time of project completion (Arikunto, 2006). The frequency analysis also shows the tendency of the respondents' answers to the cases being asked. To determine the percentage of the frequency is the number of respondents for one case divided by the number of respondents and multiplied by 100%.

Relative Importance Index (RII) Analysis

This calculation is used to show the Relative Importance Index (RII) of the multiplication between different factors from the views of some parties. The results of the RII calculation will show the most dominant factor affecting the quality achievement of the long segment preservation work. Therefore, RII is calculated as follows (Oden and Battaineh, 2002):

$$RII = \frac{\sum_{i=1}^{5} WiXi}{\sum_{i=1}^{5} Xi} \quad (1)$$

where:

i = response category index (1, 2, 3, 4, and 5)
Wi = weight associated with the i response value i (1-5)
Xi = frequency of i response as a percentage of total respondents for each factor

Rank Spearman Analysis

The Spearman Rank correlation coefficient was discovered by Carl Spearman in 1904 (Narbuko and Achmadi, 2004) which is included in non-parametric statistics. It is a measurement of the relationship between different parties or factors that are measured on a Likert scale and determines the strength and direction of a relationship between the factors. The formula used is as follows:

$$r_s = 1 - \left[\frac{(6\sum d^2)}{[N(N^2-1)]}\right] \quad (2)$$

where:

r_s = spearman Rank correlation coefficient between 2 groups
d = difference between the ratings of each variable for each cause
N = number of variables sequentially

The level of closeness of this relationship can be determined by calculating the value of the r_s correlation coefficient which will later be juxtaposed with the r_s table. The relationship between the ranks of these parties is proven by a hypothesis test with a significant level of 95%.

Multiple Linier Regression

Multiple linear regression analysis can be used to find out how the dependent variable can be predicted through individual independent variables (Sugiyono, 2003). The main purpose of multiple linear regression analysis is to estimate the value of the regression coefficient. Furthermore, this value will show the magnitude of the influence of the independent variable on the dependent variable. The formula used in multiple linear regression analysis is as follows:

$$Y = a + b_1x_1 + b_2x_2 + \cdots + b_nx_n \quad (3)$$

where:

Y = dependent variable
a = constant
x_1 = 1st independent variable
x_2 = 2nd independent variable
b_1 = 1st slope
b_2 = 2nd slope

RESULTS AND DISCUSSION

Reliability Test

Table 1 indicates that all the determined variables are declared valid because they have a coefficient greater than 0.6. Furthermore, it can be identified that the variable that has the highest Cronbach Alpha value is X5 Design/Supervision of 0.677; while the variable with the lowest coefficient is X4 Equipment of 0.612. Reliability test shows that the questionnaire that has been compiled is reliable and can be analyzed further to achieve the research objectives.

Table 1. Reliability Test Result.

Code	Variable	Cronbach Alpha Coefficient
X1	Contractors	0,626
X2	PPK	0,650
X3	Material	0,638
X4	Equipment	0,612
X5	Design/Supervision	0,677
X6	Finance	0,638
X7	Environment	0,638

Frequency Analysis

The results of the frequency analysis are later used for analysis of Relative Importance Index. Frequency analysis is carried out on the answers to the questionnaire from 54 respondents to the owner and service providers with the results in table 2 as follows:

Table 2. *Frequency Analysis Result.*

Component Management Construction		Effect Scale				
		VL (1)	L (2)	M (3)	H (4)	VH (5)
X11	Skill	0	1	12	31	10
X12	Experience	0	0	26	23	5
X13	Personnel number	0	11	29	14	0
X14	Productivity	-	3	35	16	-
X15	Mobilisation accuracy	0	6	30	18	0
X16	Health dan safety commitment	0	7	34	13	0
X17	Discipline level	0	5	25	22	2
X18	Understanding of method, schedule, and design	0	0	11	25	18
X21	Management experience	0	0	29	19	6
X22	Technical ability	0	7	29	18	0
X23	Project scheduling	0	7	33	14	0
X24	Communication skill	0	7	26	21	0
X25	Coordination flow	0	3	34	17	0
X26	Teamwork	0	1	32	18	3
X27	Health and safety control	0	10	34	10	0
X28	Problem response speed	0	13	26	15	0
X29	Supporting staff number	0	11	33	10	0
X30	Supporting staff welfare	0	16	30	8	0
X31	Quality accuracy	0	0	13	23	18
X32	Compliance with specification	0	0	24	18	12
X33	Adequate volume	0	2	38	13	1
X34	Ease of mobilisation	0	3	29	22	0
X35	Price fluctuation	0	14	30	10	0
X36	Material storage	0	8	37	9	0
X37	Quality control	0	10	28	15	1
X38	Order schedule	0	10	32	12	0
X41	Equipement availability	0	0	33	15	6
X42	Functionality	0	12	32	10	0
X43	Compliance with specification	0	3	36	15	0
X44	Equipment number	0	10	32	12	0
X45	Productivity	0	6	33	15	0
X46	Operator skill	0	8	30	16	0
X47	Mobilisation speed	0	7	36	11	0
X48	Field strorage	0	12	30	11	1
X51	Design accuracy	0	0	6	28	20
X52	Design change frequency	0	1	32	20	1
X53	Design revision procedure	0	7	33	13	1
X54	Schedule accuracy	0	0	26	24	4
X55	Supervision quality	0	0	13	26	15
X56	Reporting	0	3	34	16	1
X57	Supervision personnel presence	0	5	35	13	1
X61	Fund availability	0	6	26	20	2
X62	Payment	0	2	31	19	2
X63	Payment accuracy	0	8	30	15	1
X64	Correct price estimation	0	10	29	15	0
X65	Calculation of inflation and escalation	0	13	34	7	0
X66	Calculation of unforeseen expenses	0	15	28	11	0
X67	Fund management ability	0	9	33	12	0
X71	Weather and climate	0	10	37	7	0
X72	Field condition	0	13	31	10	0
X73	Rules and regulation changes	0	12	36	6	0
X74	Traffic	0	12	31	11	0
X75	Economy condition	0	17	26	10	1
X76	Politic and law condition	0	11	37	6	0
X77	Social situation and local culture	0	14	32	8	0

Relative Importance Index Analysis

Based on the results of the Relative Importance Index analysis, the variable ranking is then carried out to see which components have the most influence on the achievement of the quality of the long segment preservation work. This ranking is carried out separately for each respondent group so that it can be seen the perception of the owner in table 3 and the service provider in table 4 as follows:

Table 3. *RII Rank – Owner Group Respondent.*

Component Management Construction		Owner	
		RII	Rank
X51	Design accuracy	0.90370	1
X18	Understanding of method, schedule, and design	0.88889	2
X11	Skill	0.88519	3
X55	Supervision quality	0.88519	3
X12	Experience	0.88148	5
X54	Schedule accuracy	0.87037	6
X17	Discipline level	0.86667	7
X52	Design change frequency	0.86296	8
X14	Productivity	0.85926	9
X15	Mobilisation accuracy	0.85926	9

Table 4. *RII Rank – Service Provider Group Respondent.*

Component Management Construction		Service Provider	
		RII	Rank
X51	Design accuracy	0.90256	1
X11	Skill	0.88718	2
X55	Supervision quality	0.88718	2
X12	Experience	0.87692	4
X18	Understanding of method, schedule, and design	0.87179	5
X54	Schedule accuracy	0.86667	6
X14	Productivity	0.86154	7
X52	Design change frequency	0.86154	7
X15	Mobilisation accuracy	0.85641	9
X17	Discipline level	0.85641	9

Rank Spearman Analysis

The value of each construction management component that has been sorted according to ranking based on the Relative Importance Index analysis is further reviewed using Rank Spearman analysis. This analysis was conducted to identify the correlation between each group of respondents to the research variables. The correlation in question is a reciprocal relationship between the two groups of respondents that affects each other, as shown in the following table:

Table 5. Rank Spearman Correlation Coeffient**.**

			Owner	Penyedia Jasa
Spearman'sho	Owner	Correlation Coefficient	1.000	.877**
		Sig. (2-tailed)	.	.000
		N	55	55
	Penyedia Jasa	Correlation Coefficient	.877**	1.000
		Sig. (2-tailed)	.000	.
		N	55	55

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5 above shows that the value of the Spearman Rank correlation coefficient $r_s > 0.5$ so that it can be concluded that there is a strong relationship between the two groups of respondents. This indicates that there is no difference of opinion between the owner and the service provider on what components of the construction management have an effect on the success of road works implementation.

Multiple Linier Regression

Multiple Linear Regression analysis was carried out which aims to find out what components of construction management have the most dominant influence on road preservation quality achievements.

Table 6. Multiple Linier Regression Coefficient.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-18.983	4.878		-3.892	.000
	T_X1	.180	.074	.202	2.422	.019
	T_X2	.220	.066	.307	3.329	.002
	T_X3	.153	.066	.198	2.309	.026
	T_X4	.122	.096	.135	1.272	.210
	T_X5	.349	.066	.433	5.262	.000
	T_X6	.155	.090	.166	1.727	.091
	T_X7	.220	.081	.257	2.708	.009

a. Dependent Variable: T_Y

From the multiple linear regression analysis, the regression coefficient values for untuk a = -18.983 , b_1 = .180, b_2 = .220, b_3 = .153, b_4 = .122, b_5 = .349, b_6 = .155, b_7 = .220; hence the form of the regression equation is Y = -18,983 + .180 X1 + .220 X2 + .153 X3 + .122 X4 + .349 X5 + .155 X6 + .22 0X7. The largest regression coefficient is found in variable X5, namely the Design and Supervision factor of .349 with a significant level of .000. Based on the results of this analysis, it is known that the dominant factors affecting the achievement of the quality of the long segment preservation work of the national road section of West Kalimantan Province are Design and Supervision factors.

CONCLUSION

The analysis conducted in this study indicates that there is a similiar perception between owners and service providers regarding which components of construction management that affect the result of road preservation with long segment scheme. The equation model of multiple linear regression shows that Design and Supervision factor is the most influential aspect of construction manangement in road preservation on national road in West Kalimantan; with Design Accuracy and Supervision Quality being the highest ranking variables.

ACKNOWLEDGEMENTS

Author would like to thank Ayomi Dita Rarasati S.T., M.T., Ph.D. of University of Indonesia for her guidance and insights during this study. Author also expresses gratitude to colleagues from Balai Pelaksanaan Jalan Nasional Pontianak for the data and information given that helped this study to be conducted.

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