

Factors Affecting the Decreasing Age of Hotmix Road Construction Plan in Tulungagung

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Abstract— Availability of roads in fulfilling the achievement of economic improvement as part of the national transportation system which has an important role, especially in supporting the economy, socio-culture, environment, politics, and defense and security. From an economic aspect, the road as the social capital of society is a link between the production process, the market and the final consumer that reaches the community. The quality of infrastructure is affected by the owner, consultants and contractors during the construction process. The implementation journey is very influenced by many factors in the field. Based on the F test simultaneously, it is obtained that F count is greater than F table, so that all independent variables have an effect on not achieving the age of the Hot Mix road plan, while partially (t test) the influencing variables are vehicle variables (X_2), environmental variables (X_3) and condition variables. land (X_7) because the value of t count > t table. The most dominant factor in influencing the not reaching the planned age of the hotmix road is the vehicle variable with the beta coefficient value (beta coefficient is the predictive value of a variable in the model against the response variable), which is the greatest value of 0.514 or 51.40%, the significant value of 0.013 for the indicator is the number of vehicles by looking at the value of the loading factor, the highest is 0.627 and the diversity value is 62.70%. Patterns and strategies used to overcome the unachieved age of the hotmix road plan in Tulungagung are by providing weigh bridges to identify and determine the tonnage of vehicles passing through the road and impose certain minimum speeds and hours, especially for heavy vehicles; Take careful calculation in determining a specific point, and perform field contour map analysis; Conducting a sandcon test in order to determine the soil shear force and soil bearing capacity of the national standard (AISC). Regular maintenance is the most important part of the road planning life.

Keywords— Age Plan, Factors Affecting, Hotmix.

I. INTRODUCTION

Availability of roads in fulfilling the achievement of economic improvement as part of the national transportation system which has an important role, especially in supporting the economy, socio-culture, environment, politics, and defense and security. From an economic aspect, road as the social capital of society is a link between the production process, the market and final consumer that reaches the community.

Road Traffic and Transportation has a strategic role in supporting national development and integration as part of efforts to advance public welfare as mandated by the 1945 Constitution of the Republic of Indonesia. As part of the national transportation system, Road Traffic and Transportation must be developed and its role is to realize security, welfare, traffic order and road transportation in the framework of supporting economic development and the development of science and technology, regional autonomy, and accountability in state administration. The principles and objectives of creating Traffic and Road Transportation there are safe, orderly, smooth, and integrated with other modes of transportation, also have the aim of encouraging the national economy, realizing people's welfare, national unity and integrity, and being able to uphold national dignity. (Law Number 32, 2009).

The main objective of constructing a district road construction structure in Tulungagung is to reduce stress or pressure due to vehicle wheel loads, so as to achieve a value level that is acceptable to soil that supports the road structure, vehicle is at rest or stops on top of the hardened structure causing direct loads (static stress) on the pavement which is

concentrated in the small contact area between wheel and pavement. When a moving vehicle is running, additional dynamic stress occurs due to movement of vehicle up and down due to uneven pavement, wind loads and so on (Wignall Arthur, 2003).

A quality pavement if it "can reach the design life" according to the planning design by passing a number of vehicles planned, if the pavement construction is carried out properly, and all materials comply with the standards requested in the design specifications and are always used correctly (Wignall Arthur, 2003). To achieve life of the road plan required project management to identify/quantify, analyze, respond and finally control. One of approaches used in identifying is cause and effect, namely by analyzing what will happen and potential consequences (Soeharto, 2001).

Highway construction is a construction made in such a way that it can bear the traffic load (vehicles) passing on it without experiencing any structural changes on the road surface. With the development of land transportation, especially motorized vehicles, which include size and quantity, the problem of smooth traffic flow, safety, comfort and carrying capacity of road pavements must be a concern (Alamsyah, 2006).

Implementation of the district road flexible pavement project in Tulungagung, there are several factors that are thought to have influenced the road plan age not being reached, such as: Changes in design, vehicles, environment, human resources, work implementation, equipment, soil conditions, materials and finances.

Related parties such as the owner, contractor and supervision consultant must be able to identify the factors that have an impact, not reaching the planned life of the road and

how to deal with these factors, so that the quality of road construction can last for life of the road service and the construction can be sustainable in accordance with the national development program.

Based on the conditions of the Tulungagung Road Development, the Public Works Office of Bina Marga and Cipta Karya of Tulungagung has made repairs and improvements to roads on roads that are not according to the predetermined plan age. Research hopes from the research can provide benefits for improving the quality of work and knowing the factors that affect the reduced age of the Hotmix Road Construction Plan in Tulungagung.

II. LITERATURE REVIEW

Construction Management

In a construction activity, a management or management is required to have high performance, accuracy, accuracy, speed, security and work safety in order to obtain effective and efficient results. A series of work activities in a construction project is often referred to as POAC (Planning, Organizing, Actuating, Controlling). This means that project activities must be carefully planned starting from how the process is, and how long the project will be completed, the organization with everyone related to both the foreman, workers and craftsmen. In order for communication and coordination to run well, the project implementation process must be precise, thorough, careful, and fast.

Road

Roads are land transportation infrastructure which includes all parts of the road, including complementary buildings and equipment intended for traffic, which are at ground level, above ground level, below ground level, and / or water and above the water level, except for railways, lorries and cable roads. Flexible pavement is a type of pavement construction that uses aggregate and asphalt as the binding material, so it has good flexible properties, usually used for pavement HRS (Hot Rolled Sheet), Buton Asphalt, SMA (Split Mastic Asphalt) and Penetration Layer.

Hot mix asphalt (Hot Mix) is a type of mixture made to do road paving work which is placed as the top layer of construction (Surface Course) which receives loads directly with the wheels of the vehicle passing on it. The composition of the hot mix mixture consists of: coarse aggregate, fine aggregate, asphalt and rock ash (filler), while the allowable temperature of hot mix asphalt is between 145° C - 155° C, while the allowable temperature for laying is > 97° C - 145° C.

Pavement Layer Construction

Surface Layer (Surface Course) is the part that is located at the top of a pavement construction that gets the greatest load from the traffic loads that pass above it. The Base Course is a layer of pavement that lies between the base layer and the surface layer. Sub Bas Course is a pavement layer that lies between top foundation layer and subgrade. Sub-grade is a layer of soil that can be compacted if original soil is good, soil imported from other places and compacted or soil stabilized

with lime or other materials, soil layer 50-100 m thick will be put the sub-base layer is called the subgrade.

The four layers of pavement function to receive and distribute traffic loads without causing significant damage to the road construction itself thereby providing comfort to vehicle drivers during road service. For that in planning it is necessary to consider all factors that can affect the function of road construction services such as (Alamsyah, 2006).

Acceptance characteristics of forces is getting more and more spread down, the lower its effect is decreasing, so that the load received by this part of the construction also varies according to: road function; road pavement performance; pavement performance; basic soil properties; environmental conditions.

Hot Mix Asphalt

Hot mix asphalt is a type of mixture made to do road paving work which is placed as the top layer of construction (Surface Course) which receives loads directly with the wheels of the vehicle passing on it. The composition of the hot mix mixture consists of: coarse aggregate, fine aggregate, asphalt and rock ash (filler), while the allowable temperature of hot mix asphalt is between 145° C - 155° C, while the allowable temperature for laying is > 97° C - 145° C.

The characteristics of the mixture that hot mix asphalt (Hot Mix) must have are stability, durability, flexibility, skid resistance (hardness), fatigue resistance, workability (ease of implementation).

TABLE 1. Determination of Distribution Types

Test Types	How to test (MPBJ)	Requirements			
		Pen. 60		Pen. 80	
		Min.	Max.	Min.	Max.
1. Penetration (25°C 5 second)	PA.0301-76	60	79	80	99
2. Ring Bell	PA.0302-76	48	55	46	54
3. <u>Clev.</u> Open Cup	PA.0303-76	200	-	225	-
4. Weight Loss (163°, 5 hours)	PA.0304-76	-	0.8	-	0.1
5. <u>C₂HCL₃</u>	PA.0305-76	99	-	99	-
6. <u>Dactilation</u> (25°C, cm/menit)	PA.0306-76	100	-	100	-
7. Penetration after weight loss*)	PA.0301-76	50	-	50	-
8. <u>Ductilation</u> after weight loss*)	PA.0306-76	75	-	75	-
9. <u>Berat Jenis</u> 25°C	PA.0307-76	1	-	1	-

Factors Suspected of Unachieved Affecting Age

Road construction has a design life which initially became base for planning, at the time of use it experiences several factors that affect the not reaching the planned age of the road which is influenced:

1. Design Change
2. Vehicles
3. Work Environment
4. Human Resources
5. Implementation of Work
6. Equipment
7. Soil Conditions
8. Material
9. Finance

III. METHOD

Acceptance characteristics of forces is getting more and more spread down, the lower its effect is decreasing, so that the load received by this part of the construction also varies according to: Road function; Road Pavement Performance;

Pavement Performance; Basic Soil Properties; Environmental Conditions.

Data Collection

Data from population involved in the planning and implementation of hotmix road to owners, consultants, contractors who are relevant to the hotmix road works in Tulungagung. Data collection was carried out by using questionnaires to project factors in order to avoid errors in understanding the statements and respondents could provide appropriate and accurate data.

Research Variable

Research variables are things that are determined by the researcher to study so that information is obtained about them and then conclusions are drawn (Sugiyono, 2009). Research variables include:

1. The independent variable or the independent variable (X) which causes changes in the dependent variable. The independent variables used in this study are:
 - Design changes (X_1).
 - Vehicles (X_2)
 - Environment (X_3)
 - Human Resources (X_4)
 - Implementation of Work (X_5)
 - Equipment (X_6)
 - Soil conditions (X_7)
 - Material (X_8)
 - Finance (X_9)
2. The dependent variable or dependent variable (Y) is a variable that is influenced by the independent variable. In this study, which is used as the dependent variable is
 - Not Achieved Road Plan Age (Y).

Variable Measurement Scale

The variable measurement scale used in this study is the Likert scale. Likert scale is a measurement scale that shows the level of agreement with a statement. On the Likert scale, the level of agreement is measured through 5 answer choices consisting of:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Simply Agree
- 4 = Agree
- 5 = Strongly Agree

Population

The collection of all individuals with a predetermined quality, quantity or characteristic is called a variable. The population is determined based on the experience in the field of people who are considered experienced and know about the development process from the aspects of the initial planning, auction process and physical development process in the field.

Sample

A collection of sampling units drawn and constitute a sub of the population. While the sample is taken from a population

that is considered to represent all these agencies/companies.

Validity and Reliability Test

Roads are land transportation infrastructure which includes all parts.

1. Validity is a measure that shows levels or validity, instrument to be valid if it is able to measure what is desired and reveals data from variables. Validity is measured by correlating scores of each variable with total score which is the item score. Validity of instrument was obtained from correlation between scores of the instruments, correlated with total score, then compared with critical value "r". If correlation of each question instrument is greater the meaning of the item value "r" then instrument can be declared valid, rule of validity decisions is if $t_{count} > t_{table}$ means valid and if $t_{count} < t_{table}$ means invalid.
2. Reliability is an instrument that can be trusted enough to be used as a data collector because the instrument is good. A good measuring tool will not be tendentious or direct respondents to choose certain answers. Instruments that can be trusted too, as for the Reliability testing technique, namely by using coefficient values whose values range from 0 to 1. The closer to number 1 the more realistic the size used, to show that it is more reliable if the Cronbach alpha value is above 0,6 and below 0,6 indicates the total is reliable, the rule for reliable decision is If $r_{count} > r_{table}$ means reliable and if $r_{count} < r_{table}$ means not reliable.

Data Analysis Method

Roads are land transportation infrastructure which includes all parts.

1. Multiple linear regression analysis, estimating factors are most dominant in achieving planned age of road plan, magnitude of influence of each independent variable on dependent variable is shown by the value of the regression coefficient. Value of the partial correlation coefficient to be significant if $t_{count} < t_{table}$.
2. Classic Test of the Assumption of Regression Equations:
 - Normality assumption
 - Assumption of Multicollinearity
 - Heteroscedacity assumption

The steps for testing the assumptions for normality, multicollinearity, heteroscedasistas use a statistical aid program with Correlation coefficient (r) and Coefficient of Determination (R^2).

IV. RESULTS AND DISCUSSION

Analysis and testing of the validity and reliability beforehand used Statistical Packaged for Social Sciences (SPSS).

Validity

Validity testing is carried out with the Corrected Item-Total Correlation value with an error rate (significance value) $< \alpha = 0.05$ (5%). For this test, Statistical Packaged for Social Sciences (SPSS) was used. The results of the validity test for the independent variables, namely Design Change Factor (X_1),

Vehicle Factor (X_2), Environmental Factor (X_3), Human Resource Factor (X_4), Work Implementation Method Factor (X_5), Equipment Factor (X_6), Factor Soil Condition (X_7), Material Factor (X_8), Financial Factor (X_9). The results of the validity test for all question items from the independent variable found that the Corrected Item-Total Correlation was assessed to be more than above 0.374.

Reliability

To test reliability, Alpha Cronbach method was used. The Cronbach Alpha method is used to find reliability of instruments whose scores are not 1 and 0 (yes and no). Reliability testing is done by using internal consistency or the degree of accuracy of answers. For this test, Statistical Packaged for Social Sciences (SPSS) was used using the Cronbach Alpha coefficient.

The instrument to be reliable if it has a Cronbach Alpha coefficient of more than 0.6. If the calculated probability r value is greater than the significance level of 0.05 and has a reliability coefficient above 0.6, the measuring instrument used is reliable.

TABLE 2. Instrument Reliability Test

Variabel	Cronbach Alpha Reliability	Note
Design Changes	0,681	Reliable
Vehicles	0,791	Reliable
Environment	0,686	Reliable
Human Resources	0,712	Reliable
Implementation of Work	0,842	Reliable
Equipment	0,715	Reliable
Soil Condition	0,846	Reliable
Material	0,682	Reliable
Finance	0,758	Reliable

Source: Result Analysis, 2020

Factor Analysis

Factor analysis is an analysis used to identify, classify and summarize the most dominant indicators that affect the not reaching the planned age of the hotmix road in Tulungagung. Based on the output of the factor analysis above, there is 1 new variable formed because it has a total value of eigenvalues ≥ 1 , namely component 1, which means that the factors used in the factor analysis are able to explain the variation of 66.306%. So it can be explained that component 1 is the one that affects the not reaching the design life of the hot mix road.

Multiple Linear Regression Analysis

To find out whether the factors that exist simultaneously and partially have a significant effect on the not achieving the age of the regency road plan in Tulungagung, the data processing process using multiple linear regression analysis was carried out to find the relationship between the independent and dependent variables.

TABLE 3. Results of Multiple Linear Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	38.940	34.481		53.702	.000
	Perubahan_Desain	.865	.148	.122	1.837	.623
	Kendaraan	1.484	.307	.514	4.833	.013
	Lingkungan	1.131	.140	.421	3.994	.037
	SDM	.864	.239	.102	1.613	.987
	Metode_Pekerjaan	.149	.228	.123	1.042	.485
	Peralatan	.187	.119	.241	1.944	.734
	Kondisi_Tanah	1.114	.272	.408	3.507	.022
	Material	.968	.126	.237	1.682	.349
	Keuangan	.938	.237	.103	1.966	.079

a. Dependent Variable: Umur_Hotmix

Source: Result Analysis, 2020

Hypothesis Test for Regression Model Coefficient

Simultaneous testing of the regression model is carried out using the F test or ANOVA and partially testing the regression model is carried out by the t test.

TABLE 4. Results of Determination Coefficient Test

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.898 ^a	.895	.993	1.209

a. Predictors: (Constant), Keuangan, Peralatan, Metode_Pekerjaan, Perubahan_Desain, Kendaraan, Lingkungan, Kondisi_Tanah, SDM, Material

b. Dependent Variable: Umur_Hotmix

Source: Result Analysis, 2020

Simultaneous Regression Model Test

Simultaneous testing is carried out to show whether all the variables used in the regression model have a significant effect on Y. All of these variables are tested simultaneously using the F test. By using statistical aid program software, the F test results are obtained in the table:

TABLE 5. Results of Simultaneous Determination Test

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5431.569	9	603.508	43.226	.005 ^b
	Residual	265.289	18	21.460		
	Total	5457.857	27			

a. Dependent Variable: Umur_Hotmix

b. Predictors: (Constant), Keuangan, Peralatan, Metode_Pekerjaan, Perubahan_Desain, Kendaraan, Lingkungan, Kondisi_Tanah, SDM, Material

Source: Result Analysis, 2020

Partial Regression Model Test

To test this relationship, the t test is used, namely by comparing the value of t count with t table. The independent variables forming the regression model are said to have a significant effect if t count > t table or significant $<\alpha = 0.05$, the partial regression model testing is:

TABLE 6. Results of t Test

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	38.940	34.481		53.702	.000
	Perubahan_Desain	.865	.148	.122	1.837	.623
	Kendaraan	1.484	.307	.514	4.833	.013
	Lingkungan	1.131	.140	.421	3.994	.037
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	Material	.968	.126	.237	1.682	.349
	Keuangan	.938	.237	.103	1.966	.079

a. Dependent Variable: Umur_Hotmix

Source: Result Analysis, 2020

It is obtained that the t value of each independent variable and if the t value of each independent variable will be compared with the t table value using the 95% confidence level or $\alpha = 0.05$ then the t table value is 2.056. The results of the t test explain that each Vehicle Factor (X_2), Environmental Factor (X_3) and Soil Condition Factor (X_7) have a significant dominant effect on not achieving the planned age of the hotmix road in Tulungagung (Y).

V. CONCLUSIONS

Conclusions

Based on the results of the calculations from this study, the following conclusions can be drawn:

1. Based on the F test simultaneously, it is obtained that F_{count} is greater than F_{table} , so that all independent variables have an effect on not reaching the hotmix road planning age, while partially (t_{test}) the influencing variables are vehicle variables (X_2), environmental variables (X_3) and variable soil conditions (X_7) because the value of $t_{\text{count}} > t_{\text{table}}$.
2. The most dominant factor in influencing the unachievable age of the hotmix road plan is the vehicle variable with the largest beta coefficient value, namely 0.514 or 51.40%, the significant value of 0.013 for the indicator is the number of vehicles by looking at the highest loading factor value of 0.627 and diversity 62.70%.
3. The strategy used to overcome the not reaching the planned age of the hotmix road in Tulungagung by providing weigh bridges according to tonnage and imposing a minimum speed and certain hours especially for heavy vehicles; Take careful account in determining terrain conditions, and perform field contour map analysis; Conducting a sandcon test to determine the soil shear force and the national standard soil bearing capacity (AISC).

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