

Analysis of Road Widening Reviewed From The Service Level of Kedung Jajang – Ranuyoso, Lumajang

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Abstract

Indonesia is a developing country that has various problems, one of which is congestion. Congestion occurs because of the high population, population mobility and poor road facilities. The congestion that occurs in Lumajang Regency is on the Kedungjajang - Ranuyoso road. Congestion is caused by the high mobility of the population to work, and the high side barriers.

The purpose of this study was to determine the cause of congestion, the amount of road capacity, and the comparison of the level of road service before and after widening the Kedungjajang - Ranuyoso road. Data collection uses measurement data analysis techniques and documentation that was carried out before and after the widening of the Kedungjajang - Ranuyoso road section.

The results showed that the cause of congestion that occurred on Jalan Kedungjajang-Ranuyoso Lumajang was the lack of effective road width, the amount of traffic capacity of the Kedungjajang-Ranuyoso Lumajang road before the widening of the road was 2,291 smp/jam, the amount of traffic capacity of the Kedungjajang-Ranuyoso road Lumajang after road widening is 3069.94 smp/jam, changes in the level of service for the Kedungjajang-Ranuyoso road Lumajang before and after road widening have increased by 2 levels, which originally had a road service level value of "E" to "C" which means the condition the original flow before road widening was unstable current, the speed sometimes stopped, demand was approaching

Keywords

Congestion, Road Capacity, Road Service Level, Road Widening.

1. Introduction

In this modern era, the transportation system has developed for the better, driving comfort and transportation also play an important role because it can make it easier for users. Transportation is very necessary seen from the level of activity of the surrounding community. The development of road transportation in urban areas caused by technological advances, increasing population, and transportation facilities will become a necessity resulting in traffic infrastructure such as parking locations, road areas increase (Andriansyah, 2015). In big cities and developing cities, Indonesia is currently experiencing very rapid development in the field of transportation. So it requires transportation infrastructure, one of which is roads. The road is a means in the form of a circulation space made to facilitate transportation by land (Stone, 1974).

Lumajang City is a world tourist destination that is recognized for its unique natural and cultural beauty, so it has good economic and tourism potential which has led to the rapid development of transportation systems that operate on the road. The level of good and highest road service has provisions of $A < 0.6$ where at this service level the vehicle can move according to the planned speed of the road without any disturbances and obstacles. Furthermore, this level of service decreases to a service level of $F > 1$ where traffic is jammed (Irianto, 2014).

The movement of traffic flows through one of the roads in Lumajang City, namely the Kedungjajang-Ranuyoso Lumajang road which is one of the main roads. The Kedungjajang-Ranuyoso Lumajang road section every day has a very high level of traffic density due to residential areas. The purpose of this study is to evaluate the Kedungjajang-Ranuyoso Lumajang road segment from the existing point of view and then predict it in the next 5 years. Furthermore, this study aims to anticipate problems that exist in the flow of the Kedungjajang-Ranuyoso Lumajang road such as congestion. Jalan Kedungjajang-Ranuyoso Lumajang is a road that has a high level of activity because in this area there are educational activities, trade, offices, and also as an alternative route. This causes several traffic problems such as congestion due to the irregularity of vehicles on the Kedungjajang-Ranuyoso Lumajang road so that researchers are interested in taking a case study on the Kedungjajang-Ranuyoso Lumajang road.

The purposes of this study include knowing the causes of congestion that occur on the Kedungjajang-Ranuyoso Lumajang road, knowing the traffic capacity of the Kedungjajang-Ranuyoso Lumajang road before road widening, knowing the traffic capacity of the Kedungjajang-Ranuyoso Lumajang road after road widening,

knowing changes in service levels. the Kedungjajang-Ranuyoso Lumajang road before and after road widening. The method used in this study under MKJI. Some of the basic formulas and theories used are:

$$C = Co \times FCw \times FCsp \times FCsf \times FCCs$$

Where :

C = Road segment capacity (SMP/Jam)

Co = Basic capacity

FCw = Capacity adjustment factor for traffic lane width

FCsp = Capacity adjustment factor for separator and direction

FCsf = Capacity adjustment factor for side resistance

FCCs = Capacity adjustment factor for city size

$$DS = Q/C$$

Where :

DS = Degree of saturation

Q = Traffic flow (smp/jam)

C = Capacity (smp/jam)

2. Methodology

This research was conducted in a residential area which has an impact on the widening of the Kedungjajang-Ranuyoso Lumajang road which is one of the main roads. To find out the impact before and after road widening. The pros and cons of research are very important and depend on the research method described and used. Preparation, data collection, and analysis carried out in scientific research has the aim of obtaining relevant materials or objects and accurate analysis results so that they can be recognized as good and correct.

To obtain the data as desired and needed, the research uses a technique, a procedure, and tools that can make optimal results. Then it can also find out what impact variables can affect road widening to residential areas, as well as on the overall main activities of residents. The problems that have been formulated are attempted to be evaluated and reviewed in this study by focusing on several methods used in solving the problem formulation.

In every research, you need a tool or something that can facilitate the implementation of the research, this research is no exception, where the tools are as follows: Meter, Mobile (to document and record research locations), PC or Laptop (use for inputting data). data to be processed), Motorcycle (to access the research location), Microsoft Excel (used to process numerical data to be processed as primary and secondary data).

Procedures in collecting data in this study include; a) Secondary Data. This secondary data needs to be obtained and known for research because it can help complete the variables and coefficients that will be discussed, in this secondary data can also use descriptive methods, where descriptive methods can explain and explain the results obtained from the problem formulation. The secondary data of this research is in the form of detailed engineering drawings at the location of the Kedungjajang-Ranuyoso Lumajang road case study. b) Primary Data. This primary data is to make direct observations of the object and find out for sure later the case study will be examined and the problem is known, in the development of this Primary Data a method is needed for its implementation, the method that can be used in this Primary Data is the Survey Method where research with sources The main data and information were obtained from respondents as the research sample by using a questionnaire as a data collection instrument. Then in this Primary Data: location survey, respondent survey (in this respondent's data it can and can be ascertained that road widening can be a value of satisfaction for residents). C) Observation. Observation is a study in which the researcher makes direct observations of the object of research. d) Literature study. A literature study is a method of collecting data by reading journals, literature, and references related to previous research and research related to the current research.(Direktorat Jenderal Bina Marga., 1997)

In this research sample, there are 3 elements support and will be discussed, including Environment (Questionnaire / Respondent Survey), Roads (addition of the Kedungjajang - Ranuyoso road), LHR (Average daily traffic).

3. Result and Discussion

Table 1. Volume Recapitulation Before Road Widening

Time	Monday Total Vehicles (smp/jam)	Tuesday Total Vehicles (smp/jam)	Saturday Total Vehicles (smp/jam)
06.00-07.00	1839	880	1955
07.00-08.00	1402	1569	1492
08.00-09.00	1079	1405	1165
11.00-12.00	894	1062	1049
12.00-13.00	830	1211	991
16.00-17.00	1173	1383	1287

From the recapitulation table, it can be seen that the highest volume of vehicles is on Saturday at 06.00-07.00 which is as many as 1955smp/hour. This highest volume of vehicles will be used to calculate in the next calculation to support the calculation and determination of the level of road service before widening the Kedungjajang-Ranuyoso road segment. Based on the data, it is known that Road Type: 2 lanes are not separated. of 2,900 smp/ja. Based on the data, it is known that the type of road before widening the road is 2 lanes not separated and the effective road width is 7 meters. So, it can also be seen that the lane width adjustment factor (FCw) is 1.00. Based on the data, it is known that the type of road before widening the road is 2 lanes not separated and the effective road width is 7 meters with a split direction setting of 50% - 50%. Then it can also be seen that the traffic direction adjustment factor (FCsp) before road widening is 1.00. Based on the data, it is known that the type of road before widening the road is 2 lanes not separated and the effective shoulder width is 0.9 meters with the condition of the commercial area of market activity besides. Then it can also be seen that the side resistance class code is VH and the magnitude of the curb and shoulder adjustment factor (FCsf) is 0.79. Based on the data, it is known that the size of Lumajang City is about 1.5 million people. Then it can be seen that the city size factor (FCcs) is 1.00. Capacity, Degree of Saturation, before road widening:

$$C = Co \times FCw \times FCsp \times FCsf \times FCcs$$

$$C = 2900 \text{ smp/jam} \times 1,00 \times 1,00 \times 0,79 \times 1,00$$

$$C = 2.291 \text{ smp/jam}$$

$$DS = Q/C$$

$$DS = 1955\text{smp/jam} / 2291 \text{ smp/jam}$$

$$DS = 0,853$$

With the value of the degree of saturation of 0.853, it can be seen that the level of road service can be symbolized by the letter "E". This means that the condition of traffic flow on the Kedungjajang – Ranuyoso road section is unstable, the speed sometimes stops, demand is approaching capacity. Therefore, it is necessary to widen the road so that a higher level of road service is obtained than before.

Tabel 2. Volume Recapitulation After Road Widening

TIME	Sunday Total Vehicle (smp/jam)	Thursday Total Vehicle (smp/jam)	wednesday Total Vehicle (smp/jam)
06.00-07.00	1744	1590	2047
07.00-08.00	1409	1333	1644
08.00-09.00	1032	911	1271
11.00-12.00	1005	911	1085
16.00-17.00	1953	1835	2263

From the recapitulation table, it can be seen that the highest volume of vehicles is on Saturday at 16.00-17.00 which is as many as 2263 smp/hour. This highest vehicle volume will later be used for calculations in the next calculation to support the calculation and determination of the level of road service after the widening of the Kedungjajang-Ranuyoso road segment. Based on the data, it is known that Road Type : 2 lanes are not separated. So, the capacity of the road before widening is 2,900 smp/hour. Based on the data, it is known that the type of road after road widening is 2 lanes not separated and the effective road width is 11 meters. So, it can also be seen that the lane width adjustment factor (FCw) is 1.34. Based on the data, it is known that the type of road after road widening is 2 lanes not separated and the effective road width is 11 meters with a split direction setting of 50% - 50%. Then it can also be seen that the traffic direction adjustment factor (FCsp) after road

widening is 1.00. Based on the data, it is known that the type of road after road widening is 2 lanes not separated and the effective shoulder width is 0.9 meters with the condition of the commercial area of market activity besides. Then it can also be seen that the side resistance class code is VH and the magnitude of the curb and shoulder adjustment factor (FCsf) is 0.79. The capacity and degree of saturation after road widening are

$$C = C_o \times FC_w \times FC_{sp} \times FC_{sf} \times FC_{cs}$$

$$C = 2900 \text{ smp/jam} \times 1,34 \times 1,00 \times 0,79 \times 1,00$$

$$C = 3069,94 \text{ smp/jam}$$

$$DS = Q/C$$

$$DS = 2263 \text{ smp/jam} / 3069,94 \text{ smp/jam}$$

$$DS = 0,737$$

With the value of the degree of saturation of 0.737, it can be seen that the level of road service can be symbolized by the letter "C". This means that the condition of the traffic flow on the Kedungjajang – Ranuyoso road is a stable flow, but the speed and movement of vehicles are controlled. Through this, it can also be seen that there has been a change in the level of road service between before road widening and after road widening. The comparison was made on the Kedungjajang-Ranuyoso road, Lumajang to find out the effectiveness of road widening that has been carried out by the local government with various considerations. The comparison is made according to the highest volume obtained before and after road widening, namely Saturday, June 20, 2020 at 06.00-07.00, which is as many as 1955smp/jam and Saturday, May 29, 2021 at 16.00-17.00, which is 2263smp/hour.

Tabel 3. Comparative Recapitulation of Road Service Levels

Date	Time	Volume	Detail	Service Level	Conditions
Saturday, 20 June 2020	06.00-07.00	1955smp/jam	Before Road Widening	E	Unstable flow speed sometimes stops, Demand is approaching capacity
Saturday, 29 May 2021	16.00-17.00	2263smp/jam	After Road Widening	C	Steady flow, but vehicle speed and motion capacity

Changes that occur before and after road widening are an increase in the level of road service by 2 levels. This proves that the road widening that occurs has a positive impact on the effectiveness of road widening and improving traffic flow conditions. Although the traffic condition of the Kedungjajang – Ranuyoso Lumajang road after road widening has a stable flow, the speed and movement of vehicles are controlled. This can be improved again by taking into account the various kinds of congestion solutions that exist, including one of them is transportation management which has been discussed by the author in sub-chapter 2.16. Apart from transportation management, there are also other solutions to reduce congestion, namely the installation of traffic signs. The types of traffic signs that need to be installed on the Jalan Kedungjajang-Ranuyono Lumajang section need to be adjusted to the conditions in the field. Conditions in the field illustrate the number of side obstacles caused by the number of vehicles that stop and park along the road. Therefore, the types of traffic signs that need to be installed on the Jalan Kedungjajang – Ranuyoso Lumajang section as a form of one solution to unravel congestion are as follows: No parking signs, stop signs, warning signs for a lot of pedestrian traffic. Thus, it is hoped that congestion problems will be reduced and will not arise again in the future so that road users can take advantage of effective road facilities. (Prasetyo, 2019).

4. Conclusion

Based on research that has been carried out with a series of processes in it, the following conclusions have been obtained: The cause of congestion that occurs on Jalan Kedungjajang-Ranuyoso Lumajang is the lack of effective road width. This is evident after the road widening, the level of road service changed for the better 2 levels above, The amount of traffic capacity of the Kedungjajang-Ranuyoso Lumajang road before the widening of the road was 2,291 smp/jam which was taken from the highest volume on Saturday, June 20 2020 at 06.00-07.00, The amount of traffic capacity for the Kedungjajang-Ranuyoso Lumajang road after the widening of the road is 3069.94 smp/jam which is taken from the highest volume on Saturday, May 29, 2021 at 16.00-17.00, Changes in the level of service for the Kedungjajang-road Ranuyoso Lumajang before and after road widening experienced an increase of 2 levels, which originally had a road service level value of "E" to "C" which means the original current condition before road widening was unstable flow, speed sometimes stopped, demand was approaching current capacity after road widening the flow becomes stable, but the speed and motion of the vehicle control.

Based on the research that has been carried out with a series of processes in it, some suggestions are as follows: Conduct periodic research and surveys related to road widening to increase rider satisfaction and reduce congestion that causes various kinds of losses. road widening, conducting further research and surveys on road widening with other factors besides the level of road service and also with different methods for example by questionnaires to road users, and so on.

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