

**ROAD PERFORMANCE EVALUATION TGH. LOPAN - DR.SUTOMO-ROAD
FOR SUPPORTING LOMBOK INTERNATIONAL AIRPORT OPERATIONAL,
AND LOGISTIC DISTRIBUTION INTER ISLANDS**

I Wayan Suteja, Kurnia Ramzani,

Department of Civil Engineering, Faculty of Engineering, University of Mataram

ABSTRACT

With the operation of Lombok International Airport (BIL) resulted in a change in the movement of Kota Mataram trip heading to the airport. Along with the construction of the access road to Lombok International Airport (BIL) that passes through the streets TGH. Lopan - street Dr. Sutomo impact on the increase in the volume of vehicles on these roads. This study was conducted to determine the performance of traffic in 2011 and in 2012 and both of comparisons with describe by a several parameters such as : Capacity (Capacity), Degree of Saturation (DS), Travel speed (F_{LV}), Free Flow Speed (FV), and Travel Time (TT). The Results of the invernement of road side survey both of roads TGH.Lopan and Dr. Sutomo are a residential area with a length of 3.7 km to the TGH. Lopan and 3.3 km to the Dr. Sutomo, while the track width of 8 m for TGH. Lopan and 7 m for road Dr.Sutomo. The analysis of traffic data,we found that the value of the performance parameters in 2011 data for TGH. Lopan road's ie free flow speed of 42.323 kph, Capacity 3014.41 pcuph, Degree of Saturation (DS) of 0.431, Travel Speed and Travel Time respectively 36,2 kph and amounted to 0.102 hours. For Dr. Sutomo road's ie free flow speed of 39.501 km / h, Capacity 2644.22 smp / h, Degree of Saturation (DS) of 0.393, Travel Speed Travel Time respectively by 32.7 kph and amounted to 0.101 hours. As for the year 2012 obtained TGH.Lopan road performance parameters, namely Speed Free Flow of 42.323 kph, Capacity 3014.41 pcuph, Degree of Saturation (DS) of 0.575, Travel Speed Travel Time respectively 34.3 kph and amounted to 0.107 hours. For Dr. Sutomoroad's ie free flow speed of 39.501 kph, Capacity 2644.22 pcuph, Degree of Saturation (DS) are 0.575, Travel Speed Travel Time respectively of 31.2 kph and amounted to 0.106 hour. Both of this roads are the main road (trunk), so therefore thats mean both of roads are the main access from the city of Mataram heading to Lombok International Airport (BIL), and based on the result of above analysis we can said that it can be indicated that the increase in the volume of the two roads that have an impact on the level of service declines (level) caused by the of Lombok International Airport (BIL) operated.

Keywords: Performance Roads, Travel Speed, Travel Time, Traffic Survey

1. CHAPTER I : Introduction

1.1 Background

Transportation is quite important for humans in which the transportation is part of human life. Good transport determine the development of an area, as it can facilitate the movement of people, goods, services, and information from one region to another.

With the operation of Lombok International Airport (BIL) resulted in a change in the movement of Kota Mataram trip heading to the airport. Along with the construction of the access road to Lombok International Airport (BIL) that passes through the streets TGH. Lopan - street Dr. Sutomo impact on the increase in the volume of vehicles on these roads. TGH road. Lopan - street Dr. Sutomo has a road width of each 8 m

and 7 m and has a length of 3.7 km to the TGH. Lopan and 3.3 km to the Dr. Sutomo. Areas along these roads used by the residents of them as residential areas, offices, and trade (or economics.

1.2 Formulation of The Problem

How is the performance of the TGH. Lopan - street Dr. Sutomo before and after Lombok International Airport (BIL) was opreated?

How can I improve the performance of the alternative is if there is a decrease in the performance of the road in order to provide better service?

1.3 Research Purposes

Evaluating the influence due to the Lombok International Airport (BIL) operational on the

performance of the traffic roads TGH. Lopan - street Dr. Sutomo which includes capacity (Capacity), Degree of Saturation (Degre Of Saturation), High Mileage (VLV), Free Flow Speed (FV) dan Waktu Mileage (TT) Providing an alternative to improve the performance of the road in case of a decrease in road performance in order to provide better service levels.

1.4 Benefits and Scope of Research

The results of research on the Road Performance Evaluation is expected to provide the following benefits:

a. **Benefits of Research**

Can be used as a comparison by researchers - other researchers in the business development of the science of traffic engineering. Can be used as input by relevant agencies in policy making regarding the handling of the issue, especially user IHCM, 1997 (Indonesian Highway Capacity Manual, 1997).

b. **Scope Of Research Problem**

The location of research is only done in the way of TGH. Lopan - street Dr. Sutomo. Parameter - performance parameters calculated in this study are based on the parameters contained in the method IHCM, 1997 (Indonesian Highway Capacity Manual, 1997), such as: capacity (Capacity), Degree of Saturation (DS), Travel Speed or Operational Speed (V_{LV}), Free Flow Speed (FV) dan Travel Time (TT).

2. CHAPTER II : Literature Review

2.1 Roads Performance Analysis

Road performance is greatly influenced by the characteristics of the roads that are affected by traffic. While the characteristics of the road that is at any particular point in the road where there are significant changes in the geometric plan, traffic flow and road side activity which is the limit of the road segments.

2.1.1. Free Flow Speed (FV)

Free flow speed is defined as the rate at the current level of zero, which is the speed that would have been the driver when driving a motor vehicle without being influenced by other vehicles on the road (MKJI, 1997), the calculation formula Free Flow Speed (FV) for urban road is:

$$FV = (FV_O + FV_w) \times FFV_{SF} \times FFV_{CS}$$

With:

FV = Speed free flow of light vehicles (kph)

FV_O = Speed free flow of basic light vehicle (kph)

FV_w = Adjustment effective width of traffic lanes (kph)

FFV_{SF} = adjustment factor for the side barriers, multiplication

FFV_{CS} = speed adjustment factor size cities, multiplication

2.1.2. Road capacity (C)

Based IHCM, 1997, the capacity is defined as the maximum current that can be maintained unity hour that passes through a point on the road in the existing conditions. For the two-lane two-way defined per lane. Capacity calculation formula (C) path for urban roads, is :

$$C = C_O \times FC_w \times FC_{SP} \times FC_{SF} \times FC_{CS}$$

with :

C = Capacity (pcuph)

C_O = Basic Capacity (pcuph)

FC_w = adjustment factor width of traffic lanes

FC_{SP} = adjustment factor due to the separation direction (only for undivided roads)

FC_{SF} = Factor pemyesuaian due to the side barriers

FC_{CS} = city size adjustment factor

2.1.3. The Degree of Saturation (DS)

The degree of saturation is the ratio of the volume (current value) traffic to capacity. This is a picture of whether a type of roads have a problem or not, based on the assumption that if the road closer to the more limited capacity to ease movement. The degree of saturation is calculated by the equation :

$$DS = Q / C$$

with:

DS = Degree of Saturation

Q = Flow Total (pcuph)

C = Road Capacity (pcuph)

2.1.4. Travel Speed (V_{LV}) and Travel Time (TT)

Travel speed is defined as the average speed of the space light vehicle (LV) on a segment along a certain path. To get the value V_{LV} first enter a value Degree of Saturation (DS) into the chart (attachment). Then drag the vertical line from the point to intersect with the real free flow speed. From the intersection point, then drag the

horizontal line until the parameter value of the average speed of light vehicles (V_{LV}) is obtained. After getting the value of the average speed of light vehicles (V_{LV}), after which it can be searched travel time (TT) using the following equation:

$$TT = \frac{L}{V_{LV}}$$

with:

- V_{LV} = average speed of LV chamber (kph)
- L = length of the road segment (km)
- TT = average travel time along the segment of the road LV (m)

3. CHAPTER III : Research Methods

The stages of the research contained in the chart below:

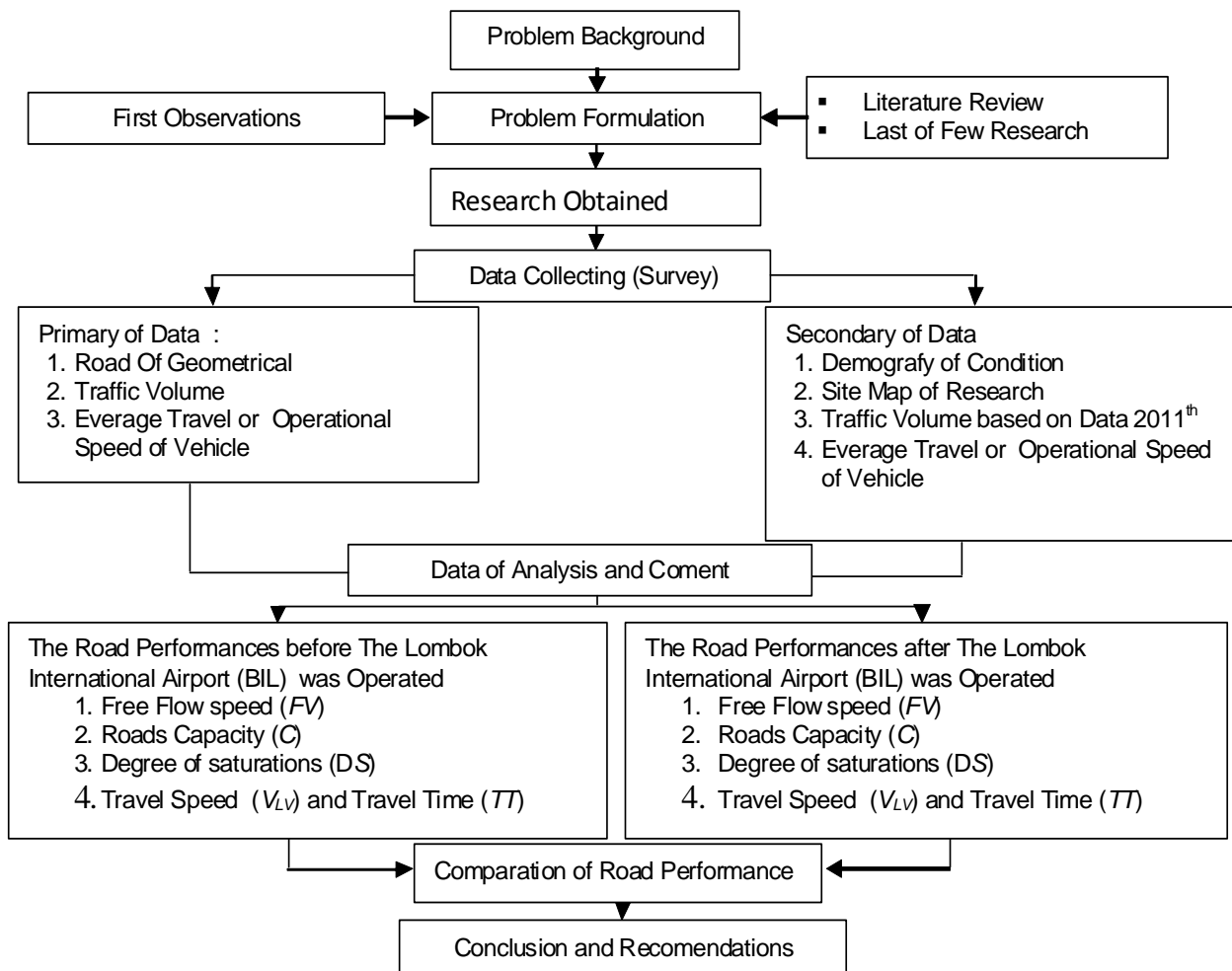


Figure 1 Stages Research, will be start the problem identifications, to be find the conclusions and few recommendation to get the improving of roads performances.

4. CHAPTER IV : Results of Analysis and Conclusions or Recommendation

4.1 Primary Data of Analysis

From the results of traffic data based on the road survey of traffic volume at TGH. Lopan and Dr. Sutomo street, the total both directions obtained through the survey during the 12-hour maximum vehicle volume obtained for both roads occurred on Monday at peak hours in the morning. As for the vehicle speed data retrieval speed field survey carried out in one day in intervals of three (3) times-making, ie morning (7:00 a.m. to 08:00), lunch (13:00 to 2:00 p.m.), afternoon (17:00 to 18:00).

In detailed survey data traffic are presented in the following table below:

Table 1 The volume of traffic on Monday on peak hour in 2012

Road Segmen	Time of Interval	Light Vehicle (LV)		Heavy Vehicle (HV)		Motorcycle (MC)		Total Vehicle (volume) (2 direction)	
		Emp	1	Emp	1,2	emp	0,25	pcuph	pcuph
		vehicle	pcu	vehicle	pcu	vehicle	pcu		
(1)	(2)	(3)		(4)		(5)		(6)	(7)
J. TGH Lopan	07.00-08.00	535	535	63	75,60	4.216	1.054,00	4.814	1.622,85
J. Dr. Sutomo	07.00-08.00	535	535	56	67,20	3.673	918,25	4.264	1.520,45

Source of data : traffic survey result

Table 2. The everage speed of roads in 2012

Road Name	Everage Speed (kph)
Jl. TGH. Lopan	30,93
Jl. Dr. Sutomo	32,904

Source of data : traffic survey result

4.2 The Secondary Data analysis

Secondary data are additional supporting data in the analysis calculations. The required supporting data is data traffic volume in 2011 derived from the Directorate General of Highways Unit Planning and National Roads Development (PU-P2JN NTB), beside that the data sources for average speed of vehicles obtained from the Department of Communication and Information (Dishubkominfo) West Lombok. While the information of population of the District West Lombok in 2011 we obtained from the Central Statistics Agency (BPS) West Lombok, where the district recorded the population of the West Lombok district as many as 599 986 inhabitants. Specifically secondary data are presented in the table below :

Table 3 Maximum peak hour traffic volume in 2011

Road Name	Time Interval	Light Vehicle (LV)		Heavy Vehicle (HV)		Motorcycle (MC)		Total Traffic Volume (2 directions)	
		emp	1	emp	1,2	emp	0,25	pcuph	pcuph
		Vehicle	pcu	Vehicle	pcu	Vehicle	pcu		
(1)	(2)	(3)		(4)		(5)		(6)	(7)
J. TGH Lopan	07.00-08.00	344	344	67	80,40	3.501	875,25	3.912	1.299,65
J. Dr. Sutomo	07.00-08.00	554	554	138	165,60	1.280	320,00	1.972	1.039,60

Source of data : P2JN-NTB

Table 4 Average Speed in 2011

Road Name	Everage Speed (kph)
Jl. TGH. Lopan	41,34
Jl. Dr. Sutomo	62,66

Source: Dishubkominfo Lobar

4.3 The Operational Speed

The Speed of Field Operations Calculation of vehicle speeds on roads surveyed, the data travel time of each vehicle that crosses along a particular piece of road data input. From the survey, it was found 25 meters long piece of road that is determined based on Free Survey and Calculation Time Traffic No. 001 / T / BNKT / 1990. Here are the results of calculations

Table 5 Summary of Field Average Speed

Road Name	Everage Speed of Filed Operational 2011 th (kph)	Everage Speed of Filed Operational 2012 th (kph)
Jl. TGH Lopan	41,34	30,93
Jl. Dr. Sutomo	62,66	32,904

Source: Calculation Results

From the calculation of operational speed (pitch) in 2011 and 2012 on the second road, showed that the road is still meets the minimum requirements of operational speed as a function of primary arterial road as seemingly in the table below.

Table 6 Minimum Requirements Operating Speed each road function (road clasification)

Road Classification	Minimum wide (PP No.34/2006 Jalan)	Operasional Speed minimum	Base Velocity (22UD) Minimum (MKJ 1997)	Free Flow Speed minimum (MKJ 1997)	Design Speed Minimum (PP No.34/2006 Jalan)	Recommendation Minimum Speed in SFM
	m	kph	kph	kph	kph	kph
Arteri Primer	11	245	68	49	60	35
Kolektor Primer	9	225	67	45	40	30
Lokal Primer	6,5	20	63	40	20	20

Source: Colloquium Center for Roads and Bridges

4.4. Roads Performance Analysis in 2012

Size analysis of the performance of roads that will be taken into account in this study is the magnitude of Free Flow Speed (FV), capacity (C), Degree of Saturation (DS), Travel speed (V_{LV}) and the Travel Time (TT).

4.4.1. Free Flow velocity (FV)

Free flow speed is defined as the speed at current levels near zero, the top speed will be selected if the driver driving a motor vehicle without being influenced by other vehicles on the road (MKJI, 1997).

Table 7 Data Calculation of Free Flow Speed (FV) in 2012

Road Name	Base of Free Flow Speed (FV) (km/jam)	Adjustment factor for lane width (FV _l) (km)	Adjustment Factor (FV ₊) (FV ₊) (2)+(3)	Adjustment Factor		Free Flow Speed (FV) (4)×(5)×(6) km/jam
				Sub Friction of road (FV _f)	City Size (FV _s)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
J. TGH Lopen	42	3	45	0,99	0,95	42,323
J. Dr. Sutomo	42	0	42	0,99	0,95	39,501

Source: Calculation Results

4.4.2. Road Capacity (C)

Road capacity is the maximum current passing through a point on the road that can be maintained unity clock in certain circumstances.

Table 8 Data Capacity Calculation 2012th

Road Name	Base Capacity (C) (smp/jam)	Adjustment Factor				Road Capacity (C) (smp/jam) (2)×(3)×(4)×(5)×(6)
		Lane width (FC _l)	Direction Split (FC _d)	Sub Friction (FC _f)	City Size (FC _s)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
J. TGH Lopen	2900	1,14	1,0	0,97	0,94	3014,41
J. Dr. Sutomo	2900	1,0	1,0	0,97	0,94	2644,22

Source: Calculation Results

4.4.3. Degree of Saturation (DS)

The degree of saturation which is a parameter for determining the performance of intersections and roads. The formula is as follows:

$$DS = Q / C$$

Table 9 Value Degree of Saturation

Road Name	Traffic Volume (Q) (1)	Road Capacity (C) (2)	Degree of Saturation (DS) (1)/(2)	LOS
Jalan TGH Lopen	1.622,85	3014,41	0,538	C
Jalan Dr. Sutomo	1.520,45	2644,22	0,575	C

Source: Calculation Results

Based on the table 9 on the characteristics of the service levels, showed that on both roads have the degree of saturation (DS) is at the level of service C with DS 0.45 to 0.75 and the current criteria is still stable (Stable flow conditions), but the speed and movement is controlled by the volume high traffic, the driver restricted their freedom to choose the desired speed, change lanes and tracks, the level of service is particularly suited to urban road design.

4.4.4. Travel Speed and Travel Time

MKJI 1997 using a travel speed of light vehicles as one of the main measure of segment performance road, because it is easy to

understand and measure. The travel speed is defined in the manual as the average speed of the space light vehicle (LV) on a segment along a certain path

Based on the speed chart as a function of the DS to the UD 2/2 (appendix 4) obtained value (V_{LV}) based on the degree of saturation (DS) and the free flow speed of the two roads that was researched. After we get the value of the average vehicle speed of light (V_{LV}), after which it can be searched travel time (TT) using the following equation:

$$TT = L / V_{LV}$$

Table 10 Value Travel Speed Travel Time

Road Name	Free Flow Speed (FV) (km/jam)	Degree of Saturation (DS)	Travel Speed (V _{LV}) (km/jam)	Travel Time (TT) (jam)
Jalan TGH Lopen	42,323	0,538	34,3	0,107
Jalan Dr. Sutomo	39,501	0,575	31,2	0,106

Source: Calculation Results

Performance Analysis of Roads in 2011 Size analysis of the performance of roads that will be taken into account in this study is the magnitude of Free Flow Speed (FV), capacity (C), Degree of Saturation (DS), Travel Speed (V_{LV}) and the Travel Time (TT). By using the same calculation method in 2012 it obtained the results of the performance parameter which is detailed in the table below :

Table 11 Jalan performance in the year 2011

Road Name	Free Flow Speed (FV) (km/jam)	Capacity (C) (smp/jam)	Degree of Saturation (DS)	LOS	Travel Speed (V _{LV}) (km/jam)	Travel Time (TT) (jam)
Jl. TGH Lopen	42,323	3014,41	0,431	B	36,2	0,102
Jl. Dr. Sutomo	39,501	2644,22	0,393	B	32,7	0,101

Source: Calculation Results

Street Performance Evaluation in 2011 and 2012 From the analysis of the performance of the road in 2011 and 2012 can be evaluated based on the performance parameters including Free Flow Speed (FV), Highway Capacity (C), Degree of Saturation (DS) Travel Speed (V_{LV}) and the Travel Time (TT).

Table 12 Performance of TGH. Lopen Road

Year	Free Flow Speed (FV)	Road Capacity (C)	Degree of Saturation (DS)	LOS	Travel Speed (V _{LV})	Travel Time (TT)	Category
	kph	pouph			kph	h	
2011	42,323	3014,41	0,431	B	36,2	0,102	Good
2012	42,323	3014,41	0,538	C	34,3	0,107	Good Enough

Source: Calculation Results

Table 13 Performance of Dr. Sutomo Road

Year	Free Flow Speed (FV)	Road Capacity (C)	Degree of Saturation (DS)	LOS	Travel Speed ($V_{t,v}$)	Travel Time (TT)	Category
	kph	pcuph	(DS)		kph	h	
2011	39,501	2644,22	0,393	B	32,7	0,101	Good
2012	39,501	2644,22	0,575	C	31,2	0,106	Good Enough

Source: Calculation Results

From the results of the performance evaluation in 2012 and in 2011, it is known that an increase in volume on both these roads. This volume increase is not followed by an increase kapasaitas road, so the level of service in 2011 showed a level of service B (with a DS value of 0.20 to 0.44 and a stable flow characteristics, but is limited by the speed of operation start traffic conditions, the driver still has freedom to choose the speed) decreased to a level of service C with a value (DS 0.45 to 0.75 and the current criteria still stable, but the speed and movement is controlled by the high volume of traffic, the driver restricted their freedom to choose the desired speed, change lanes as well as the track, a level of service is particularly suited to urban road design).

Considering both sides of the road is the main access from the city of Mataram heading to Lombok International Airport (BIL), it can be presumed that the increase in the volume of these roads caused by the operation of Lombok International Airport (BIL). So the decicion for improvement that roads must be done efectifely to be improved the logistic and economic parameters from Mataram City (NTB) to other city or island (provinces). It's can improvement the logistic systems to. because there is no increased activity Gerung city characterized by the absence of an increase in the number of offices and the number of significant housing and the absence of increased activity on the port sheet characterized by the absence of additional trip vessel visits significantly. Below are presented data on the number of ship visits trip and the number of ships operating in the port sheet in 2011 and 2012.

To improve the performance of both these roads due to increased traffic volume, it can be done several steps to improve the performance of the two streets that do physically and traffic management.

Improved physical performance can be done by widening the road on both roads studied in order to road capacity can be increased, so that the impact on the change in free flow speed, degree of saturation, travel speed and travel time. Furthermore in line with the increase in traffic volume indirectly also increase the road due to heavy load vehicle, so fast the road surface damage and impact on the reduction of the operational speed. It is necessary to repair the pavement of roads in order to improve the operational speed of the vehicle.

While the traffic management which can be applied to roads TGH. Lopan namely by shifting lanes for heavy vehicles, due to frequent cause queuing / slow the rate of motion of other motor vehicles. Heavy vehicles leading the way TGH. Lopan from the direction of the harbor Sheet diverted towards Kediri, Kediri such as road directly towards Sweta and an area known Bertais warehousing of goods and trade.

5. CHAPTER V : Conclusions and Recomendation

5.1. Conclusion

Based on the analysis and discussion of some of the conclusions obtained in this study, such as:

1. Free Flow Speed value in 2011 did not change in 2012, for roads TGH. Lopan obtained a value of 42.323 km / h while on the road Dr. Sutomo obtained a value of 39.501 km / h. The absence of changes in the value of the free flow speed due to the absence of changes in the type of road and road geometric and no significant change in the activity side friction (seen from the percentage of the number of non-motorized vehicles and the development of land use along the way) and a number of residents of West Lombok.
2. The value of both Road Capacity (C) in 2011 and 2012 there was no change, namely for roads TGH. Lopan at 3014.41 smp / hour and the road Dr. Sutomo at 2644.22 smp / hour. The absence of changes in the value of the capacity of the road because there is no change in the type of road and road geometric and no significant change in the activity side friction (seen from the percentage of the number of non-motorized vehicles and the development of land use along the way), the percentage of traffic flow conditions in both

directions and the number of residents West Lombok.

3. Changes in traffic flow at Jalan TGH. Lopan and Dr. Sutomo directly affect the performance of the road. Where the value of the degree of saturation (DS) in 2012 for the TGH. Lopan and street Dr. Sutomo respectively 0.538 and 0.575 which indicates the level of service C (with a DS value of 0.45 to 0.75 and the current criteria is still stable, but the speed and movement is controlled by the high traffic volume, drivers restricted their freedom in choosing speed desired, change lanes and tracks, the level of service is particularly suited to urban road design). While the degree of saturation (DS) in 2011 for the TGH. Lopan amounted to 0.431 and for the way Dr. Sutomo of 0.393 which indicates the level of service B (with a DS value of 0.2 to 0.44 and a steady flow criteria, but the speed is limited by traffic conditions, the driver still has the freedom to choose the desired speed and road).
4. Travel speed (V_{LV}) in 2012 decreased from travel speed in 2011, namely for roads TGH. Lopan 36,2 kph to 34.3 kph. While the travel speed to the road Dr. Sutomo of travel speed of 32.7 kph was increased to 31.2 kph
5. The travel time in 2011 for road TGH. Lopan amounting to 0.102 hours increased to 0.107 hours in 2012 and to the road Dr. Sutomo amounted to 0.101 hours in 2011 increased to 0.106 hours.
6. Road widening, road and pavement repairs manajemen application traffic can be done to improve the performance of the road. Traffic management can be done such as the transfer of vehicle lanes for heavy vehicles. Due to the frequent cause queuing/slow the rate of motion of other motor vehicles.
7. Based on the evaluation of the performance of both these roads increases, changes in the performance of the allegedly affected by the operation of Lombok International Airport.

5.2 Suggestions

Based on the conclusions that have been formulated, then the advice that can be given is as follows:

1. Settings on the development of land use activities which are located along the road so as not to disrupt traffic that crosses the road

so that the function and role of the road can be maintained in accordance with its function.

2. Road widening, road and pavement repairs manajemen application traffic can be done as an alternative to solving traffic problems.
3. Manajemen traffic that is applied to the transfer path of heavy vehicles from crossing the road TGH. Lopan that should pass through the road to Kediri City.

BIBLIOGRAPHY

1. Alam, AA, 2008, "Traffic Engineering", University of Muhammadiyah Malang, Malang.
2. Anonymous, 1990, "Technical Procedures Manual Way Traffic Survey", No. 016 / T / BNKT / 1990, the Directorate General of Highways, Directorate of Road Town, Jakarta.
3. Anonymous, 2008, "Perambuan As for Road Works", Road and Bridge Research and Development Center, Research and Development Department of Public Works, Jakarta.
4. Department of Public Works, 1997, "Indonesian Highway Capacity Manual", Directorate of Highways, Ministry of Public Works, Jakarta.
5. Hadi, A., 2003, "Segment Performance Evaluation Roads and Intersections In Airlangga municipality Mataram". Thesis S1 Bachelor of Civil Engineering, University of Mataram, Mataram.
6. Hobbs, FD, 1995, "Planning and Traffic Engineering", Second Edition, Gadjah Mada University, Yogyakarta.
7. Susanti, IP, 2011, "Performance Evaluation of Roads Gadjah Mada result Characteristics of Land Use Change", Thesis S1 Bachelor of Civil Engineering, University of Mataram, Mataram.
8. Saputra, YS, 2010, "Performance Evaluation of Two-Lane Two-Way Road (2/2 UD) Become a Two Way Lane One Direction (2/1) and the Vehicle Operating Costs (VOC) in Mataram", Thesis S1 Bachelor of Civil Engineering University of Mataram, Mataram.
9. Tamin, OZ, 2000, "Planning and Transport Modelling", Second Edition, Bandung Institute of Technology, Bandung.

