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ANALYZING TRAFFIC CONGESTION ON THE KAPASARI ROAD SECTION IN SURABAYA

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Abstract - *This research has several problems that will be used as study materials, among others, what is the capacity that can be accommodated by the Kapasari road section, how is the level of vehicle volume from the Kapasari road section, how big are the side obstacles and the degree of saturation value, and what is the value of the Kapasari road service level according to MKJI 1997. This type of research is a case study. Data obtained from real time survey results at a predetermined time and the results of observations based on previous researchers and the author's supporting literature and documentation. The results of the study can show that the capacity that can be accommodated by the Kapasari road section according to the MKJI 1997 method for 4 lanes 2 directions is 1,373 smp / hour. The highest volume level was obtained on Monday at 17.00 - 18.00 amounting to 1,789.6 smp / hour or 2,569 vehicles / hour. The highest side obstacles are obtained on Monday at 17.00 - 18.00 amounting to 541 events / hour which is included in the class of high side obstacles (H). The degree of saturation of the highest Kapasari road section is 0.963 and can be obtained from the classification of level of service values according to MKJI 1997 is E (0.90 - 1.00) which can be interpreted as unstable flow, low speed, dense volume or close to capacity.*

Keywords: road capacity, vehicle volume, bottleneck, degree of saturation, level of service values.

INTRODUCTION

As the region's economy grows, the standard of living in the region will also increase. This, of course, leads to increased mobility into and out of the region. Increased use of public and private transportation facilities and adequate infrastructure networks to support and encourage community mobility. The road network is an integral part of the development of urban quality, which means that the road transportation network as a medium for regulating the movement of people, goods and even services will certainly affect urban growth activities that tend to be high (Djaelani &; Amri, 2022). Lightweight transportation, especially the choice of motorcycles, is used as the best way to get efficiency value to avoid congestion due to excessive traffic capacity of road users. This is justified because the ratio and flexibility of motorcycle motion when utilizing space on the road extension encourages riders to perform more diverse movements compared to other vehicle classifications (Djaelani et al., 2022). Motorcyclists tend to adopt an active driving style and perform illegal operations to achieve their desired position on the road. This causes congestion due to road congestion and, in some cases, the effects of high lateral obstacles or disturbances that can narrow the road. Traffic jams or delays also often result from the deviant behavior of road users who do not obey traffic rules, making congestion unavoidable.

Congestion in urban areas in the last 10 years has gotten worse, and has even spread to some small cities in Indonesia. One of the main problems that can cause congestion in general is the influence of the volume of vehicles that are not balanced with the available road sections, especially during peak hours in the morning and evening. According to MKJI (1997), congestion is a condition where the traffic flow that occurs on the road section under review exceeds the capacity of the road plan which results in a buildup of vehicle volume and the free speed of the road section approaches or reaches 0 km / h, causing vehicle queues. At the time of vehicle accumulation, the degree of saturation value reaches or exceeds 0.5. Even congestion also occurs as a result of road sections that are unable to accommodate high vehicle flow capacity. This affects the obstacles or side disturbances that arise, resulting in narrowing of the road section. Congestion increases when the flow is so large that vehicles are very close to each other. Total congestion occurs when vehicles have to stop or move very slowly. Congestion in terms of level of service (LOS), when LOS is less than C, traffic flow conditions begin to be unstable, operating speed decreases relatively quickly due to obstacles that arise and freedom of movement is relatively fast due to obstacles that arise and freedom of movement is relatively small. In this condition, the volume capacity is greater than or equal to 0.8 (V/C≥0.8), if the LOS (Level Of Service) has reached E, the traffic flow becomes unstable, so there is a heavy delay, which is called traffic congestion. In general, traffic is a means of movement of people, goods, or animals on the road from one place to another by using a driving device with a predetermined unit of time.

In MKJI (1997), lateral obstacles are defined as roadside activities that can cause collisions, affect traffic flow, and reduce the effectiveness of road functions. The types of side obstacles are divided into pedestrians and road crossings, the number of vehicles entering and exiting the side of the road, slow vehicle flow. According to MKJI (1997), road geometry is one of the main characteristics of the road that will affect the capacity and performance of the road when

loaded with traffic flow. Among those included in the road geometry are the following road types, traffic lane widths, shoulders. The road types listed in the Indonesian Road Capacity Manual (MKJI, 1997) will show different performance under certain traffic loadings. The width of the traffic lane is the part of the road that chooses the most holistic transverse width of the road (Sukirman, 1999). As well as the free flow speed and capacity is getting higher using the increasing width of the traffic lane. Kreb or the boundary between the traffic lane and the sidewalk also affects the side obstacles on the capacity and speed of the road lane. Obviously, the kerb is smaller than a road with a shoulder but it also has the effect of reducing the capacity of the road itself. As explained in Wikipedia, the shoulder is the part of the roadside that is used as a place for vehicles that experience something that is required to stop or used by emergency vehicles, especially ambulances, fire engines, police vehicles, and so on that are heading to emergency places when the road is experiencing high density. In addition, the shoulder is also used as a place to avoid traffic accidents, especially on roads that are not separated by road medians, especially when there is a vehicle crossing but then from the opposite direction comes a vehicle, so that vehicles coming from the front can avoid and enter the shoulder. Therefore, shoulder construction should not differ in height from the roadway. By law, the shoulder should not be used for passing other vehicles but only for emergency use by public vehicles or in the event of an accident.

Road section performance is a quantitative measure used in MKJI (1997). Based on MKJI (1997) the main function of a road is to provide transportation services so that road users can drive safely and comfortably. Transportation as a technological system is the main framework. A transportation system is a combination of 5 components, namely, vehicles, driving forces, lanes, terminals and control systems. (Nasution, 1996). Traffic flow parameters that are important factors in traffic planning are traffic volume, free flow speed, capacity, degree of saturation and travel speed. Volume is the number of vehicles that pass a certain point in a certain road section and with a certain unit of time, usually expressed in units of vehicles / hour. Volume is an important variable in traffic engineering and is basically a calculation process related to the number of movements per unit time at a particular location. Capacity is defined as the maximum flow through a point on the road that can be maintained per unit hour under specified conditions. For two-lane two-way roads, capacity is determined for the two-way flow (two-way combination), but for multi-lane roads, flows are separated by direction and capacity is determined per lane. Degree of Saturation (DS), defined as the ratio of flow to capacity, is used as the primary factor in determining the performance level of intersections and road segments. The DS value indicates whether the road segment has a capacity problem or not. The degree of saturation is calculated using flow and capacity expressed in smp/hr. DS is used for traffic behavior analysis in the form of speed. Road segment performance is a measure of traffic conditions on a road segment that can be used as a basis for determining whether a road segment has a problem or not. The degree of saturation is the ratio between traffic volume and road capacity, where: (a) if the degree of saturation value > 0.8 indicates very high traffic conditions; (b) if the degree of saturation value > 0.6 indicates heavy traffic conditions; (c) if the degree of saturation value < 0.6 indicates low traffic conditions. Level of service is the level of service of a road that describes the quality of a road and is the limit of operating conditions. The level of service of a road is a qualitative measure used by the United States Highway Capacity Manual (USHCM 1985) that describes the operational conditions of traffic and assessment by road users. The level of service of a road indicates the quality of the road as measured by several factors. The level of service is determined on an interval scale consisting of six levels, and to determine the value of the level of service can be used: TP = Q/C, where Q is volume and C is capacity.

Table 1. Service Level Characteristics

V/C	Road Service Level	Information
< 0.60	A	Smooth current, low volume, high speed
0.60-0.70	B	Stable current, limited speed, volume suitable for out-of-town roads
0.70-0.80	C	Steady flow, speed affected by traffic, volume according to city roads
0.80-0.90	D	Unstable approaching current, low speed
0.90-1.00	E	Unstable current, low speed, solid volume
>1.00pm	F	Obstructed current, low speed, volume above capacity, many stops

Source: Tamin and Nahdalina (1998)

To complete the research and validity and as a reference, previous research is included, as follows. Maretia (2007) showed that the highest value of side obstacles occurred on the Kartini road section on Monday, totaling 2677 events and on holidays, namely Sunday, totaling 1993 events with a degree of saturation of 0.63. Rizani (2013) states that the side obstacle factor that occurs is still relatively low. However, the overall road performance is affected by heavy traffic, especially in the condition of a very high side obstacle class (HV) of only 4818 smp / hour.

RESEARCH METHODS

In summary, the flow chart of this study starts from: (1) starting, this stage starts from licensing to the University regarding the title and location of the research; (2) determining the object including determining the subject matter, objectives, and benefits of writing; (3) data collection includes primary and secondary data collection as research

processing material; (4) data processing carried out as the formulation of problems determined by the author; (5) the results obtained are appropriate will proceed to the discussion, if the results are not appropriate, then return to the data collection stage; (6) discussion which means from the results of data processing, the appropriate data is summarized and followed up to further analysis and conclusions; (7) drawing conclusions and suggestions which means from all writing activities, conclusions will be drawn and the author includes suggestions regarding writing problems.

The study of the Raya Kapasari road section is to determine the causes of congestion, the magnitude of side obstacles to the service of the road section, as well as the capacity and degree of saturation of the road section. This study involves several variables, namely road geometric conditions, environmental conditions, traffic volume, and vehicle classification. The literature study is needed as a research reference after the subject is determined. The literature study is also a theoretical basis for research that refers to books, opinions, and theories related to the research. This stage involves data collection and preliminary analysis to determine the study location, the types of data to be surveyed and the methods used for field surveys as well as the preparation of survey forms according to the type of survey to be conducted. Before conducting field surveys, initial secondary data is required which is used as a reference in the initial analysis of these data.

This data collection is carried out at the intersection of the road to be studied, namely on the Raya Kapasari road section. Traffic volume surveys are conducted on road sections that are considered representative of the volume under review, the data sources needed include primary data and secondary data. Primary data through manual equipment, such as record sheets and survey form sheets containing traffic volume data on Raya Kapasari road during rush hour, road section geometric data, environmental condition data. Traffic survey time was conducted for 7 days, namely on Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday. Traffic volume is taken every 1 hour. The reason this method is used is to obtain more accurate data so that the results obtained will be used for future planning and improvement. Secondary data is data or information compiled for the needs that are in accordance with the research. This data collection was carried out through observation and location documentation, including infrastructure around the reviewed road network, basic maps and location administration, location road network conditions, conditions of facilities and infrastructure around the reviewed road network.

The research method of traffic volume data is done manually. To obtain this data, 4 observation posts were placed, each post occupied by 2 officers in charge of recording the number and origin of vehicles passing through the recording post. Each post is equipped with a form for the number and classification of vehicle types. The vehicle classifications are: (1) light vehicles (LV) such as passenger cars and small trucks; (2) heavy vehicles (HV) such as buses and large transport trucks; (3) motorcycles (MC) such as motorcycles, 3-wheeled vehicles and bentor. The method of collecting road geometric data is done by direct measurement in the field with the aim of obtaining the type of location, number of lanes, road width, and parking space. Measurements were made using a roll meter and the time of collection was carried out at midnight when traffic was empty. The survey was conducted by visualization or direct observation on each road section, and was conducted simultaneously with the road volume calculation. The survey was conducted by placing observers at each event that caused side obstacles or activities that disrupted vehicle movement. In addition, documentation was also carried out as evidence in the calculation. The road section is located on Kapasari road in Surabaya City, Genteng Sub-district, 417m long.

RESULTS AND DISCUSSIONS

Jalan Kapasari is one of the urban village roads in the Genteng sub-district of Surabaya City, East Java Province. With an area directly bordered by Gubeng and Tegalsari sub-districts to the south, while to the west it borders Tambak Sari sub-district. The research was conducted in the area because the road is one of the congested and slum roads in Surabaya City caused by the characteristics of dense residential conditions, land users that are not in accordance with the function, and the absence of green open space (RTH). This area consists of slums with illegal status and even slums in the middle of the city.

The following is the geometric data of Kapasari road section:

Road Type: 4/2 D (4 lanes - 2 divided directions)
Road Shoulder: Less than 1-meter on left and right sides
Road Width: 3.25 per lane
Length of road under review: 417 meters
City Population: 2.87 million people

According to Wardhana and Sulistyarso (2015), the results of the study show that there are 8 factors that cause slum in squatter areas, namely the level of education, accessibility to work locations, level of education, level of in-migration, quality of facilities and infrastructure, level of public awareness, high building density, and government participation. Whereas in slum areas, there are 5 factors that cause slumliness, namely accessibility to work locations, the level of in-migration, the level of community awareness, the density of high-rise buildings, and the role of the government. Migrants generally build residential buildings that are far from livable, so that the surrounding roads become narrow with no permission from the local government. Basically, the area is an area with a narrow level of land, so most migrants build settlements around the edge of the railroad tracks. The road is also a meeting point for people affiliated with the Gembong flea market and Adi Husada Kapasari hospital. Genteng Sub-district has an area of approximately 34.1 km2 which is divided into 5 urban villages, including: Embong Kaliasin, Ketabang, Genteng, Peneleh and Kapasari.

The research was conducted on February 14 - February 20, 2022 for 6 hours per day, namely in the morning at 07.00 - 09.00, afternoon at 11.00 - 13.00, and afternoon at 16.00 - 18.00 WIB. From the data obtained from the survey, data processing is then carried out starting from the calculation of road capacity, volume, degree of saturation, side obstacle class, free flow speed of vehicles, and level of service analysis based on the Indonesian Road Capacity Manual (MKJI 1997).

Capacity

The capacity of the Kapasari road section uses the 1997 MKJI procedure for urban roads. The following is the calculation of capacity in the presence of side barriers. Base capacity Co = 1650 smp/hour.
Road width adjustment factor FCw = 0.96
Directional separation adjustment factor FCsp = 0.985
Side obstacle adjustment factor FCsf = 0.88
City size adjustment factor FCcs = 1.00
C = Co x FCw x FCsp x FCsf x FCcs = 1650 x 0.96 x 0.985 x 0.88 x 1.00. C = 1,373.0112 smp/hour. Based on the calculation of capacity using the MKJI 1997 method, the capacity value of the Kapasari road section for a total of 4 lanes in 2 directions is 1,373 smp / hour.

Traffic Volume

The traffic volume survey was conducted by directly counting the number of vehicles passing through the observation point using a counter. The survey was conducted by 4 surveyors at the designated observation point for each traffic direction, where each surveyor will count each type of vehicle based on the vehicle classification. The types of vehicles in question are light vehicles (LV), heavy vehicles (HV) and motorized vehicles (MC).

Table 2. Vehicle volume Monday, 14 February 2022

Vehicle Volume (Vehicle Rating/hour)						
Day	Time (WIB)		MC	LV	HV	TOTAL
Monday	Morning	06.00-07.00	1264	531	8	1803
		07.00-08.00	1587	673	6	2266
		08.00-09.00	1492	639	14	2145
	Noon	11.00-12.00	1201	530	22	1753
		12.00-13.00	1124	566	29	1719
	Afternoon	15.00-16.00	1288	654	23	1965
		16.00-17.00	1582	762	15	2359
		17.00-18.00	1789	842	28	2659
Overall Vehicle Total			11327	5197	145	16669

Source: processed author

Table 3. Vehicle volume Tuesday, 15 February 2022

Vehicle Volume (Vehicle Rating/hour)						
Day	Time (WIB)		MC	LV	HV	TOTAL
Tuesday	Morning	06.00-07.00	1112	442	9	1563
		07.00-08.00	1416	566	11	1993
		08.00-09.00	1337	550	18	1905
	Noon	11.00-12.00	1092	472	24	1588
		12.00-13.00	1280	503	23	1806
	Afternoon	15.00-16.00	1197	600	19	1816
		16.00-17.00	1328	651	17	1996
		17.00-18.00	1506	738	29	2273
Overall Vehicle Total			10268	4522	150	14940

Source: processed author

Table 4. Vehicle volume Wednesday, 16 February 2022

Vehicle Volume (Vehicle Rating/hour)						
Day	Time (WIB)		MC	LV	HV	TOTAL
Wednesday	Morning	06.00-07.00	1258	481	12	1751
		07.00-08.00	1267	596	11	1874
		08.00-09.00	1209	512	17	1738
	Noon	11.00-12.00	1042	486	20	1548
		12.00-13.00	1122	474	22	1618
	Afternoon	15.00-16.00	1072	604	19	1695
		16.00-17.00	1113	590	19	1722
		17.00-18.00	1404	696	26	2126
Overall Vehicle Total			9487	4439	146	14072

Source: processed author

Table 5. Vehicle volume Thursday, 17 February 2022

Vehicle Volume (Vehicle Rating/hour)						
Day	Time (WIB)		MC	LV	HV	TOTAL
Thursday	Morning	06.00-07.00	1230	399	13	1642
		07.00-08.00	1382	509	19	1910
		08.00-09.00	1144	488	14	1646
	Noon	11.00-12.00	1292	466	17	1775
		12.00-13.00	1061	382	29	1472
	Afternoon	15.00-16.00	1226	508	25	1759
		16.00-17.00	1191	551	22	1764
		17.00-18.00	1592	642	37	2271
Overall Vehicle Total			10118	3945	176	14239

Source: processed author

Table 6. Vehicle volume Friday, 18 February 2022

Vehicle Volume (Vehicle Rating/hour)						
Day	Time (WIB)		MC	LV	HV	TOTAL
Friday	Morning	06.00-07.00	1230	327	8	1565
		07.00-08.00	1052	508	6	1566
		08.00-09.00	1100	450	9	1559
	Noon	11.00-12.00	1268	473	24	1765
		12.00-13.00	1271	384	18	1673
	Afternoon	15.00-16.00	1244	441	22	1707
		16.00-17.00	1032	351	39	1422
		17.00-18.00	1341	497	29	1867
Overall Vehicle Total			9538	3431	155	13124

Source: processed author

Table 7. Vehicle volume Saturday, 19 February 2022

Vehicle Volume (Vehicle Rating/hour)						
Day	Time (WIB)		MC	LV	HV	TOTAL
Saturday	Morning	06.00-07.00	1281	388	4	1673
		07.00-08.00	1021	482	14	1517
		08.00-09.00	1193	470	12	1675
	Noon	11.00-12.00	1012	404	21	1437
		12.00-13.00	1120	448	16	1584
	Afternoon	15.00-16.00	1948	421	29	2398
		16.00-17.00	1137	409	17	1563
		17.00-18.00	1304	521	27	1852
Overall Vehicle Total			10016	3543	140	13699

Source: processed author

Table 8. Vehicle volume Sunday, 20 February 2022

Vehicle Volume (Vehicle Rating/hour)						
Day	Time (WIB)		MC	LV	HV	TOTAL
Sunday	Morning	06.00-07.00	1388	413	8	1809
		07.00-08.00	1121	330	4	1455
		08.00-09.00	1115	306	9	1430
	Noon	11.00-12.00	1016	319	21	1356
		12.00-13.00	1088	332	16	436
	Afternoon	15.00-16.00	1021	346	29	396
		16.00-17.00	1052	351	24	1427
		17.00-18.00	1140	439	27	1606
Overall Vehicle Total			8941	2836	138	11915

Source: processed author

Monday calculation
Morning 06.00 - 07.00 WIB
MC x EMP MC = 1264 x 0.25 = 316 smp/hour
LV x EMP LV = 531 x 1 = 531 smp/hour
HV x EMP HV = 8 x 1.2 = 9.6 smp/hour
Total in smp/hr is 316 + 531 + 9.6 = 856.6 smp/hr.

Afternoon 11.00 am - 12.00 pm
MC x EMP MC = 1201 x 0.25 = 300.2 smp/hour
LV x EMP LV = 530 x 1 = 530 smp/hour
HV x EMP HV = 22 x 1.2 = 26.4 smp/hour
Total in smp/hr is 300.2 + 530 + 26.4 = 856.6 smp/hr.

Afternoon 17.00 - 18.00 WIB
MC x EMP MC = 1789 x 0.25 = 447.2 smp/hour
LV x EMP LV = 842 x 1 = 842 smp/hour
HV x EMP HV = 28 x 1.2 = 33.6 smp/hour
The total in smp/hr is 447.2 + 842 + 33.6 = 1322.8 smp/hr.

Calculation on Sunday
Morning 06.00 - 07.00 WIB
MC x EMP MC = 1388 x 0.25 = 347 smp/hour
LV x EMP LV = 413 x 1 = 413 smp/hour
HV x EMP HV = 8 x 1.2 = 9.6smp/hour
Total in smp/hr is 347 + 413 + 9.6 = 769.6 smp/hr.

Afternoon 12.00 - 13.00 pm
MC x EMP MC = 1016 x 0.25 = 254 junior high school/hour
LV x EMP LV = 319 x 1 = 319 smp/hour
HV x EMP HV = 21 x 1.2 = 25.2 smp/hour
Total in smp/hr is 254 + 319 + 25.2 = 598.2 smp/hr.

Afternoon 5:00 pm - 6:00 pm
MC x EMP MC = 1140 x 0.25 = 285 junior high school/hour
LV x EMP LV = 439 x 1 = 439 smp/hour
HV x EMP HV = 27 x 1.2 = 32.4 smp/hour
Total in smp/hr is 285 + 439 + 32.4 = 756.4 smp/hr.

Table 9. The volume of vehicles in passenger car units (junior high school / hour) is calculated from Monday - Sunday

Vehicle Volume								
Time		Day						
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning	06.00-07.00	856.6	730.8	809.9	722.1	644.1	713.05	769.6
	07.00-08.00	1076.95	933.2	925.95	877.3	778.2	754.05	615.05
	08.00-09.00	1028.8	905.85	834.65	790.8	735.8	782.65	595.55
Noon	11.00-12.00	856.65	773.8	770.5	809.4	818.8	682.2	598.2
	12.00-13.00	881.8	850.6	780.9	682.05	723.35	747.2	623.2
Afternoon	15.00-16.00	1003.6	922.05	894.8	844.5	778.4	942.8	636.05
	16.00-17.00	1175.5	1003.4	891.05	875.15	655.8	713.65	642.8
	17.00-18.00	1322.85	1149.3	1078.2	1084.4	867.05	879.4	756.4

Source: processed author

In table 9, it can be seen that the highest volume is obtained on Monday afternoon at 16.00-17.00 WIB amounting to 1197.85 smp / hour, this is due to the dense flow of returning to work and the very high activity of shops and markets.

Side Barriers

The data taken in the survey are vehicles that stop and park on the shoulder, pedestrians, slow vehicles and outgoing and incoming vehicles. The survey was carried out with a distance of 100-meters and selected on the most segment data.

Table 10. Total side resistance results for events per 100m/h

Side Resistance 100m (events/hour)								
Time		Day						
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning	06.00-07.00	424	384	398	366	329	338	257
	07.00-08.00	368	319	220	419	312	218	231
	08.00-09.00	397	388	361	347	456	248	298
Noon	11.00-12.00	440	472	435	451	321	398	236
	12.00-13.00	413	458	417	310	461	421	322
Afternoon	15.00-16.00	231	212	264	222	280	269	217
	16.00-17.00	394	218	378	261	390	325	331
	17.00-18.00	541	502	497	534	445	470	306
MAX VALUE					541			
MIN VALUE					212			

Source: processed author

From the data in Table 10, it is obtained that on Monday is included in the high class of side obstacles (H) according to the classification of side obstacle classes (MKJI 1997) with a total value of events reaching 500 - 899 events / hour (641 events / hour) at 17.00 -18.00 WIB. this is due to the dense flow of returning from work and the activities of shops and markets are very high, thus reducing road performance. While the lowest class of side obstacles (L) on Saturday at 08.00 - 09.00 WIB with an event value of 100-299 events / hour (212 events / hour). This is because in the morning shops and road user activities tend to be lower.

Degree of Saturation

Calculation of the degree of saturation in the presence of side obstacles at the highest vehicle volume, as follows:

DS = Q/C

Description:

Q = vehicle volume

C = capacity

Table 11. The result of calculating the degree of saturation per hour with side obstacles

Degree of Saturation								
Time		Day						
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning	06.00-07.00	0.624	0.532	0.590	0.526	0.469	0.519	0.561
	07.00-08.00	0.784	0.680	0.674	0.639	0.567	0.549	0.448
	08.00-09.00	0.749	0.660	0.608	0.576	0.536	0.570	0.434
Noon	11.00-12.00	0.624	0.564	0.561	0.590	0.596	0.497	0.436
	12.00-13.00	0.642	0.620	0.569	0.497	0.527	0.544	0.454
Afternoon	15.00-16.00	0.731	0.672	0.652	0.615	0.567	0.687	0.463
	16.00-17.00	0.856	0.731	0.649	0.637	0.478	0.520	0.468
	17.00-18.00	0.963	0.837	0.785	0.790	0.632	0.640	0.551

Source: processed author

From the results of the calculation of the degree of saturation in table 11, it can be seen that the volume of vehicles on Monday (17.00-18.00) exceeds the road capacity, where the degree of saturation is the ratio between the volume and capacity of the road where if the degree of saturation exceeds 0.8 indicates very high traffic conditions, so that the level of road service according to the 1997 MKJI classification obtains a value of E (0.963), namely unstable flow, low speed, dense volume or close to capacity.

From the results of the Kapasari Road Congestion Analysis research, the data was analyzed using the MKJI (1997) method, so the research results can be concluded as follows: (1) the highest vehicle volume is on Monday Kapasari road at 17:00 -18:00 pm amounting to 1789.6 smp / hour or 2,569 vehicles / hour. This is due to the dense activity of road users during working hours and also the activities of shops and traditional markets affiliated with Kapasari road; (2) the highest side obstacles obtained on Monday at 17.00 - 18.00 WIB included a high class of side obstacles (H) which amounted to 541 events / hour due to the absence of sidewalks for pedestrians and the edges of the road used as a parking lot and vehicle stops that interfere with and reduce the service of the road; (3) the highest degree of saturation analysis result is 0.963 which shows very high traffic conditions that affect the value of the level of service of the road. The road

assessment obtained from the classification of the level of service value according to MKJI 1997 is E (0.90 -1.00) which can be interpreted as unstable flow, low speed, dense volume or close to capacity; (4) the densest volume is dominated in the morning (07.00-08.00) and in the afternoon (17.00 - 18.00) because Kapasari road is one of the densest roads in Surabaya and an alternative road to get to the downtown area as well as the traditional market and shops affiliated with Kapasari road.

CONCLUSIONS

Based on the results of data analysis and processing on Kapasari road section, then due to side obstacles that occur, the following conclusions can be drawn: (1) the capacity that can be accommodated by the Kapasari road section according to the 1997 MKJI method for 4 lanes 2 directions is 1,373 junior high school / hour; (2) the highest level of vehicle volume on Kapasari road is on Monday at 17.00 - 18.00 WIB amounting to 1789.6 smp / hour or 2569 vehicles / hour. This is due to the density of road user activities at very high working hours and also the activities of shops and traditional markets affiliated with Kapasari road; (3) the highest Kapasari road section side obstacles were also obtained on Monday at 17.00 - 18.00 WIB, which included a high class of side obstacles (H) which amounted to 541 events / hour. The degree of saturation of the highest Kapasari road section is 0.963 which shows very high traffic conditions that affect the level of service of the road; (4) road assessment on the Kapasari road section can be obtained from the classification of the level of service value according to MKJI 1997 is E (0.90 - 1.00) which can be interpreted as unstable flow, low speed, dense volume or close to capacity.

To restore the optimal function of the Kapasari road section can be done in the following ways: (1) construction and improvement of road sidewalks, especially on Kapasari road; (2) provide road markings for pedestrians and surrounding road users, and the need for the construction of pelican crossing or archaically pelican crossing to facilitate pedestrian crossing.

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