Traffic Analysis of Traffic in The Wonokusumo Road City of Surabaya

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Abstract

The purpose of this study was to determine the traffic congestion that occurred on the Wonokusumo road in 2020. This study uses a method that refers to the calculation of congestion rates. In accordance with observations in the field on roads with 2/2 UD type two-lane road - two directions are not divided, with a road width of 6 meters for a total of 2 directions with shoulder shoulders 1 meter each on the right and left. The facilities on these roads are not fully equipped with traffic signs such as (no stops, no parking, no speed limit). The highest average daily traffic volume on these roads from 07.00 - 18.00 is 1606 vehicles / hour. The most dominant motorbike type of vehicle passes the road section. From the analysis of the level of congestion conducted obtained results, the side barriers on the road are categorized as moderate (M) by 396 events / hour. Congestion occurs because of crowded activities and vehicles reduce speed and stop beside the road. This causes the service value on the road section is D shows that the vehicle flow is obstructed, the speed is low and the volume of the vehicle is above capacity. Therefore the role of the government is very important to reduce the level of congestion that occurs and motorists are more orderly in carrying out activities on these roads. This causes the service value on the road section is D shows that the vehicle flow is obstructed, the speed is low and the volume of the vehicle is above capacity.

Keywords:
Average Daily Volume, Field Observation, Traffic Jams.

1. Introduction

Congestion is a result of the growing need for transportation while the need for providing transportation facilities and inadequate road infrastructure so that the infrastructure does not function as it should. This is also found in the city of Surabaya, the characteristics of the use patterns in a variety of patterns can cause traffic generation, indiscipline of drivers, large vehicles driving at low speed, accidents and parking in any place.

Boedningsih, (2011) states that, "traffic jams occur due to several factors, such as many disorderly drivers, road users who go against the flow, lack of traffic officers who supervise, the existence of cars parked on the road, uneven road surface , there are no crossing bridges, and there are no restrictions on vehicle types. " The number of traffic users who are not disorderly, such as street vendors who sell by the side of the road, illegal parking and road users who go against the flow. This lack of traffic control and public awareness in the city will cause traffic jams.

The occurrence of congestion is the imbalance of the existing traffic network, the accumulation of several types of vehicles ranging from bicycles, motorbikes, cars, box cars, trucks, buses and other public transportation on a road that causes inhibition of the city traffic network.

The purpose of this analysis is to find out important information such as traffic jams at the location of the incident. The results of the study can be utilized by government agencies to improve the traffic transportation system and for road users to be more disciplined and wise when using motorized vehicles in road traffic.

Based on these considerations, in order to obtain accurate information, it is necessary to conduct a research on identifying the location of traffic congestion, which is located on the Wonokusumo Road in Surabaya. Overall research uses numbers (levels) of congestion with data that represent conditions, potential and characteristics of the place. The results of this study are expected not only to be the location of traffic jams, but this research method also identifies the best so that later it can be used as a common reference for implementers and if there are innovations of new methods and do not deviate from civil engineering studies.

In this study, the road section to be examined is on the Wonokusumo Surabaya road, this road was chosen because of several considerations, including:
In this road, there are many intersections at this particular point, causing traffic delays. In particular hours 07.00-08.00 WIB where many students, workers and traders start activities, at 12.00-13.00 WIB where workers resting hours to find food and the activities of truck drivers and drivers online application send goods and at 17.00-18.00 WIB where the vehicle users go home to end the activity at their respective homes.

These roads have many food stands or restaurants located on the roadside. The level of side obstacles is the number of cars and motorbikes parked on the shoulder of the road.

The large volume of vehicles going in and out along the Keputih city of Surabaya causes the average delay time (DT) of each vehicle to be large which causes queues.

Analysis of traffic congestion on Surabaya's Wonokusumo road is not new. However, the problem becomes a priority with the increasing congestion on the road. The method used in the analysis as a procedure is to analyze the average daily traffic volume (LHR) survey data.

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1.1. Problem
1. How is the traffic condition on Jalan Wonokusumo?
2. How are the side barriers on Jalan Wonokusumo?
3. What is the level of capacity and degree of saturation at Jalan Wonokusumo?

1.2. Purpose
1. Knowing the traffic conditions on Jalan Wonokusumo.
2. Knowing the side obstacles on Jalan Wonokusumo.
3. Knowing the capacity and degree of saturation on Jalan Wonokusumo.

2. Literature Review
2.1. Previous Research
Here are some studies related to congestion analysis:
3. Melisa Margareth, Traffic Studies in the City Center of Ratahan.
4. Deden Firmasnyah, Analysis of Congestion in an Area (Case Study on Jalan Lenteng Agung).
7. Iwan Mudjanarko, Driving Factors Cause of Congestion.

2.1. Traffic Volume
Traffic volume is the most important change (variable) in traffic engineering, which is basically a calculation process related to the number of movements per unit time at a certain location. Traffic volume analysis basically aims to determine the importance value of a route, fluctuations in flow, traffic distribution on a road system, and trends in road usage.

To get this traffic volume, the formula for the Average Daily traffic survey is used, namely:
\[ LHR = \frac{\text{Number of passing vehicles}}{\text{Unit Time (60 Minutes)}} \]

2.2. Road Capacity
Road capacity is the maximum flow through a waypoint that can be maintained per hour under certain conditions. For two-lane two-way roads, the capacity is determined for the two-way (two-way combination). Capacity values were observed through field data collection surveys wherever possible. Capacity is expressed in passenger car units (MKJI, 1997).
4. Research Methodology

![Research Flowchart]

4.1. Street Profil

Wonokusumo Street is the name of a street in the city of Surabaya. Wonokusumo Street is a central or central area because from the east is a tenggumung road, from the west is Karang Tembok road, from the south is Wonosari road and from the north is Sidotopo School Road. On that road the point where there are shops, restaurants and warehousing, passing traffic flow that is active in daily activities.

This is what causes congestion so that congestion often occurs on the Wonokusumo road section. The following is the Geometric data of the 100-meter Wonokusumo road segment:

a. Road Type: 2/2 UD (2 lanes - 2 undivided directions)
b. Street: 1 meter on the right side and 1 meter on the left side
c. The width of the road: 6 meters for a total of 2 directions

d. Population: 181,653 inhabitants (Fuad, 2017)

4.2. Traffic Volume

Traffic volume is the total of vehicles traveling at a particular point on a certain time road segment. Expressed in units of passenger car vehicles (SMP). For the planned traffic volume (VLHR) is the estimated traffic volume at the end of the planned traffic year expressed in junior high school / hour.

Calculation on Monday in the direction of Karang Wall Junior High School / hour (17.00-18.00)

a. \( LV \times EMP_{LV} = 486 \times 1.0 \) = 486 pcu / hour

b. \( HV \times EMP_{HV} = 9 \times 1.2 \) = 10.8 junior high / hour

c. \( MC \times EMP_{MC} = 1140 \times 0.25 \) = 285 junior high / hour

So the total in junior high / hour obtained: 486 + 10.8 + 285 = 781.8 junior / hour

Calculation on Monday to Tenggumung Junior High School / hour (17.00-18.00)

a. \( LV \times EMP_{LV} = 544 \times 1.0 \) = 544 pcu / hour

b. \( HV \times EMP_{HV} = 9 \times 1.2 \) = 10.8 junior high / hour

c. \( MC \times EMP_{MC} = 1081 \times 0.25 \) = 270.25 pcu / hour

So the total in junior high / hour is obtained: 544 + 10.8 + 270.25 = 825.05 junior / hour

So the total volume of vehicles 682.8 + 664.05 = 1606 pcu / hour.

<table>
<thead>
<tr>
<th>Time</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Monday</th>
<th>Tuesday</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00-8:00</td>
<td>1287.3</td>
<td>1240.85</td>
<td>1379.2</td>
<td>1302.6</td>
<td>1517.85</td>
<td>1371.8</td>
</tr>
<tr>
<td>12:00-13:00</td>
<td>1109.85</td>
<td>959.55</td>
<td>1025.6</td>
<td>920.15</td>
<td>1267.65</td>
<td>1227.6</td>
</tr>
<tr>
<td>17:00-18.00</td>
<td>1412.6</td>
<td>1388.75</td>
<td>1211.05</td>
<td>1061.95</td>
<td>1606.85</td>
<td>1503.9</td>
</tr>
</tbody>
</table>

4.3. Analisis Data

The following graph shows the average daily traffic survey on the Wonokusumo road.

![Figure 1. Average Daily Traffic Survey Graph on Wonokusumo Road](image)

From the table, it can be seen that the maximum volume on Monday afternoon at 17.00 - 18.00 West Indonesia Time is 1606 pcu / hour, this is due to the dense trade activity, which is the number of restaurants, shops, and hours of work which are very high. While the sloping traffic volume occurred on Saturday afternoon at 12.00 - 13.00 WIB at 920.15 pcu / hour due to the quiet activity at that hour and for the road dominated only pick up and trucks for delivery of goods. The data taken in this survey are vehicles that stop and park on the shoulders, pedestrians that are in line and also cross the road, traffic flowing in and out of the road, and slow
vehicles. From this study multiplied by the side obstacle weighting factor. The survey was conducted at a distance of 100 meters and selected the most segment data.

Table 2. Total side drag results for events per 100 meters per hour

<table>
<thead>
<tr>
<th>Time</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Monday</th>
<th>Tuesday</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 to 8:00</td>
<td>149.8</td>
<td>160.7</td>
<td>197.9</td>
<td>289.2</td>
<td>221.8</td>
<td>173.9</td>
</tr>
<tr>
<td>12:00-13:00</td>
<td>84.9</td>
<td>121.8</td>
<td>396.4</td>
<td>103</td>
<td>109.9</td>
<td>103.1</td>
</tr>
<tr>
<td>17:00-18:00</td>
<td>206.8</td>
<td>230.5</td>
<td>260.3</td>
<td>243</td>
<td>231.5</td>
<td>228.6</td>
</tr>
<tr>
<td>Total</td>
<td>441.5</td>
<td>513</td>
<td>854.6</td>
<td>635.2</td>
<td>563.2</td>
<td>505.6</td>
</tr>
<tr>
<td>Max Value</td>
<td>396.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. Graph of Side Barriers on the Wonokusumo Road Section

After analyzing the side obstacle class table above, it was found that on Friday is included in the medium obstacle class (M), namely the number of events 300-499 events per hour (396 events / hour). Medium obstacles on Friday due to the activities of worshiping Muslims perform Friday prayers and use the shoulder of the road around the mosque as parking and shopping activities and shops that are on the edge of the road interfere with road performance activities.

Whereas on Wednesday shows a class of side barriers at a very low level <100 events per hour (85 events / hour) because around shops, stalls and restaurants activities are lower and not too disturbing traffic activities.

This degree of saturation is a comparison between the volume of traffic and the capacity of the road.

Calculation of degree of saturation in the presence of side barriers can be seen as follows:

\[ DS = \frac{Q}{C} \]

Information :
- Q = Vehicle Volume
- C = Capacity

Vehicle volume from the results of the average daily traffic survey is on Monday at 17:00 - 18:00 with a total of 1346 pcu / hour.

Capacity (C) = 1985 junior high / hour

Then \[ = \frac{1346}{1985} = 0.678 \]

From the calculation of the degree of saturation we can see that the recapitulation of the degree of saturation.
Table 3. The results of the calculation of the degree of saturation per hour in the presence of side barriers.

<table>
<thead>
<tr>
<th>Time</th>
<th>Wednesday</th>
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<th>Friday</th>
<th>Saturday</th>
<th>Monday</th>
<th>Tuesday</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 to 8:00</td>
<td>0.648514</td>
<td>0.625113</td>
<td>0.694811</td>
<td>0.656222</td>
<td>0.76466</td>
<td>0.691083</td>
</tr>
<tr>
<td>12:00-13:00</td>
<td>0.559118</td>
<td>0.483401</td>
<td>0.516675</td>
<td>0.463552</td>
<td>0.638615</td>
<td>0.618438</td>
</tr>
<tr>
<td>17:00-18:00</td>
<td>0.711637</td>
<td>0.699622</td>
<td>0.610101</td>
<td>0.534987</td>
<td>0.809496</td>
<td>0.757632</td>
</tr>
</tbody>
</table>

The following graph shows the degree of saturation that occurs in the Wonokusumo road section.

![Graph of Saturation Degrees in the Wonokusumo Road Section](image)

Figure 3. Graph of Saturation Degrees in the Wonokusumo Road Section

Based on the analysis it appears that the value of the degree of saturation that exceeds the maximum limit of the degree of saturation in a few hours of observation time that is past the DS limit > 0.75 - 0.80 based on MKJII 1997 even the road capacity up to DS of 0.809 then the results produce the level of service is D, namely: current approaches not stable and low speed.

5. Conclusion and Acknowledge

5.1. Conclusion

Based on the results of data management and analysis of the Wonokusumo road section due to side constraints, conclusions can be drawn as follows:

1. The highest vehicle volume on the Wonokusumo road section is 1606 km / hour. This is due to the high volume of vehicles due to the dense activities of returning home from work and accompanied by high activity around shops, kiosks and restaurants.
2. The highest side barriers on Friday with the category of medium side barriers (M) 396 events / hour, caused by the side of the road which is a row of shops, stalls, restaurants and places of worship for Muslims Friday prayer there is no parking space that is provided properly so it really disrupts the wonokusumo road traffic activity.
3. Based on observations that have been made the value of the worst service level is D. This shows that the vehicle flow is obstructed, low speed, the volume of the vehicle is above capacity.

From the results of the analysis that has been done, suggestions that can be given by the author are:

1. To reduce the level of side barriers, namely for the local community to be more obedient when driving, do not grab each other, not to put parking on the shoulder of the road during the purchase transaction, place the vehicle on the land that is thought to be empty, awareness for stall owners, shops and restaurants to provide parking space proper so as not to disrupt the flow of traffic on the road. And for truck drivers who ignore the deadline entering the Wonokusumo road, it causes obstruction in morning and evening activities.
2. Particularly for the government to complete traffic signs for maximum speed, no parking, no stops and so on and it is hoped that it will not disrupt traffic flow on the Wonokusumo road.
3. The government is expected to expand the road due to the very high volume of traffic on the road and improve the function of the shoulder as a pedestrian track to function properly.

5.2. Acknowledge

Praise be to thank Alhamdulillah the authors pray for the presence of Allah SWT, for the blessings of grace, guidance and gifts so that the author can complete the thesis entitled "Analysis of Traffic Congestion on Jalan Wonokusumo, Surabaya City" smoothly. This thesis is made to apply for graduation requirements for Bachelor of Engineering in Civil Engineering Study Program, Faculty of Engineering, Narotama University, Surabaya.

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References
