

## **Analysis of Level of Service at Jati Raya Street Semarang during New Normal Covid-19 Pandemic**

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**Abstract.** Jati Raya Street is one of the streets in Banyumanik district, Semarang, where many vehicles pass. Before the Covid-19 pandemic, the traffic jam usually occurs at certain hours because of people activities passing through this street. The purpose of this research is to know the degree of saturation and the street level of service from the volume / capacity ratio during New Normal condition on Covid-19 pandemic. The primary data survey is by measuring the street width and counting the two-way traffic volume. The survey was held on Monday, 9 November 2020, at 06.15 – 08.15, 11.05 – 13.05, and 16.05 – 17.05. From the survey results, the maximum traffic flow is 784 pcu/hour, the time is at 07.15 – 08.15, and the traffic direction is from Pasar Jati toward Sukun Raya street. The street capacity is 2371 pcu/hour, with a 0,33 degree of saturation. The street level of service based on this survey is B, which means, steady traffic flow, the driver has enough option to control the vehicle speed. This research was done during New Normal condition on Covid-19 pandemic, where there is a decrease on the number of vehicles that passing through this street, for some reasons, which one of them is because the school activities is using an online methods, so that students can study from home, without the needs of parents taking them to school and picking them up from school.

**Keywords:** capacity, degree of saturation, level of service

### **1. Introduction**

Jati Raya Street is one of the streets in Banyumanik district, Semarang, where many vehicles pass. Before the Covid-19 pandemic, the traffic jam usually occurs at certain hours because of people activities passing through this street. In the street segment from Pasar Jati to the end of Jati Raya street before Sukun Raya street, there are houses and there are also banks, restaurants, stationery shop, fruit shops, and others. The people activities from these places can cause traffic jam. There are some tri junction in this street segment, each leading to Jati Barat street, Keruing Raya street, and Rasamala Raya street, where there can be a queue if vehicles want to enter / exit.

The purpose of this research is to know the degree of saturation and the street level of service from the volume / capacity ratio during New Normal condition on Covid-19 pandemic.

**2. Research Methods**

This research is using primary data survey. The primary data survey is by measuring the street width and counting the two-way traffic volume. On counting the two way traffic volume, using a form that has a table in it. The table has some sections. There are direction section, time section, and vehicle section. An example of the table is shown below.

Table 1 An example of survey form table

Direction: From Pasar Jati							
Time	Light Vehicle		Heavy Vehicle			Motorcycle	Unmotorized Vehicle
	Private Car	Small public transportation (Angkot)	Bus	Truck	Trailer Truck		
06.15 - 06.30							
06.30 - 06.45							
06.45 - 07.00							
07.00 - 07.15							
Summary :							
07.15 - 07.30							
07.30 - 07.45							
07.45 - 08.00							
08.00 - 08.15							
Summary :							

The survey was held on Monday, 9 November 2020 at 06.15 – 08.15, 11.05 – 13.05, and 16.05 – 17.05, with the counting interval every 15 minutes on each time.

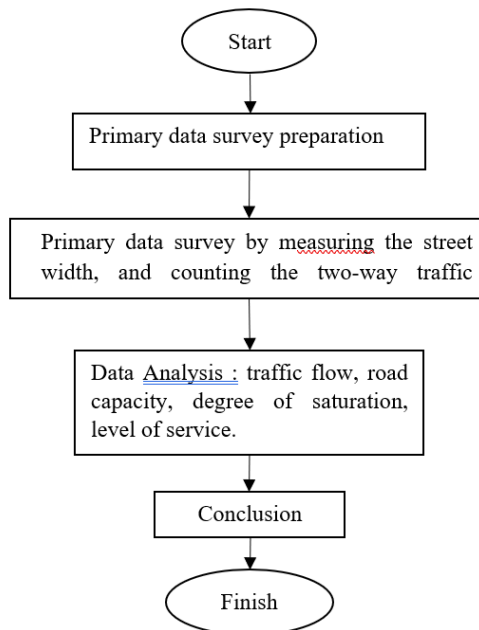


Figure 1 Research Methodology

**3. Results and Discussion**

3.1. Traffic Flow (Q)

Traffic flow according to MKJI 1997, means the number of motorized vehicles that pass a point on the road per unit time [1].

The number of vehicles for the direction from Pasar Jati, at 06.15 – 08.15, in every 15 minutes is shown in this table below.

Table 2 Number of Vehicles at 06.15 – 08.15 From Pasar Jati

Time	Direction : From Pasar Jati						
	Light Vehicle		Heavy Vehicle			Motorcycle	Unmotorized Vehicle
Private Car	Small Public Transportation (Angkot)	Bus	Truck	Trailer Truck			
06.15 - 06.30	54	12	0	0	0	230	3
06.30 - 06.45	68	7	0	0	0	285	1
06.45 - 07.00	77	10	0	0	0	330	0
07.00 - 07.15	76	8	0	0	0	322	0
<b>Jumlah :</b>	<b>275</b>	<b>37</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1167</b>	<b>4</b>
07.15 - 07.30	97	11	0	2	0	408	0
07.30 - 07.45	73	9	0	0	0	405	0
07.45 - 08.00	94	10	0	1	0	367	0
08.00 - 08.15	83	12	0	0	0	393	0
<b>Jumlah :</b>	<b>347</b>	<b>42</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>1573</b>	<b>0</b>

Source : Survey results, 2020

The number of vehicles for the direction toward Pasar Jati, at 06.15 – 08.15, in every 15 minutes is shown in this table below.

Table 3 Number of Vehicles at 06.15 – 08.15 Toward Pasar Jati

Time	Direction : Toward Pasar Jati						
	Light Vehicle		Heavy Vehicle			Motorcycle	Unmotorized Vehicle
Private Car	Small Public Transportation (Angkot)	Bus	Truck	Trailer Truck			
06.15 - 06.30	19	5	0	0	0	91	2
06.30 - 06.45	27	16	0	0	0	72	9
06.45 - 07.00	21	8	0	0	0	184	3
07.00 - 07.15	36	16	0	0	0	190	0
<b>Jumlah :</b>	<b>103</b>	<b>45</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>537</b>	<b>14</b>
07.15 - 07.30	23	10	0	1	0	187	2
07.30 - 07.45	25	12	0	3	0	201	1
07.45 - 08.00	33	17	0	2	0	263	0
08.00 - 08.15	44	6	0	3	0	235	0
<b>Jumlah :</b>	<b>125</b>	<b>45</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>886</b>	<b>3</b>

Source : Survey results, 2020

The number of vehicles for the direction from Pasar Jati, at 11.05 – 13.05, in every 15 minutes is shown in this table below.

Table 4 Number of Vehicles at 11.05 – 13.05 From Pasar Jati

<u>Direction :</u> From Pasar Jati							
Time	Light Vehicle		Heavy Vehicle			Motorcycle	Unmotorized Vehicle
	Private Car	Small Public Transportation (Angkot)	Bus	Truck	Trailer Truck		
11.05 - 11.20	81	3	0	1	0	280	0
11.20 - 11.35	75	5	0	4	0	329	0
11.35 - 11.50	68	4	0	2	0	281	0
11.50 - 12.05	65	4	0	1	0	233	0
<b>Jumlah :</b>	<b>289</b>	<b>16</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>1123</b>	<b>0</b>
12.05 - 12.20	67	5	0	1	0	253	0
12.20 - 12.35	70	7	0	1	0	269	0
12.35 - 12.50	67	11	0	2	0	258	0
12.50 - 13.05	69	8	0	2	0	271	0
<b>Jumlah :</b>	<b>273</b>	<b>31</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>1051</b>	<b>0</b>

Source : Survey results, 2020

The number of vehicles for the direction toward Pasar Jati, at 11.05 – 13.05, in every 15 minutes is shown in this table below.

Table 5 Number of Vehicles at 11.05 – 13.05 Toward Pasar Jati

<u>Direction :</u> Toward Pasar Jati							
Time	Light Vehicle		Heavy Vehicle			Motorcycle	Unmotorized Vehicle
	Private Car	Small Public Transportation (Angkot)	Bus	Truck	Trailer Truck		
11.05 - 11.20	70	5	0	4	0	307	0
11.20 - 11.35	71	9	0		0	288	0
11.35 - 11.50	77	9	0	4	0	273	0
11.50 - 12.05	82	4	0	5	0	248	0
<b>Jumlah :</b>	<b>300</b>	<b>27</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>1116</b>	<b>0</b>
12.05 - 12.20	85	8	0	2	0	259	0
12.20 - 12.35	67	10	0	2	0	272	1
12.35 - 12.50	53	7	0	3	0	243	0
12.50 - 13.05	60	5	0	1	0	252	0
<b>Jumlah :</b>	<b>265</b>	<b>30</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>1026</b>	<b>1</b>

Source : Survey results, 2020

The number of vehicles for the direction from Pasar Jati, at 16.05 – 17.05, in every 15 minutes is shown in this table below.

Table 6 Number of Vehicles at 16.05 – 17.05 From Pasar Jati

Direction : From Pasar Jati							
Time	Light Vehicle		Heavy Vehicle			Motorcycle	Unmotorized Vehicle
	Private Car	Small Public Transportation (Angkot)	Bus	Truck	Trailer Truck		
16.05 - 16.20	48	4	0	1	0	292	0
16.20 - 16.35	58	11	0	0	0	347	0
16.35 - 16.50	59	6	0	0	0	327	0
16.50 - 17.05	69	3	0	2	0	373	0
<b>Jumlah :</b>	<b>234</b>	<b>24</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>1339</b>	<b>0</b>

Source : Survey results, 2020

The number of vehicles for the direction toward Pasar Jati, at 16.05 – 17.05, in every 15 minutes is shown in this table below.

Table 7 Number of Vehicles at 16.05 – 17.05 Toward Pasar Jati

Direction : Toward Pasar Jati							
Time	Light Vehicle		Heavy Vehicle			Motorcycle	Unmotorized Vehicle
	Private Car	Small Public Transportation (Angkot)	Bus	Truck	Trailer Truck		
16.05 - 16.20	72	6	1	3	0	346	0
16.20 - 16.35	82	6	1	1	0	392	0
16.35 - 16.50	90	9	0	3	0	440	0
16.50 - 17.05	88	5	0	0	0	460	0
<b>Jumlah :</b>	<b>332</b>	<b>26</b>	<b>2</b>	<b>7</b>	<b>0</b>	<b>1638</b>	<b>0</b>

Source : Survey results, 2020

The summary on number of vehicles for the direction from Pasar Jati is shown in this table below.

Table 8 Summary on Number of Vehicles From Pasar Jati

Direction : From Pasar Jati							
Time	Light Vehicle		Heavy Vehicle			Motor cycle	Unmotorized Vehicle
	Private Car	Small Public Transportation (Angkot)	Bus	Truck	Trailer Truck		
06.15 - 07.15	275	37	0	0	0	1167	4
<b>07.15 - 08.15</b>	<b>347</b>	<b>42</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>1573</b>	<b>0</b>
11.05 - 12.05	289	6	0	0	0	327	0
12.05 - 13.05	273	31	0	6	0	1051	0
16.05 - 17.05	234	24	0	3	0	1339	0

Source : Analysis, 2020

The summary on number of vehicles for the direction toward Pasar Jati is shown in this table below.

Table 9 Summary on Number of Vehicles Toward Pasar Jati

Time	Direction : Toward Pasar Jati						
	Light Vehicle		Heavy Vehicle			Motor cycle	Unmotorized Vehicle
	Private Car	Small Public Transportation (Angkot)	Bus	Truck	Trailer Truck		
06.15 - 07.15	103	45	0	0	0	537	14
07.15 - 08.15	125	45	0	9	0	886	3
11.05 - 12.05	300	6	0	0	0	327	0
12.05 - 13.05	265	30	0	8	0	1026	1
<b>16.05 - 17.05</b>	<b>332</b>	<b>26</b>	<b>2</b>	<b>7</b>	<b>0</b>	<b>1638</b>	<b>0</b>

Source : Analysis, 2020

The maximum number of vehicles (vehicle/hour) for the direction from Pasar Jati is at 07.15 – 08.15, and for the direction toward Pasar Jati is at 16.05 – 17.05. To convert vehicle/hour to passenger car unit (pcu)/hour is by multiplying number of vehicles with passenger car equivalence factor.

Passenger car equivalence according to MKJI 1997 is a factor that shows a different types of vehicles compare to light vehicle in connection with their effect on the speed of light vehicle in traffic flow (for passenger car and light vehicle with similar chassis, the passenger car equivalence factor is 1,0) [1].

$$Traffic\ flow = number\ of\ vehicles \times passenger\ car\ equivalence\ factor \tag{1}$$

- Traffic flow for the direction from Pasar Jati at 07.15 – 08.15
  - Light Vehicle : 389 x 1 (pce factor) = 389 pcu/hour
  - Heavy Vehicle : 2 x 1,2 (pce factor) = 2 pcu /hour
  - Motorcycle : 1573 x 0,25 (pce factor) = 393 pcu/hour

Traffic flow = 389 + 2 + 393  
= 784 pcu/hour.
  
- Traffic flow for the direction toward Pasar Jati at 16.05 – 17.05
  - Light Vehicle : 358 x 1 (pce factor) = 358 pcu/hour
  - Heavy Vehicle : 9 x 1,2 (pce factor) = 10 pcu /hour
  - Motorcycle : 1638 x 0,25 (pce factor) = 409 pcu/hour

Traffic flow = 358 + 10 + 409  
= 777 pcu/hour.

Degree of saturation is calculated using the maximum traffic flow, that is 784 pcu/hour.

### 3.2. Road Capacity (C)

The definition of capacity according to MKJI 1997 is the maximum traffic flow that can be maintained (fixed) on a road section in a certain condition [1].

The basic equation for capacity (MKJI, 1997) :

$$C = C_0 \times FC_W \times FC_{SP} \times FC_{SF} \times FC_{CS} \tag{2}$$

- C = Capacity (pcu/hour)
- C<sub>0</sub> = Basic capacity (pcu/hour)
- FC<sub>W</sub> = Road width adjustment factor
- FC<sub>SP</sub> = Directional separation adjustment factor (for undivided road only)

$FC_{SF}$  = Side friction and kerb adjustment factor

$FC_{CS}$  = City size adjustment factor

The capacity is :

$$C = 2900 \times 0,87 \times 1 \times 0,94 \times 1,00$$

$$C = 2371 \text{ pcu/hour}$$

### 3.3. Degree of Saturation (DS)

Degree of saturation according to MKJI 1997 is the ratio of traffic flow to capacity on a certain road section [1]. The equation is :

$$DS = \frac{Q}{C} \quad (3)$$

The degree of saturation is :

$$DS = \frac{784}{2371}$$

$$DS = 0,33$$

### 3.4. Level of Service (LoS)

Level of service on urban roads according to MKJI 1997 is the degree of saturation and the speed of light vehicle [1].

The degree of saturation is 0,33, according to Level of Service table in Traffic Planning and Engineering, 2<sup>nd</sup> edition, in H.E Prasetyo and Trijeti [2], [3], the level of service in Jati Raya street when the survey was done is B, which means, steady traffic flow, the driver has enough option to control the vehicle speed [2].

## 4. Conclusions

The conclusions on this research is that the degree of saturation on Jati Raya street when the survey was done is 0,33. And the level of service is B, which means, steady traffic flow, the driver has enough option to control the vehicle speed. This research was done during New Normal condition on Covid-19 pandemic, where there is a decrease on the number of vehicles that passing through this street, for some reasons, which one of them is because the school activities is using an online methods, so that students can study from home, without the needs of parents taking them to school and picking them up from school.

## 5. Acknowledgments

The authors would like to acknowledge Semarang University, and the LPPM of Semarang University for facilitating and providing funds on this research.

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