LEADER
Civil Engineering and Architecture Journal

Civil Engineering and Architecture Journal Vol 1 No. 5 (2023) 3026-622X
DOI 10.37253/leader.v2i1.9505

ANALYSIS OF ROAD PERFORMANCE IN THE MAMBO MARKET CULINARY AREA DUE TO SIDE OBSTACLES-MAJALENGKA

Dini Widyanti[1], Indrastuti[2], Adinda Fajarika[3]

[1]Faculty of Civil Engineering, Majalengka University, Indonesia
[2]Faculty of Civil Engineering and Planning, Batam International University
[3]Faculty of Civil Engineering and Planning, Mercu Buana University Jakarta, Indonesia
Emai korespondensil: Diniwidyanti@email.com

ARTICLE INFO

Keywords:

Road, Traffic Flow, Intersection

ABSTRACT

Roads are an essential means of transportation to connect various places such as industrial centers, agricultural land, and residential areas and to distribute goods and services to support the economy. Rapid economic growth in Indonesia has also increased the number of private vehicles. This dramatically impacts the balance between the number of cars driving and the capacity of a road. The type of research used this time is qualitative research. Qualitative research is research that usually uses analysis and descriptive. The data collected is in the form of primary and secondary data. Preliminary data is obtained by surveying the research location to get an accurate picture of the situation and conditions. Meanwhile, secondary data is data obtained by collaborating with related agencies for data obtained such as Research location and road situation map. The location of this research is on Jalan. Ahmad Yani. The results of the discussion can be concluded that the volume of traffic flow at the intersection of four Mambo markets at peak hours, namely 16.30 - 17.30 WIB, heading north, gets 103 SMP/hour, in the south direction gets 102.25 SMP/hour, in the west gets 124.95 SMP/hour. The east direction gets 117 SMP / hour with a 134.3 SMP/hour side drag factor.

1. Introduction

Cities in developing countries are facing several challenges, including air and noise pollution, traffic congestion, road accidents, public transport decline, environmental degradation, climate change, and energy depletion [1]. Roads are an essential means of transportation to connect various places such as industrial centers, agricultural land, and residential areas and to distribute goods and services to support the economy. The increasing growth of vehicles, in terms of the number and capacity of loads carried, damages the road surface and pavement structure. This damage can also cause various problems, one of which can increase the number of traffic accidents worldwide. In 2018, nearly 1.35 million people worldwide died in traffic accidents every year, implying that one person died in a traffic accident every 24 s, an increase of 100,000 people compared to 2015 [2].

Cities in Indonesia have been recognized as crowded cities, particularly Jakarta, which is the capital city, is having traffic jams on a daily basis, which, in the end, will create chaos, air pollution, congestion, waste of fuel, wasting time, and so on [3]. Rapid economic growth in Indonesia has also increased the number of private vehicles. This has a significant impact on the balance between the number of cars driving and the capacity of a road. Traffic congestion has become a significant problem across the globe [4]. In

general, three factors can cause traffic jams to get worse over time, including the continued increase in the number of vehicle ownership (demand), lack of resources for the construction and development of roads and other transportation facilities (supply), and less than optimal operation of transportation facilities. They provided (operating system).

Majalengka is experiencing relatively fast economic growth, with many developments in Majalengka. The new face of this recreation area affects the volume of vehicles that crowd the road. Vehicle volume is the number of cars crossing a road section per unit of time. In contrast, road capacity is the capacity of the road to accommodate the volume of vehicles per unit of time. [5]. Insufficient road capacity combined with rapid economic growth in Majalengka is affecting traffic in Majalengka.

Traffic jams in Majalengka City, especially on Ahmad Yani Road, occur during rush hours, namely 07.00 and 16.00 WIB. Congestion cannot be avoided because, at 07.00, people continue to carry out various activities, including going to/from work, going to/from school, or other activities, especially on weekends. This will cause traffic jams, especially along Ahmad Yani road. Therefore, an increase in population can directly trigger an increase in the need for the use of means of transportation such as cars, motorbikes, etc., and indirectly can cause congestion, especially if the existing road capacity is unable to accommodate the increase in the number of vehicles [6]. The capacity of the Ahmad Yani road itself is still unable to adjust the volume of cars because the distance between the road shoulders is still relatively narrow. Urban traffic, as vital infrastructure construction, plays a crucial role in modern life [7].

Based on the problems above, to achieve efficiency and smoothness on Jalan Ahmad Yani, it is necessary to improve the performance of the road. This research aims to calculate daily traffic figures at the Market Mambo intersection. To provide solutions to problems on Road Ahmad Yani so that traffic activities are not hampered and prevent accidents from occurring at the Mambo intersection.

2. Literature Review

2.1 Road

According to Law of the Republic of Indonesia Number 38 of 2004, roads are land transportation infrastructure that includes all parts of the road, including complementary buildings and equipment. An arterial road is a high-capacity urban road. Its function is to send traffic from collector roads to freeways and expressways and between urban centers at the highest possible level of service. Collector roads are roads developed to serve and connect cities between regional activity centers and local activity centers or small-scale areas and regional feeder ports and local feeder ports. Congestion has become a common problem, and many ways have been tried to find a solution [8].

Roads as a means of transportation are vital for successful development. Of course, in developing road infrastructure, it is necessary to pay attention to the safety aspects of road construction. The negative impact of the development of road infrastructure is the reduction of green areas in urban areas. However, in other countries, this impact can be minimized well. At the international level, several efforts have been made to apply GPP to the road sector: in Sweden, environmental aspects are integrated into road maintenance contracts; in Finland, procurement methods are implemented to reduce the ecological impacts of roads; in the Netherlands, GPP has been implemented to manage the main road [9]. The success of the development is greatly influenced by its role of transportation as the center of economic, socio-cultural, security, and political life [10]. In developing road infrastructure, it is necessary to pay attention to the safety aspects of road construction. Ideas and principles of quality management and sustainable safety have made progress in the last 20 years. This progress could have driven policymakers and project managers to understand the requirement for simple road security tools

[11].

2.2 Traffic Flow

Traffic flow is the number of vehicles passing at a particular time interval at a certain road point and is measured in specific vehicle time units. The improvement in the economy increases the need for transportation facilities. As a result, the number of traffic flows is getting denser every day, and the types of vehicles using the roads are increasing. The traffic characteristics on a road section will vary based on location and time. Traffic flow is a fundamental measurement reflecting the state of the highway [12].

As the urban population has continued to grow in the last few decades, increasing urban traffic imposes significant challenges on the transportation system infrastructure in smart cities, such as managing accidents, traffic congestion, and parking difficulties [13]. The traffic flow on Pemuda Street is also quite dense because it is the access to the Munjul roundabout and also the access to the Taman Raharja Food Court itself. Freeway traffic flow modeling and control are primarily based on fundamental relationships, including meaningful relationships between macroscopic state variables such as density and speed [14].

Although traffic congestion may be unavoidable nowadays due to the continuous increase in the number of vehicles and traffic demand, some of its ramifications may be alleviated by employing real-time traffic control strategies [15]. The causes of traffic jams come from various interrelated aspects of life, for example, poor discipline, weak low power, and increasing vehicle growth, but which cannot keep pace with the development of road infrastructure. Current traffic flow forecasting methods can be divided into three categories: Predictive methods based on traditional statistical theories, including regression analysis, time series, and Kalman Filtering [16].

2.3 Intersection

An intersection is the meeting point of two or more road sections. Many problems occur at the intersection of these roads, such as queues, traffic jams, and accidents, all of which lead to congestion at the intersection. Transportation problems are also caused by several factors, including the high volume of vehicles, lack of infrastructure, community activities next to the road, and drivers who lack discipline [17].

There are several intersections, including three, four, and even five. Apart from that, there are also intersections with and without signals. The existence of intersections in a road network is indicated so that motorized vehicles, pedestrians, and non-motorized vehicles can move in different directions and at the same time [18], where the driver must decide to go straight or turn and change roads to reach a destination [19].

So good service is needed so as not to disrupt traffic flow. Traffic volume is the number of vehicles passing at one place on the road in a unit of time. Expressed in vehicles/hour, pcu/hour [20]. These include light vehicles (LV), motorized vehicles with two axles and four wheels with an axle spacing of 2.0 – 3.0, namely (cars, microbuses, and pickups), and heavy vehicles (HV), including vehicles with more than four wheels. , namely (buses, 2 – 3 axle trucks, combination trucks), motorbikes (MC), including motorized vehicles with 2 or 3 wheels (motorbikes, three-wheeled vehicles).

3. Methodology

3.1 Types of Research

The type of research used this time is qualitative research. Qualitative research, namely research that usually uses analysis and naturedeskriptif. In qualitative research, data are used to decide which way interpretation should move forward, using data to generate hypotheses and new research questions [21].

3.2 Research Location

The location of this research is in the middle of the city of Majalengka, which is on the road—Ahmad Yani who will go to Majalengka Square. To be more precise, it is in Figure 1 Research Locations.

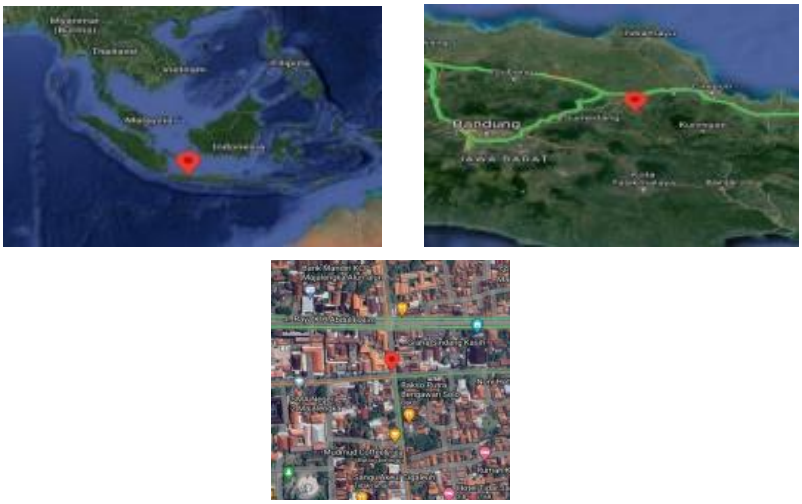

Figure. 1 Location

3.3 Data Collection

The data collected is in the form of primary and secondary data. Primary data is data obtained by direct survey at the research location so as to get a real picture of the situation and conditions. Meanwhile, secondary data is data obtained by collaborating with related agencies, for data obtained such as: Research location, road situation map. This research was conducted on Sunday, December 10 2023 at 07.00 WIB – 17.30 WIB.

4. Discussion

4.1 Road Geometric Survey

Table 1. Road Geometric Data

Type Road	Geometric conditions		
	Wide street	Wide shoulder	Wide sidewalk
	(m) left/right	(m) left/right	(m) left/right
2/1 UD	6 m	2 m	1 m

Source: Observation Results, 2023

The table above shows geometric data on Jalan Ahmad Yani, a shopping center area with many street vendors at the Mambo intersection. This road is a two lane undivided road (2/1 UD). Where the width of the road is 6 meters, the width of parking on the road is 2 meters, so the effective width is 4 meters. The minimum lane width for urban areas is 3.5 m. From the geometric results of the road above, the observation point, namely the Ahamad Yani mesh section, meets the requirements for urban road width.

4.2 Traffic Flow Volume Data

After passing the survey on Monday, 10 December 2023, with the help of 4 surveyors. The equivalent vehicle quantities can be seen in Table 2 below.

Table 2.Equivalent vehicle size for undivided urban roads

Road type	kind/jam	Emp			
		H.V	MC		LV
			Path width		
			≤ 6 m	≥ 6 m	
2/1 OUT	0	1,3	0,50	0,40	1,0
	≥ 1800	1,2	0,35	0,25	

Source: MKJI, 1997

It converts traffic flow data into passenger car units (SMP) by multiplying the number of vehicles by the Passenger Car Equivalent (EMP). The MKJI guides the EMP value used and carried out by direct observation at the location.

4.2.1 North Direction

Table 3. Northbound traffic flow or red light direction

No	Time	LV (emp =1,0)	MC (emp= 0,25)	vehicle	SMP	4x15 minutes (SMP/hour)
1	07:00- 07:15	12	47	59	23,75	87,5
2	07:15-07:30	8	40	48	18	
3	07:30- 07:45	9	56	65	23	
4	07:45- 08:00	9	55	64	22,75	
5	13:00- 13:15	3	30	33	10,5	36
6	13:15- 13:30	2	22	24	7,5	

7	13:30- 13:45	4	20	24	9	
8	13:45- 14:00	2	28	30	9	
9	16:30- 16:45	9	48	57	21	103
10	16:45- 17:00	15	58	73	29,5	
11	17:00- 17:15	18	36	54	27	
12	17:15- 17:30	13	50	63	25,5	

Source: Observation Results, 2023

It can be seen in the table above that the LHR recapitulation data on the westbound road section in the morning is 87.5 SMP/hour; in the afternoon, it is 36 SMP/hour, and in the afternoon, it is 103 SMP/hour. So on this section, the heaviest traffic flow occurs in the afternoon or 16:30-17:30, from the direction of the red light towards the Four Mambo intersection.

4.2.2 South direction

Table 4. Traffic flow towards the south or Indomaret Babakan Jawa

No	Time	LV (emp =1,0)	MC (emp= 0,25)	vehicle	SMP	4x15 minutes (SMP /hour)
1	07:00- 07:15	12	42	54	23,5	83,25
2	07:15 - 07:30	8	40	48	18	
3	07:30- 07:45	7	53	60	20,25	
4	07:45- 08:00	9	50	59	21,5	
5	13:00- 13:15	4	36	40	13	47,5
6	13:15- 13:30	2	22	24	7,5	
7	13:30- 13:45	5	28	33	12	
8	13:45- 14:00	7	31	38	14,75	
9	16:30- 16:45	10	50	60	22,5	102,25

10	16:45- 17:00	12	55	67	25,75	
11	17:00- 17:15	17	58	75	31,5	
12	17:15- 17:30	10	50	60	22,5	

Source: Observation Results, 2023

It can be seen in the table above that the traffic flow on the westbound road in the morning is 83.25 SMP/hour, in the afternoon, it is 47.5 SMP/hour, and in the afternoon, it is 102.25 SMP/hour. So, on this section, the heaviest traffic flow occurs in the afternoon, or 16:30-17:30, from the direction of Indomaret Babakan Jawa Majalengka towards four intersection Mambo.

4.2.3 West Direction

Table 5. Traffic flows west or towards Majalengka Square

No	Time	LV (emp=1,0)	MC (emp= 0,25)	vehicle	SMP	4x15 minutes (smp/hour)
1	07:00-07:15	11	40	51	21	80,75
2	07:15-07:30	9	42	51	19,5	
3	07:30-07:45	5	51	56	20,25	
4	07:45- 08:00	8	48	56	20	
5	13:00-13:15	3	32	35	11	52
6	13:15-13:30	5	29	34	12,25	
7	13:30-13:45	6	20	26	11	
8	13:45-14:00	9	35	44	17,75	
9	16:30-16:45	12	65	77	28,25	124,95
10	16:45-17:00	15	52	67	28	
11	17:00-17:15	19	70	89	36,5	
12	17:15-17:30	14	65	79	32,2	

Source: Observation Results, 2023

It can be seen in the table above that the traffic flow on the westbound road in the morning is 80.75 smp/hour, in the afternoon it is 52 smp/hour and in the afternoon it is 124.95 smp/hour. So on this section the traffic flow is heaviest in the afternoon or at night 16:30-17:30, from Majalengka Square towards four intersection Mambo.

4.2.4 East Direction

Table 6. Eastbound traffic flow or Pujasera

No	Time	LV (emp =1,0)	MC (emp= 0,25)	vehicle	SMP	4x15 minutes (smp/hour)
1	07:00-07:15	9	35	44	26,5	84,5
2	07:15-07:30	12	38	50	21,5	
3	07:30-07:45	7	49	56	19,25	
4	07:45-08:00	6	45	51	17,25	
5	13:00-13:15	4	28	32	11	52
6	13:15-13:30	7	30	37	14,5	
7	13:30-13:45	9	38	47	18.5	
8	13:45-14:00	7	30	37	14,5	
9	16:30-16:45	12	60	72	27	117
10	16:45-17:00	16	55	71	29,75	
11	17:00-17:15	18	65	83	34,25	
12	17:15-17:30	11	60	71	26	

Source: Observation Results, 2023

It can be seen in the table above that the traffic flow on the westbound road in the morning is 84.5 smp/hour, in the afternoon it is 52 smp/hour and in the afternoon it is 117 smp/hour. So on this section the heaviest traffic flow occurs in the afternoon or 16:30-17:30, from the direction of Pujasera Majalengka towards the intersection of four mambo.

4.3 Side Obstacles

Table 7.HS recap on Jalan Ahmad Yani four intersection Mambo

Time	Pedestrian Legs (0,5)	Slow vehicle (*0,4)	Vehicle park/stop (*1,0)	Number of HS	Amount HS smp/hour
07:00-07:15	16	-	10	26	11
07:15-07:30	31	2	13	46	29,8
07:30-07:45	37	2	15	54	34,3
07:45-08:00	38	3	15	56	35,2
13:00-13:15	37	-	11	48	29,5
13:15-13:30	20	-	12	22	22
13:30-13:45	16	-	7	23	15
13:45-14:00	16	4	11	31	20,6
16:30-16:45	40	6	18	30	40,4
16:45-17:00	25	4	20	22	34,5
17:00-17:15	33	1	16	29	32,9
17:15-17:30	23	-	15	18	26,5

Source: Observation Results, 2023

Based on the number of side obstacles on Jalan Ahmad Yani, to be precise, the four mambo intersection at peak hours, namely in the afternoon, has a light side obstacle class of 40.4. This is because the large number of stopped vehicles results in a reduction in the effective lane width of traffic, so that it can indirectly affect the speed passing through the road.

5. Conclusions and Suggestions

From the results of the discussion above, it can be concluded that the volume of traffic flow at the intersection of four Mambo Markets at peak hours, namely 16.30 - 17.30 WIB, heading north, gets 103 smp/hour, in the south direction it gets 102.25 smp/hour, in the west it gets 124, 95 smp/hour, and the east direction gets 117 smp/hour. With a side drag factor of 134.3 smp/hour. This greatly affects traffic performance on the road. Ahmad Yani, precisely at the intersection of four Mambo markets. Suggestions for the future: the Maalengka government should pay more attention to traffic on the roads. Ahmad Yani

is at the intersection of four Mambo markets, especially since this road is the road that leads to Majalengka Square and the Majalengka Regent's Office.

References

[1] M. M. A. W. Ahmed and N. A. E. Monem, "Sustainable and green transportation for better," *HBRC Journal,* pp. 17-37, 2020.

[2] A. Aiash and F. Robusté, "Traffic accident severity analysis in Barcelona using a binary probit and CHAID tree," *International journal of injury control and safety promotion, 29(2),* pp. 256-264, 2022.

[3] A. S. Putra and H. L. H. S. Warnars, " Intelligent traffic monitoring system (ITMS) for smart city based on IoT monitoring," *In 2018 Indonesian Association for Pattern Recognition International Conference (INAPR). IEEE,* pp. 161-165, 2018.

[4] S. R. Samal, P. G. Kumar, J. C. Santhosh and M. Santhakumar, "Analysis of traffic congestion impacts of urban road network under Indian condition.," *In IOP conference series: materials science and engineering (Vol. 1006, No. 1, p. 012002),* p. 1, 2020.

[5] D. W. Sharfina and A. Saputra, "Analisis Tingkat Kemacetan Lalu Lintas di Ruas Jalan Arteri dan Kolektor Kota Magelang Menggunakan Sistem Informasi Geografis)," *(Doctoral dissertation, Universitas Muhammadiyah Surakarta,* p. 7, 2022.

[6] M. I. Ali and M. R. Abidin, "Pengaruh kepadatan penduduk terhadap intensitas kemacetan lalu lintas di Kecamatan Rappocini Makassar.," p. 69, 2019.

[7] C. Yujun, P. Juhua, D. Jiahong, W. Yue and X. Zhang, "Spatial–temporal traffic outlier detection by coupling road level of service," *IET Intelligent Transport Systems, 13(6),* pp. 1016-1022, 2019.

[8] A. I. Rifai, Y. A. Surgiarti, M. Isradi and A. Mufhidin, "Analysis of Road Performance and the impact of Development in Pasar Minggu, Jakarta: Case Study of Jalan Lenteng Agung-Tanjung Barat," *ADRI International Journal of Civil Engineering, 6(1),* pp. 68-74, 2021.

[9] G. Trunzo, L. Moretti and A. D'Andrea, "Life cycle analysis of road construction and use," *Sustainability, 11(2),,* p. 377, 2019.

[10] M. Isradi, H. Dwiatmoko, M. I. Setiawan and D. Supriyatno, " Analysis of Capacity, Speed, and Degree of Saturation of Intersections and Roads," *Journal of Applied Science, Engineering, Technology, and Education, 2(2),* pp. 150-164, 2020.

[11] S. Sahu, S. P. Mishra, K. K. Barik and D. K. Sahu, " Implementation of Road Safety Audit to Highlight the Deformities in the Design and Environmental Safety Features: A Case Study on National Highway-326," *International Journal of Environment and Climate Change, 12(11),* pp. 1123-1140, 2022.

[12] S. Guo, Y. Lin, N. Feng, C. Song and H. Wan, "Attention-based spatial-temporal graph convolutional networks for traffic flow forecasting.," *In Proceedings of the AAAI conference on artificial intelligence (Vol. 33, No. 01, pp,* pp. 922-929, 2019.

[13] K. S. Liu, J. Gao, X. Wu and S. Lin, "On-street parking guidance with real-time sensing data for smart cities," *In 2018 15th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON) (pp. 1-9). IEEE.,* 2018.

[14] S. Mohammadian, M. M. Haque, Z. Zheng and A. Bhaskar, "Integrating safety into the fundamental relations of freeway traffic flows: A conflict-based safety assessment framework," *Analytic methods in accident research, 32, 100187,* pp. 1-9, 2021.

[15] N. Bekiaris-Liberis and A. I. Delis, "PDE-based feedback control of freeway traffic flow via time-gap manipulation of ACC-equipped vehicles," *IEEE Transactions on Control Systems Technology, 29(1),* pp. 461-469, 2020.

[16] M. Yang, J. Xie, P. Mao, C. Wang and Z. Ye, "Application of the ARIMAX model on forecasting freeway traffic flow. In CICTP 2017: Transportation Reform and Change—Equity, Inclusiveness, Sharing, and Innovation," *Reston, VA: American Society of Civil Engineers.,* pp. 593-602, 2018.

[17] S. M. Utari, "Studi Kinerja Lalu Lintas Pada Ruas Jalan Abdul Kadir Kota Parepare," *Jurnal Karajata Engineering, 1(2) ,* pp. 66-70, 2021.

[18] I. Ishak and S. Dewi, "Analisis Kinersa Simpang Empat Tak Bersinyal (Studi Kasus: Persimpangan Jalan Ahmad Yani Ekor Lubuk Kota Padang Panjang)," *Ensiklopedia Research and Community Service Review, 1(1),* pp. 165-172, 2021.

[19] R. Andika, "Analisis Kinerja Simpang Bersinyal untuk Meningkatkan Keselamatan dengan Pengaturan Ulang Waktu Siklus APILL di Simpang Empat Maya Kota Tegal," *Jurnal Universal Technic, 1(2),* pp. 84-95, 2022.

[20] MKJI, "Indonesia, M. K. J. (1997). Departemen Pekerjaan Umum. Direktorat Jenderal Bina Marga.," 1997.

[21] T. L. Haven and D. L. Van Grootel, "Preregistering qualitative research," *Accountability in research, 26(3),* pp. 229-244, 2019.