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Impact of Traffic Congestion: Case Study of Jatiwangi-Majalengka Highway Section

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ABSTRACT

Traffic congestion is a common problem that plagues most metropolitan cities in the world. In Indonesia, traffic jams have become part of the daily routine, especially in big cities like Jakarta (Indonesia), Mumbai (India), and New York (United StatesHighways experience significant congestion during peak hours, which generally occur twice a day, in the evening and also in the morning. This is usually caused by the work schedule of workers who leave in the morning and return in the afternoon. It is this concentration of vehicles at peak hours that triggers congestion. There are also other factors associated with congestion, such as the lack of adequate public transportation alternatives, so that people prefer to use private vehicles. Thus, collaborative efforts from various parties are needed to address this issue as a whole. And usually vehicles such as cars, and motorcycles park carelessly, as well as street vendors who like to sell on the side of the road which is the impact of the congestion that often occurs. The purpose of this paper is to adopt a qualitative approach to assess the impact of congestion related to road speed and density. This research method was carried out by survey on the Bandung-Palimanan road, Ciborelang village, Jatiwangi sub-district, Majalengka district in December 2024 which has a length of about ± 200 meters. Data analysis using primary data consisting of the number of vehicles passing, Microsoft Excel 2013 and Traffic Counter software The results revealed that the volume of vehicles peaked at 2543.4 vehicle units per hour, which indicates the occurrence of traffic congestion, with the highest speed reaching 66.92 km / h, which identifies that conducive traffic conditions allow transportation to move at a fairly high speed.

1. Introduction

Traffic congestion is a common problem that plagues most metropolitan cities in the world. In Indonesia, traffic congestion has become part of daily routine, especially in big cities like Jakarta (Indonesia), Mumbai (India), and New York (Usa) (Samasal, Manakane, & Leuwol, 2024). Highways experience significant congestion during peak hours, which generally occur twice a day, in the evening and in the morning. This is usually caused by the work schedules of workers who leave in the morning and return in the afternoon. It is this concentration of vehicles at peak hours that triggers congestion. A road can be considered congested if the volume of traffic passing through it exceeds the planned capacity, so that the free speed on that section of road is almost/approaching 0 km/hour or even becomes 0 km/hour, which results in long queues (Abdi, Priyanto, & Malkamah, 2019).

Congestion is a common obstacle facing the transportation sector in many countries (Ali & Abidin, 2019). There are many factors that cause traffic jams to occur frequently, including the increasing number of vehicles which makes the road infrastructure inadequate, the lack of discipline among road users, and the implementation of the supervisory function by road managers which is not yet effective (ARJUNA, 2022). Congestion also occurs due to road areas that cannot accommodate the number of vehicles, irregular parking, traffic chaos, flooding, inadequate or damaged road conditions, and traffic accidents (Rahayu, Rifai, & Akhir, 2022). In addition, another factor associated with congestion is the lack of adequate public transportation alternatives, so the majority of people tend to choose to use private vehicles, so collaborative efforts from various parties are needed to overcome this problem as a whole.

Traffic congestion is a condition in which traffic flow is obstructed or even stops completely due to the number of vehicles exceeding road capacity (Maha, 2022). And usually vehicles such as cars, and motorcycles park carelessly, as well as street vendors who like to sell on the side of the road which is the impact of the congestion that often occurs. Nowadays, the public's need for traffic activities is huge as it serves as a means to work and perform various other activities (Akbar & Saputra, 2024).

Congestion on the Jatiwangi highway This phenomenon generally occurs on Wednesdays, between 6:00 am and 11:00 am which is caused by the Wednesday market where traders sell on the side of the road, as well as illegal parking where vehicles such as cars and motorbikes park on the side of the road so that it makes the road infrastructure less adequate so that congestion occurs.. This area can cause traffic congestion at certain times such as when students, workers, and merchants start their activities (Fatimah & Rifa'i, 2024). Significant economic growth in Indonesia has led to an increase in the volume of vehicles on the road, causing worsening traffic congestion(Anugraha, Rifai, Taufik, & Isradi, 2024). Busy working hours concentrated in the morning and evening cause a surge in the volume of vehicles on the road, exacerbating congestion (Permatasari, 2020).

Tujuannya adalah mencari tahu apa saja masalah yang ditimbulkan oleh kemacetan di jalan Jatiwangi, khususnya bagi pengguna jalan. With the increasing volume of vehicles that is not comparable to road capacity, congestion results in wasted time and fuel, and reduces the economic productivity of the community (Daryamah, 2019). It is hoped that this research will provide a comprehensive understanding of the root causes of traffic congestion, as well as recommendations to reduce its negative impact on society, so that traffic flow can be smoother and support local economic growth. Thus, the title of this journal is “The Impact of Traffic Congestion: A Case Study of Jalan Raya Jatiwangi – Majalengka”.

2. Literature Review

2.1 Transportation

Transportation is a complex system that involves the movement of people and goods, infrastructure, and various modes of transportation such as land, sea, air, and rail. Transportation acts as a bridge that connects people to various destinations and activities(Nurhasanah, Rifai, Taufik, & Isradi, 2024). The concept of transportation began with the invention of the wheel around 3500 BC, which was used to facilitate the transfer of goods.. The development of transportation in the world took place very slowly, until gradual changes occurred which finally resulted in the means of land, sea and air transportation as we know it today (Karim, Lis Lesmini, Sunarta, Suparman, & ... Bus, p. 2023).

Most Indonesians think that owning a private vehicle is an indicator of an improved quality of life. Around the world, the increasing number of motorized vehicles has created congestion problems on

roads, resulting in severe congestion, impaired productivity, and environmental hazards (Rachman, 2024). People's reliance on private vehicles has led to a number of negative impacts on the environment and urban quality of life, such as environmental degradation, traffic congestion, and decreased efficiency of public transportation (Othman & Ali, 2020). Transportation, especially in urban areas, is often a significant source of environmental stressors, triggering severe traffic congestion and increasing levels of air and noise pollution, reducing people's quality of life(Hybel & Mulalic, 2022).

Transportation is a crucial element in supporting the survival of society (Chairi, Melasari, & Afandi, 2020). Transportation plays a strategic plays a role in driving national economic growth, in addition, the transportation sector is also a business area that is comparable to other sectors such as economics, agriculture, industry, mining, trade, construction, finance, government, transmigration, and defense and security (Serang & Hiariey, 2022). Many large countries that already have good transportation facilities still face transportation problems, such as congestion (Firmansyah, Rifai, & Taufik, 2022). The transportation system in Indonesia still faces many challenges, such as uneven infrastructure, as well as congestion in big cities that need attention.

2.2 Road Section

A road segment is a road segment that is bounded by two points where roads meet, either in the form of a parallel or non-parallel intersection (Rofida, 2019). In the context of sections jalan raya Jatiwangi - Majalengka, This road not only connects the two regions, but also plays an important role in supporting the economic and social activities of the local community. With a significant length, this road section faces challenges such as increased traffic volume, congestion, and the physical condition of the road that can affect the safety of users. The state of the road is crucial to ensure safe and efficient travel (Natalia & Rifa'i, 2023). Therefore, the management and maintenance of road sections is crucial to ensure smooth transportation and support economic growth in the region.

According to (Sarwandy & Royan, 2023) An arterial road is a type of public road that is specifically designed to serve long-distance traffic at high speeds, and has limited access to maintain smooth traffic flow. Collector roads function as a link between arterial roads and local roads, serving traffic with medium distance and medium speed. Local roads are roads that serve traffic on a local scale, characterized by low speeds and limited traffic volumes. Neighborhood roads are specifically designed to serve internal traffic within a residential area, characterized by very low speeds and limited traffic volumes. In addition, there are also access roads, which are designed to connect local roads with specific buildings or areas, providing direct access for vehicles and pedestrians, these access roads usually have low speeds and serve to support local activities, such as housing, shopping centers, and other public facilities.

Roads are vital infrastructure that acts as a catalyst in driving the growth and development of a region, as well as strengthening social, economic and cultural connectivity (Harahap & Modifa, 2020). As such, it will create better connectivity. Good and adequate roads improve accessibility to services and opportunities, which in turn encourages investment and improves the quality of life of the surrounding communities.

2.3 Traffic

The road is an access that connects one area to another and is useful for providing convenience to the community traveling to other places. Rapid population growth will increase the demand for transportation services, potentially leading to various traffic problems, such as congestion, accidents, and the need for more adequate road infrastructure (Putra, Ratih, & Primantari, 2022). One of the

factors causing the increasing number of traffic accidents is the rapid growth in motor vehicle ownership in the last decade, especially motorbikes (Soimun, Leliana, Ulmi, Ziantono, & Widyastuti, 2020).

Roads are a very crucial transportation infrastructure to ensure smooth mobility of people and distribution of goods (Abadiyah, Alfandi, & DwiKusuma, 2023). In order for roads to provide the expected service, periodic upgrades are necessary, including physical condition improvement, capacity expansion, and application of modern technology. These efforts aim to reduce congestion, improve road user safety, and support economic growth in the region. Internationally, road infrastructure plays a significant role in economic development, trade and global connectivity (Natalia & Rifa'i, 2023)

Traffic is the movement of people or goods that takes place by utilizing transportation facilities or space on land, either using transportation tools such as motorized vehicles and bicycles, or non-motorized. Traffic activities on the road can cause various problems, such as accidents and congestion that can disrupt the mobility and safety of road users (Pradana & Intari, 2019). Accidents can also occur due to driver inattention when traveling around corners, causing traffic flow conflicts and resulting in traffic jams and other congestion (Muizz, Rifa'i, & Fajarika, 2024). In addition to ensuring the safety of road users and conducting regular vehicle condition checks, road planning in accordance with guidelines, such as a safe bend radius and adequate shoulder width, can reduce the number of accidents caused by road geometric factor (Herdiana, Rifai, Taufik, & Prasetijo, 2024). Effective traffic management and planning is necessary to build a safe, efficient, and sustainable transportation system.

3. Method

This research adopts a qualitative approach in data collection and analysis. Qualitative research generally relies on analysis and is descriptive. In qualitative research, data serves to direct the interpretations to be made, as well as being used to create new hypotheses and research questions(L. Haven & Van Grootel, 2019)

The data collected is based on primary data. Primary data in this study was obtained through field surveys conducted at three different times, namely December 4, 18, and 25, 2024, with the time span of data collection from 06.00 to 11.00 WIB.

The location of this research is in Jatiwangi, Majalengka district, more precisely in the Ciborelang market on the highway connecting Bandung and Cirebon. The length of this research location is ± 200 M. To be more precise, it is in Figure 1 Research location.

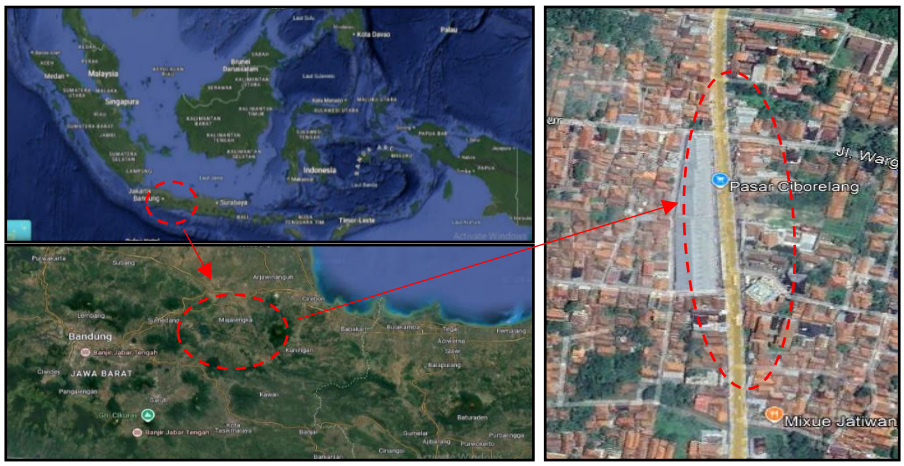

Figure. 1 Research Location
Source: Google Maps (accessed 18 Oktober 2024)

Figure. 2 Poto Survey
Source: Mobile Camera (accessed 18 Desember 2024)

4. Results and Discussion

4.1 Road Section Data

Jatiwangi highway is an artery, heavy goods transportation vehicles and light goods transportation can be allowed through this road. The road data is as follows The first type of road is a two-lane two-way road, with the width of each lane around $\pm$ 3.5 meters. The traffic lanes on this road section are separated by road markings in the form of dotted lines.

4.2 Road Volume Analysis Results

Vehicle volume is a quantity that indicates the total number of vehicles traveling on a road section within a certain period of time, usually expressed in vehicle units per hour (PCU/hour). Measurement of transportation volume is very important to understand traffic flow patterns in a particular location. Data on the number of vehicles is very important in planning and managing the transportation system. In addition, the volume of vehicles is also influential in determining the volume of vehicles passing on a road section in a certain period of time. By having knowledge of the amount of transportation passing through, road capacity analysis can be carried out.

4 Desember	Number of Vehicles (ken/jam)					Number of Vehicles (Smp/jam)				
Waktu	LV	HV	MC	UM	Total	LV	HV	MC	UM	Total
06.00-07.00	1099	18	1245	23	2385	985	27	490,5	19,3	1521,8
07.00-08.00	1240	15	1687	26	2968	1248	23	674,7	20	1965,7
08.00-09.00	1218	22	1505	13	2758	1116	30	765	12,4	1923,4
09.00-10.00	1124	16	1139	17	2296	1170	21	580,6	15,7	1787,3
10.00-11.00	989	17	1264	20	2290	985	25	687	21,8	1718,8
18 Desember	Number of Vehicles (ken/jam)					Number of Vehicles (Smp/jam)				
Waktu	LV	HV	MC	UM	Total	LV	HV	MC	UM	Total
06.00-07.00	975	30	1345	24	2374	1190	40	542,7	19,4	1792,1
07.00-08.00	1173	25	1380	10	2588	1375	19,3	549,3	17,5	1961,1
08.00-09.00	968	30	1217	7	2222	963	34,4	688,6	20,6	1706,6
09.00-10.00	957	19	1060	20	2056	955	22,8	424,4	16,3	1418,5
10.00-11.00	920	25	1290	18	2253	1220	35,7	632,1	15,9	1903,7
25 Desember	Number of Vehicles (ken/jam)					Number of Vehicles (Smp/jam)				
Waktu	LV	HV	MC	UM	Total	LV	HV	MC	UM	Total
06.00-07.00	1261	17	2165	34	3477	1209	17	663	26,8	1915,8
07.00-08.00	1549	23	2316	36	3924	1497	23,9	985,7	36,8	2543,4
08.00-09.00	1267	19	2032	29	3347	1267	23,1	817,2	20,4	2127,7
09.00-10.00	1354	17	1989	24	3384	1286	20,4	837,4	23,2	2167
10.00-11.00	1170	14	1748	20	2952	1170	18	564,4	22	1774,4

Table. 1 Volume Density Test Results

The data showed that the highest vehicle volume reached 2543.4 smp/h (vehicle units per hour) between 7:00 and 8:00 am, when many vehicles were traveling on the road under analysis. Traffic volumes peaking at these hours can create rush hour conditions or traffic congestion that occurs as a result of the high intensity of road use by vehicles at that time.

4.3 Vehicle Speed Analysis Results

To understand the traffic flow characteristics of the Jatiwangi highway section, it is very important to know the speed pattern of vehicles at different times and days. Information on this speed pattern can be used to identify peak times and the creation of an effective traffic control plan is very important to overcome the problem of effective congestion to improve road smoothness and safety. Congestion test results are used for transportation planning and traffic management. The traffic speed test results are shown in Table 2.

No	4 Desember	Distance Traveled	Total Data	Travel Time	Space Mean Speed	
	Time	(m)	observation	(Seconds)	(m/det)	(km/jam)
1	06.00-07.00	200	12	26,63	7,51	27,04
2	07.00-08.00	200	12	29,26	6,83	24,59
3	08.00-09.00	200	12	27,88	7,17	25,81
4	09.00-10.00	200	12	19,35	10,33	37,19
5	10.00-11.00	200	12	10,76	18,59	66,92
No	18 Desember	Distance Traveled	Total Data	Travel Time	Space Mean Speed	
	Time	(m)	observation	(Seconds)	(m/det)	(km/jam)
1	06.00-07.00	200	12	27,31	7,32	26,35
2	07.00-08.00	200	12	29,51	6,77	24,37
3	08.00-09.00	200	12	26,92	7,43	26,75
4	09.00-10.00	200	12	18,97	10,54	37,95
5	10.00-11.00	200	12	11,24	17,80	64,08
No	25 Desember	Distance Traveled	Total Data	Travel Time	Space Mean Speed	
	Time	(m)	observation	(Seconds)	(m/det)	(km/jam)
1	06.00-07.00	200	12	28,16	7,10	25,56
2	07.00-08.00	200	12	30,26	6,61	23,80
3	08.00-09.00	200	12	28,13	7,11	25,60
4	09.00-10.00	200	12	19,55	10,23	36,82
5	10.00-11.00	200	12	13,29	15,04	54,15

Table. 2 Vehicle Speed Test Results

The test results show that the highest speed of the vehicle reached 66.92 km/h on Wednesday, December 4 from 10:00 to 11:00 am, when the uncongested traffic flow allowed the vehicle to drive at a fairly high speed. At the same time, the lowest average speed was 23.80 km/h from 7:00 am to 8:00 am. During this period, vehicle speeds were seen to decrease as it is likely that vehicle volumes decreased.

4.4 Vehicle Density Analysis Results

It is important to measure the traffic density of vehicles traveling on a segment The average speed of vehicles on that road during a given time, the space average speed (Us) is measured using units of km/h, the volume (Q) is calculated in units of vehicles per hour (smp/h), the flow speed is also calculated in units of vehicles per hour (smp/h), and the transportation density is calculated in units of vehicles per km per hour. All these parameters are used to conduct this traffic density test. Volume (Q) is a term that refers to the number of vehicles that cross a road segment during an hour of observation, based on the intensity of traffic flow that occurs on the observed road segment. This volume data is crucial to know

the amount of traffic crossing the road. Rate Of Flow is the total transportation that passes through a lane in one hour. To analyze the traffic intensity on the road segment under study, this parameter is also helpful. The test results to traffic are in table 3

The test results show that vehicles reached the highest density of 427.5 Smp/h on December 25 from 7

No	4 Desember Time	Space Mean Speed (Us) (Km/Jam)	Volume (Q) (smp/jam)	Rate Of Flow (smp/jam)	Density (D) (smp/jam)
1	06.00-07.00	27,04	1521,8	6087,2	225,2
2	07.00-08.00	24,59	1965,7	7862,8	319,7
3	08.00-09.00	25,81	1923,4	7693,6	298,1
4	09.00-10.00	37,19	1787,3	7149,2	192,2
5	10.00-11.00	66,92	1718,8	6875,2	102,7
No	18 Desember Time	Space Mean Speed (Us) (Km/Jam)	Volume (Q) (smp/jam)	Rate Of Flow (smp/jam)	Density (D) (smp/jam)
1	06.00-07.00	26,35	1792,1	7168,4	272
2	07.00-08.00	24,37	1961,1	7844,4	321,9
3	08.00-09.00	26,75	1706,6	6826,4	255,2
4	09.00-10.00	37,95	1418,5	5674	149,5
5	10.00-11.00	64,08	1903,7	7614,8	118,8
No	25 Desember Time	Space Mean Speed (Us) (Km/Jam)	Volume (Q) (smp/jam)	Rate Of Flow (smp/jam)	Density (D) (smp/jam)
1	06.00-07.00	25,56	1915,8	7663,2	299,8
2	07.00-08.00	23,80	2543,4	10173,6	427,5
3	08.00-09.00	25,60	2127,7	8510,8	332,5
4	09.00-10.00	36,82	2167	8668	235,4
5	10.00-11.00	54,15	1774,4	7097,6	131,1

Table. 3 Traffic density test results

am to 8 am, when traffic tends to increase in density and transportation can move slowly at lower speeds. At the same time, the lowest vehicle density occurred on December 4, from 10am to 11am, at 102.7 Smp/hr. During this period, vehicle density was seen to decrease.

5. Conclusion

Based on the results of the data analysis and discussion, it can be seen that between 7:00 am and 8:00 am, the vehicle volume peaked at 2543.4 vehicles per hour, indicating traffic congestion. In addition, an analysis of the vehicle speed showed that on December 4, the average vehicle speed reached its highest point from 10:00 to 11:00 am, at 66.92 km/h, indicating that the traffic was fairly smooth. In contrast, the lowest average speed was recorded between 7:00 am and 8:00 am, at 23.80 km/h, indicating a decrease in vehicle speed during this time, possibly due to the increase in vehicle volume. On the other hand, vehicle congestion reached its highest peak of 427.5 Smp/h on December 25 between 7:00 am and 8:00 am, while the lowest congestion occurred on December 4 from 10:00 am to 11:00 am, with 102.7 Smp/h.

References

Abadiyah, S., Alfandi, B., & DwiKusuma, S. E. (2023). Analysis of Traffic Congestion on the Gatot Subroto Highway. *Structure, 4*(2), 88-96.

Abdi, G. N., Priyanto, S., & Malkamah, S. (2019). Relationship between Volume, Speed and Traffic Density on Padjadjaran Road (North Ring Road). *Teknisia*, 55-64.

Akbar, S. M., & Saputra, A. J. (2024). ANALYSIS OF SIGNALIZED INTERSECTION PERFORMANCE: A CASE SIMPANG EMPAT SMPN 1 MAJALENGKA.

Ali, M. I., & Abidin, M. R. (2019). The influence of population density on the intensity of traffic jams in Rappocini District, Makassar.

Anugraha, P. T., Rifai, A. I., Taufik, M., & Isradi, M. (2024). The redesign of provincial road geometric used AutoCAD® 2D: A case Jalan Majalengka-Rajagaluh, Indonesia. *Indonesian Journal of Multidisciplinary Science, 3*((12)).

ARJUNA, Y. S. (2022). *ANALYSIS OF THE IMPACT OF IMPLEMENTATION OF INTILLIGENT TRANSPORT SYSTEM (ITS), HIGHWAY CONDITIONS, AND GENERAL POLICIES ON TRAFFIC CONSTRUCTION ON THE JAYAPURA-SENTANI ROAD.* Jayapura-Sentani Kota Jayapura.

Chairi, M., Melasari, J., & Afandi, R. (2020). Analysis of Factors Causing Traffic Congestion on Collector Road. Case Study of Jalan Gajah Mada Gunung Pangilun, Padang City. *Civil Engineering Collaboration*, 37-46.

Daryamah, C. (2019). THE IMPACT OF TRAFFIC CONSTRUCTION ON THE SOCIO-ECONOMY OF ROAD USERS IN THE CITY OF BANDUNG. *Doctoral dissertation, Universitas Pendidikan Indonesia*.

Fatimah, G. T., & Rifa'i, A. I. (2024). ANALYSIS OF UNSIGNALIZED INTERSECTIONS: CASE STUDY OF THE INTERSECTION OF JALAN SUKARAJA WETAN, MAJALENGKA. *LEADER: Civil Engineering and Architecture Journal, 2*((1)), 612-620.

Firmansyah, F., Rifai, A. I., & Taufik, M. (2022). The Performance of Roundabouts with Traffic Signals: A Case Kadipaten Intersection, Indonesia A Case Kadipaten Intersection, Indonesia. Citizen: Jurnal Ilmiah Multidisiplin Indonesia,. *2*, 823-832.

Harahap, A. K., & Modifa, I. (2020). Study of the Development of the Outer Ring Road (Ringroad) in Terms of Traffic Density in Pematangsiantar City. *Jurnal Teknik Sipil, 1*(1).

Herdiana, Y., Rifai, A. I., Taufik, M., & Prasetijo, J. (2024). The Evaluation of Horizontal Alignment Design: A Case Study of Jalan Tarikolot Majalengka. *Asian Journal of Social and Humanities, 2*((11)), 2814-2825.

Hybel, J., & Mulalic, I. (2022). Transportation and quality of life: Evidence from Denmark. *Transportation Research Part A: Policy and Practice, 157*, 107-125.

Karim, H. A., Lis Lesmini, S. H., Sunarta, D. A., Suparman, A. S., & ... Bus, M. ((2023)). Transportation management. *Cendikia Mulia Mandiri.*

L. Haven, T., & Van Grootel, D. L. (2019). Preregistering qualitative research. *Accountability in research, 26*((3)), 229-244.

Maha, E. (2022). Analysis of the Driving Factors that Cause Congestion in the Pajus Padang Bulan Medan Area. *Jurnal Samudra Geografi,, 5*(1), 38-42.

Muizz, F. A., Rifa'i, A. I., & Fajarika, A. (2024). ANALYSIS OF THE SUITABILITY OF HORIZONTAL ALIGNMENT TO DRIVER SAFETY LEVEL NEEDS CASE STUDY OF CIGASONG-MAJA ROAD, MAJALENGKA ROAD. *LEADER: Civil Engineering and Architecture Journal, 2*((3)), 818-825.

Natalia, D., & Rifa'i, A. I. (2023). Evaluation of Road Damage Using The Pavement Condition Index (PCI) Method on Jalan Raya Waringin, Palasah District, Majalengka Regency., , . *LEADER: Civil Engineering and Architecture Journal, 1*((4)), 439-448.

Nurhasanah, R., Rifai, A. I., Taufik, M., & Isradi, M. (2024). The Perception of User for Road Damage: A Case Majalengka-West Java. *OPSearch: American Journal of Open Research, 3*((10)), 258-267.

Othman, A. G., & Ali, K. H. (2020). Transportation and quality of life. *Planning Malaysia*, 18.

Permatasari, O. (2020). The Impact of Traffic Congestion on Work Productivity in Surabaya. *Media Mahardhika, 18*(2), 322-331.

Pradana, M. F., & Intari, D. E. (2019). Analysis of traffic accidents and their causal factors on Cilegon highways. *Jurnal Kajian Teknik Sipil, 4*(2), 165-175.

Putra, E. E., Ratih, S. Y., & Primantari, L. (2022). Analysis of areas prone to road traffic accidents in Ngerong Cemorosewu. *Jurnal Kacapuri: Jurnal Keilmuan Teknik Sipil, 4*(2), 255-264.

Rachman, M. N. (2024). ANALYSIS OF SPEED AND TRAFFIC DENSITY OF JALAN RAJAGALUH-MAJALENGKA. . *LEADER: Civil Engineering and Architecture Journal, 2*((2)), 745-753.

Rahayu, A. J., Rifai, A. I., & Akhir, A. F. (2022). The Phenomena of On-Street Parking at Kadipaten Traditional Market, West Java. *Citizen: Jurnal Ilmiah Multidisiplin Indonesia, 2*, 815-822.

Rofida, I. (2019). COMPARISON OF ROAD SECTION PERFORMANCE BEFORE AND AFTER THE IMPLEMENTATION OF THE ONE WAY SYSTEM ON THE PRAWIROKUAT ROAD (THE PERFORMANCE ROAD COMPARISON OF BEFORE AND AFTER THE ONE WAY SYSTEM OF PRAWIROKUAT ROAD).

Samasal, S., Manakane, S. E., & Leuwol, F. S. (2024). The Impact of Traffic Congestion on Lecture Entrance Hours for Students in the Geography Education Study Program, Faculty of Teacher Training and Education. *2*, 54-63.

Sarwandy, M. H., & Royan, N. (2023). ANALYSIS OF THE CAUSES OF CONNECTION ON TRAFFIC FLOW ON THE PANGKALAN BALAI SUMATRA HIGHWAY. *Bearing: Jurnal Penelitian dan Kajian Teknik Sipil, 8*(2), 90-95.

Serang, M. R., & Hiariey, H. (2022). Analysis of the Relationship between Land Transportation and Economic Growth in Ambon City for the 2012-2021 Period. *Management Studies and Entrepreneurship Journal (MSEJ), 3*(5), 3293-3305.

Soimun, A., Leliana, A., Ulmi, E. I., Ziantono, D. H., & Widyastuti, H. (2020). Analysis of students' understanding of traffic signs. *Jurnal Teknologi Transportasi dan Logistik, 1*(2), 91-100.