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ANALYSIS OF ONE-WAY TRAFFIC REGULATION IN THE MAJALENGKA SQUARE AREA

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ABSTRACT

A one-way traffic control system is a traffic system that converts a two-way road into a one-way road. This system aims to increase safety, road, and intersection capacity. This can improve the smoothness of traffic, which is usually applied in urban areas. Majalengka also implements a one-way road traffic system in several areas, such as the Majalengka Square area. This research aims to determine the system for regulating one-way road traffic so that drivers have the awareness to obey traffic rules without violating one-way road traffic. The case study in this research is located on Jalan One, Alun-Alun Majalengka Area, Jl. Ahmad Yani, Majalengka Kulon, Kab. Majalengka, Majalengka Regency, West Java. The data used in this research is primary data obtained directly through observation, personal interviews, or experimental results. The traffic volume on Jalan Ahmad Yani Majalengka Kulon is measured by counting the number of vehicles passing at the observation point. The survey was carried out directly at the research location for two days, namely Tuesday and Sunday, with a period of 1 hour divided by 15 minutes. Each period is held in the morning from 06.30-07.30, in the afternoon from 12.00-13.00, and in the afternoon (16.00-17.00). The survey results are in the form of a manual grouping of each type of vehicle. Therefore, data collection and calculations are required to determine the volume and side resistance on a road. After data collection and calculations have been carried out, it can be concluded that the volume of traffic flow in the Majalengka Square area is quite dense in the morning, and the side obstacle class in the afternoon is medium class.

1. Introduction

A one-way traffic control system is a traffic system that converts a two-way road into a one-way road. This system has a function, namely to increase safety, road and intersection capacity. This can improve the smoothness of traffic, which is usually applied in urban areas. The one-way traffic management system must be designed as well as possible by considering several aspects, including safety and its consequences. If one-way streets are not intended as a system or if there is no good balance in the decision, the one-way streets system may represent a restraint to traffic flow [1].

As time progresses, transportation in the Asian region is increasing. This can lead to congestion in the traffic system, which can cause congestion and accidents. The existence of a convenient and effective

one-way road traffic system can minimize the congestion. This system has been implemented in major cities and countries, such as China. Some people in China believe that the one-way street system has advantages. Zhuo and wang believed that one-way traffic organizations have the benefit of alleviating traffic congestion and facilitating implementation. Still, the traffic burdens such as bypass and end pressure may reduce traffic efficiency in a wider range [2].

Not only in China, but one of the areas in Indonesia has also implemented a one-way road traffic system, namely in the Dukuh Atas area in Jakarta. Dukuh Atas is a Transit-oriented area with the most transit access in Jakarta. In this area, there are five types of public transportation that will accommodate the Jakarta MRT, Trans Jakarta BRT, Airport Train, Commuterline Train, and Jabodebek LRT will meet in the area. The more transit access, the more human resources will be transported, causing traffic congestion and even fatal accidents. Road accidents are a serious problem for modern society, which results from the costs of treating accident victims as well as economic and property costs [3].

Majalengka is one of the cities in West Java, with a population of 1,328,894 people. Majalengka also implements a one-way road traffic system in several areas, such as the Majalengka Square area. Majalengka Square usually experiences traffic density only on certain days. With the one-way road traffic system, it can reduce congestion. However, some drivers commit violations by not paying attention to traffic signs. Road signs are inalienable features on the most modern roads, informing the drivers about the oncoming dangers and organizing traffic [4].

This research aims to find out about one-way road traffic regulations so that drivers can be aware of obeying traffic rules without violating the one-way road traffic system. In this way, the one-way road traffic management system in the Majalengka Square area can run effectively. This system can also reduce the risk of traffic jams and accidents. Congestion mainly arises in or near densely populated areas with high levels of car ownership, such that road capacity is insufficient to accommodate all the trips that might be made, particularly during morning and evening travel to and from work [5]. Based on the statements above, the researcher is interested in writing a paper titled Analysis of One-Way Traffic Arrangement in the Majalengka Square Area.

2. Literature Review

2.1 Traffic

Traffic is the flow of vehicles and people in road traffic. Traffic space is infrastructure intended for moving vehicles, people, or goods in the form of roads and supporting facilities. A well-planned city means the traffic system also runs well. The traffic system must be well regulated to minimize density in a particular area. One example of an unplanned city is roads are narrow and poorly built. As cities grow ad hoc, no provision is made towards scaling road capacities, eventually resulting in several bottleneck roads, which remain congested for extended periods [6].

The traffic system has three components: people, vehicles, and roads. Humans, as users, cars, and roads, interact in road movement. The three components are related to each other, and if one of them is missing, there will be no traffic movement. In traffic movement, prediction is needed to create proactive and efficient traffic control. Specifically, short-term traffic prediction is an important component of a proactive traffic control system [7].

Managing proactive and smooth traffic mobilization is challenging. The United Nations classifies this challenge as one of 17 Goals to Transform Our world, which, by 2030, will make cities more inclusive, safe, resilient, and sustainable [8]. Several challenges may hinder the smooth flow of traffic, namely the

nominal increase in the number of vehicles. Along with the times, the population in an area increases; therefore, the number of cars also increases. This can make it difficult to manage traffic.

Traffic systems can be smooth if modified properly to create a smooth flow. Even if the traffic flow seems proactive, it may lead to congestion. In developing countries, urban migration is increasing rapidly, creating pressure on traffic flow and congestion [9]. Therefore, efforts to modify the traffic system are very important. Many consequences occur when traffic system modifications are not good, such as accidents, road congestion, etc. Traffic congestion is a major issue in our daily life [10].

2.2 One-way Street

The road is a land transportation infrastructure that includes all parts of the road, including complementary buildings intended for traffic. Transport is a tool to strengthen cross-border ties and increase a coastal position's role in overall regional development [11]. Transportation is also an important means of supporting cross-border cooperation between regions. Roads have a very important role as a transportation infrastructure that connects one region to another, realizes balanced inter-regional development, and equitable distribution of development results. There are several road lanes, namely two-way roads and one-way roads. However, this research will discuss roads with one-way lanes.

A one-way street is a traffic pattern that involves converting a two-way street into a one-way street. By converting a two-way street into a one-way street, it serves to improve the safety and capacity of roads and intersections, thereby increasing traffic flow. Towns and cities are very significant to transport, with larger cities being of greater significance [12]. As the population grows, vehicle mobilization increases. This can lead to congestion. Therefore, the one-way road system was changed in order to reduce congestion.

The increasing use of road vehicles and the resulting high traffic volumes bring about ever-increasing transport-related problems in urban areas [13]. Therefore, two-way roads are converted into one-way roads. The implementation of one-way streets already exists in some areas, for example, in Indonesia, mostly in Surabaya and Bandung, some in Jakarta, and many more. It is proven that this one-way system can reduce the number of traffic jams.

Currently, in science and world practice, there is no one way to solve the problem of increasing traffic management efficiency in cities to prevent traffic congestion on the road network [14]. Therefore, changes in the road network from two directions to a one-way system must take several steps, namely calculating the benefits of SSA (one-way system), geometric changes, signs, and socialization. The four steps have a purpose, namely with the calculation of the benefits of SSA, can consider the advantages and disadvantages of two-way roads that are converted into one-way roads; geometric changes are useful to make it easier for road users to understand the one-way system, signs are useful for providing prohibition signs or instructions to road users, and socialization aims to provide information to road users that two-way roads in a certain area are converted into one-way roads.

2.3 Crowded Places

A crowd center location is where many people visit, such as a square. In this place, there must be a lot of interaction. Interactions occur both within the location and vehicle interactions on the road. With the increasing population, it can create density in that place. When an element is presented in the presence

of nearby components or clutter, it becomes harder to perceive, a well-known effect called crowding [15].

In general, the square is located in the middle of the city so that it can be accessed easily using public transportation or private vehicles. The location of a crowd center, such as a square, becomes an object where the community carries out many activities. Some of them are relaxing, chatting with friends, enjoying free facilities, taking pictures, culinary, etc. Coupled with the increasing number of residents, it is increasingly crowded. Growing urbanization threatens both mental ill health and biodiversity [16].

The more people at the square's location, the more vehicles are used. This can trigger congestion on the road, especially on weekends. Also, sometimes some motorists are not careful driving, resulting in traffic accidents. There are even motorists who violate traffic laws. According to the World Health Organization, as many as 3000 people die in road accidents every day, and another 100,000 receive serious injuries [17].

Road traffic accidents now represent the eighth leading cause of death globally [18]. Globally, road traffic collisions are one of the top 10 leading causes of death; for those aged 15–29 years, it is the primary cause of death [19]. Therefore, to improve traffic safety, one-way streets were created. This can minimize the number of accidents. To maximize these efforts, security must be present in the crowd center so no drivers violate traffic rules. For example, breaking traffic flow, disobeying traffic signs, etc.

3. Method

This research uses quantitative methods, namely research methods whose data analysis can be measured, and the data collection process uses statistical numbers. The research is also known as empirical research, as it can be accurately and precisely measured [20]. This research requires data on the number of vehicles crossing the road under study. The data used in this research is primary data obtained directly through observations, personal interviews, or experimental results. Relevant data can be used for analysis, to directly or indirectly conclude, and to help propose appropriate measures to improve road safety [21]. Therefore, the research process of collecting data through observation techniques is a survey at the research location on the one-way road.

The case study in this research is located on the street in the Majalengka Square Area, Jl. Ahmad Yani, Majalengka Kulon, Kec. Majalengka, Majalengka Regency, West Java. The following is the research location:

Figure 1. Research Location

Primary data is obtained from direct survey results to the research location. In the process of collecting this data, it was carried out for two days, namely on Tuesday and Sunday. Observation and recording of traffic flow on one-way roads is carried out at one point with a period of 1 hour divided into 15 minutes, where each period is carried out in the morning, afternoon, and evening.

4. Result and Discussion

4.1 Traffic Volume

Measurement of traffic volume on Ahmad Yani Road, Majalengka Kulon, measured by counting the number of vehicles passing at the observation point. The survey was conducted directly to the research location for two days, namely on Tuesday and Sunday, with a period of 1 hour, which was divided into 15 minutes. Each period was conducted in the morning from 06.30-07.30, in the afternoon from 12.00-13.00, and the afternoon (16.00-17.00). The survey result is a manual grouping of each type of vehicle.

According to the Indonesian Road Capacity Manual (MKJI) 1997, the grouping of vehicle types is divided into 3 (three), namely light vehicles (LV), heavy vehicles (HV), and motorcycles (MC). After grouping, the next type of vehicle is calculated by passenger car units (SMP), and the value of the passenger car equivalent factor (emp) is determined. The following is the value of the passenger car equal factor (emp) according to the Indonesian Road Capacity Manual (MKJI) 1997:

Table 1: Passenger car equivalent factor (emp) values

No	Vehicle Type	Emp Factor Value
1	Motorcycle (SPM)	0,25
2	Light Vehicle (KR)	1,0
3	Heavy Vehicle (KB)	1,2

Sumber: MKJI 1997

The data used is the largest number of vehicles on Sunday, January 13, 2024. The data is then calculated by multiplying the vehicle volume by the Passenger Car Unit (SPM) factor to get the traffic volume in SMP/hour.

Table 2: Traffic Volume Data

Time	Traffic flow vehicle/hour			Vehicle Volume/hour	Vehicle traffic flow SMP/hour			Vol. smp/hour
	MC	LV	HV		MC * 0.25	LV * 1	HV * 1.2	
Morning	892	243	4	1.139	223	243	4,8	470,8
Afternoon	625	231	2	858	156,25	231	2,4	389,65
Evening	841	191	1	1033	210,25	191	1,2	402,45

4.2 Side Obstacle Analysis

For the analysis of side obstacles, the data used is data generated from direct surveys to the research location, and the data taken is the data with the greatest frequency, namely on January 13, 2024, with a period of 1 hour, which is divided into per 15 minutes of side obstacles along 200 meters. Based on the provisions of the 1997 Indonesian Road Capacity Manual (MKJI), namely pedestrians, parking or stopping vehicles, exiting and entering vehicles, and slow cars. Several factors can affect the value of the class of side obstacles at a weighted frequency of events per hour per 200 meters of road segment that must be considered.

Table 3. Determination of the frequency type of side obstacles

Side Obstacle Event Type	Symbol	Weight Factor
Pedestrian	PED	0,5
Vehicle Parking	PSV	1,0
Entering and exiting vehicles	EEV	0,7
Slow vehicles	SMV	0,4

Sumber: MKJI 1997

After taking into account the determination of the frequency of occurrence of side obstacles, the next step is processing the data. The following is a table of side obstacle calculations.

Table 4. Obstacle Calculation Results

Time	Frequency of Occurrence/200/hour				Frequency of Occurrence/200/hour				Total	Class Side obstacles
	PED	PSV	EEV	SMV	PED*0,5	PSV*1,0	EEV*0,7	SMV*0,4		
Morning	156	47	223	5	78	47	156,1	2	283,1	Low
Afternoon	104	31	152	2	52	31	106,4	0,8	190,2	Low
Evening	172	59	241	4	86	59	168,7	1,6	315,3	Medium

5. Conclusion

Data collection and calculation are required to determine the volume and side obstacles on the road. From the results of the discussion related to traffic volume and side obstacles on Jalan Ahmad Yani, Majalengka Kulon, conclusions can be drawn, namely:

- The volume of traffic flow on the Majalengka Square Area road is known on Sunday, January 13, 2024; in the morning from 06.30-07.30, the traffic volume is 470.8 SMP / hour; in the afternoon from 12.00-13.00, the traffic volume is 389.65 SMP / hour and in the afternoon from 16.00-17.00 the traffic volume is 402.45 SMP / hour. It can be concluded that the volume of traffic flow in the Majalengka Square area is quite dense in the morning.

- The results of the calculation of side obstacles on the Majalengka Square Area Road are known in the morning, the class of side obstacles is low; in the afternoon, the side obstacles are common; and in the afternoon, the side obstacles are moderate.

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