Performance Analysis and Implementation of Traffic Management on The Medan Pematang Siantar Road Section

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Abstract : This research is to determine and analyze the level of service on the Medan - Pematang Siantar road section and the factors that influence it using the Indonesian Road Capacity Manual (MKJI) method as well as forms of handling in the form of implementing traffic management. Like cities in Indonesia, the city of Pematang Siantar is a transit city with quite high levels of social activity, services and trade, so it requires good transportation arrangements, this is because Pematang Siantar City is one of the connecting cities to neighboring cities. north to cities in the south via the western route. As a transit city, the city of Pematang Siantar is forced to have a good road network and be able to serve transportation activities that cross it.
From the analysis results it is known that the average speed (V) on the Jl Medan - Pematang Siantar section is 57.95 km/hour with the Capacity (C) on the Jalan Medan Pematang Siantar section being 2568.7 pcu/hour. The value of the degree of saturation (DS) on working days in existing conditions for both directions is 0.56 with a service level indicator of C, as well as on holidays for both directions it is 0.59 with a service level indicator of C. Meanwhile, for the next 5 years, the value of the degree of saturation (DS) on weekdays for both directions is 0.77 with service level indicator D, the value of the degree of Saturation (DS) on holidays for both directions is 0.82, service level indicator E, where the flow is approaching unstable with high traffic volumes due to internal traffic obstacles high, the driver begins to experience short-duration traffic jams.

Keywords: *Speed, Capacity, Degree of Saturation, Indicators, Service Level*

INTRODCTION

The city as a center of activity is very dependent on the existing systems in the city. One of them is the transportation system. Having a good transportation system will really support all activities in the city. In its interrelated relationship, transportation system planning is an inseparable part of city planning and development.
Transportation has a very important function in development. The development of the transportation sub-sector in villages for three purposes supports economic movement, economic stability and also reduces development disparities between regions (sub-districts) by expanding the reach of the distribution of goods and services to all corners of the region. In Dorojatun Kuntjoroyakti's opinion, globalization is synonymous with the 4T revolution, namely transportation, travel, telecommunications and television. Roads are infrastructure to facilitate population mobility and trade, so roads are very important in supporting the economy of a region.
Like cities in Indonesia, the city of Pematang Siantar is a transit city with quite high levels of social activity, services and trade, so it requires good transportation arrangements, this is because Pematang Siantar City is one of the connecting cities to neighboring cities. north to cities in the south via the western route.
As a result of the growth in the population of districts and cities in the province of North Sumatra and accompanied by economic growth, this will cause an increase in overall vehicle ownership which will also cause an increase in the amount of traffic. This growth is usually not accompanied by growth in road facilities and infrastructure, so that the increase

in traffic volume increases. The number of vehicles and the increasing types of vehicles in operation give rise to general traffic problems

LITERATURE REVIEW

Approach to Problem Identification.

There are 2 stages of problem identification, including a preliminary study of a road network to determine general characteristics, and carrying out a problem ranking to identify locations that appear to have the worst problems.
More detailed studies at these locations to identify specific causes of these problems, which can then become the subject of improvement proposals.
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Based on the above, 4 areas (fields) of problem identification can be proposed:

1. Traffic management:
Carry out speed surveys on road sections and obstacles at intersections with the aim of determining where and how much traffic flow has been hampered. The goal is to carry out more detailed investigations at these locations to identify specific problems, then analyze these problems in detail, and create urgent (traffic engineering design) and short-term solutions. traffic management.

2. Operation of public transportation:
Carrying out speed surveys on road sections and obstacles at intersections with the aim of determining where and how much passengers experience obstacles.

3. Road network development:
Carrying out accessibility analyzes for private vehicles around the road network. A strategy must be developed to create medium and long term solutions which are generally based on the development of road and route networks and control of land use with the aim of balancing current and predicted demand with the supply available for the whole these time periods.

4. Development of public transportation
Carry out accessibility analyzes for passengers around the public transport network. Identification of detailed problems regarding road problems must be followed up with detailed research by conducting additional surveys. In terms of traffic engineering, speed is usually a problem. Detailed travel time and obstacle surveys must be carried out along the road section, with the aim of preparing a time-space diagram that can graphically show speed and obstacles, and can identify in detail the mobility (smoothness of traffic).

Geometry

Road geometry is a structure that describes a road, which includes cross sections, longitudinal sections, and other aspects related to the physical shape of the road. The components of road geometry include:
Road Type: Different road types will perform differently under certain traffic loads; for example, divided and undivided roads; one-way roads.
Traffic lane width: Free flow speed and capacity increase with increasing traffic lane width.
Kereb: Kereb as the boundary between the traffic lane and the sidewalk influences the impact of side obstacles on capacity and speed. The capacity of a road with a carriage is

smaller than a road with a shoulder. Furthermore, capacity is reduced if there are fixed barriers near the edge of the carriageway, depending on whether the road has carriages or shoulders.
Shoulders: Urban roads without carriages generally have shoulders on both sides of the traffic lane. The width and condition of the surface affect shoulder use, in the form of increased capacity and speed in certain flows, due to increased shoulder width, especially due to reduced side obstacles caused by events on the side of the road such as stopped public transport vehicles, pedestrians and so on. Median: A well-planned median increases capacity. Running alignment: Horizontal curves with small radius reduce free flow speed. Steep inclines also reduce free flow speed. Because in general the free flow speed in urban areas is low, this influence is neglected.

Degree of Saturation (DS)

The capacity volume value is the same as the degree of saturation (DS), indicating the condition of the road section in serving the existing traffic volume. The volume capacity ratio or degree of saturation (DS) value for road sections within the area of influence will be obtained based on the results of traffic volume surveys on road sections and geometric surveys to obtain the current capacity.
Based on the results of processing the volume of traffic flow, a Volume Capacity Ratio will be obtained which can then indicate recommendations for the type of treatment for roads and intersections.
By using the basic relationship of volume, capacity and travel speed that has been determined by the 1965 Highway Capacity Manual, the Service Level Index (ITP) can be determined based on a graph of the relationship between volume capacity ratio or degree of saturation (DS) and speed (Edward K. Marlok, 1991).
The Capacity Volume Ratio or Degree of Saturation (DS) value at a signalized intersection is obtained using the following formula:

$$DS = Q/C = (Q \times c)/ (S \times g)$$

Where :
DS = Degree of saturation or capacity volume ratio.
Q = Traffic volume (pcu/hour)
S = Saturation current, namely the average departure current from the queue in the approach during the green signal (pcu/hour = pcu per hour green)
g = Green time (seconds).
c = Cycle time, i.e. the time interval for a complete sequence of signal changes (i.e. two consecutive green starts of the same phase).

The Value of Volume Capacity Ratio (NVK) or Degree of Saturation (DS) of Road Sections, can be calculated using the formula as below,

$$DS = Q/C$$

Where :
Q = Total traffic flow volume (pcu/hour)
C = Capacity (pcu/hour).

Free Flow Speed (FV) of the road section

Free flow speed (FV) is the speed at zero flow level, namely the speed that the driver would choose if driving a motor vehicle without being influenced by other motor vehicles on the road. The free flow speed of light vehicles has been chosen as the basic criterion for the performance of road segments at flow = 0, the free flow speed for heavy vehicles and

motorbikes is also given as a reference. Free flow speeds for passenger cars are typically 10-15% higher than other types of light vehicles.
The equation for determining free flow speed according to the Indonesian Road Capacity Manual (MKJI) February 1997, has the following general form:

$$FV = (FV_O + FV_W) \times FFV_{SF} \times FFV_{CS}$$

Where :
FV = Free flow speed of light vehicles in field conditions (km/hour)
FVO = Basic free flow speed of light vehicles on the observed road
FVW = Speed adjustment for road width (km/hour)
FFVSF = Adjustment factor for side obstacles and shoulder width or barrier carriage distance
FFVCS = Speed adjustment factor for city size

ANALYSIS

Data Collection and Management of Current Data (existing)

The collection of existing data includes traffic volume data, geometric data, space speed data, pedestrian data and road crossing data.

Collecting traffic flow volume data in this research was carried out by means of a traffic counting survey or carrying out calculations directly using surveyors who were placed on the left and right sides of Jalan Medan Pematang Siantar, carried out on weekdays and holidays in one week with observation times from morning to evening (06.00-22.00). The collected data is then recapitulated according to the data required during the calculation, then each type of vehicle is grouped, such as light vehicles (LV), heavy vehicles (HV) and motorbikes (MC), after grouping they are multiplied by the car equivalent value. passengers (emp) such as light vehicles (LV) emp value = 1, heavy vehicles (HV) emp value = 1.2 and motorbikes (MC) emp value = 0.25, so that finally data on traffic volume in passenger car units per hour is obtained. (junior/hour).

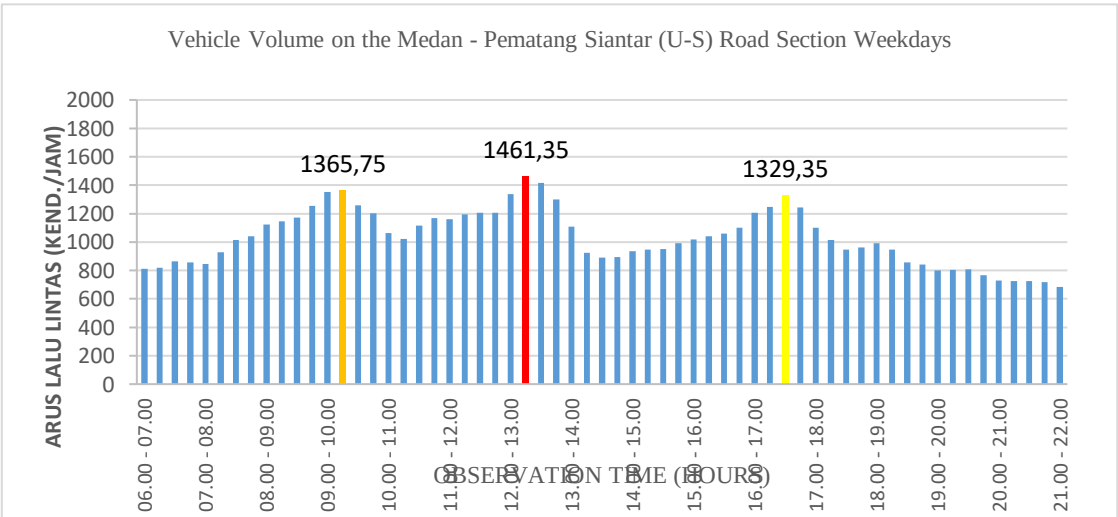


Figure 1. Fluctuations in traffic flow on Jl Medan Pematangsiantar(U-S) weekdays

From Figure 1, it is known that the highest amount of traffic flow on the Medan Pematang Siantar road section from North to South during working hours occurs at 12.15-13.15 with a total flow of 1461.35 smp/hour.

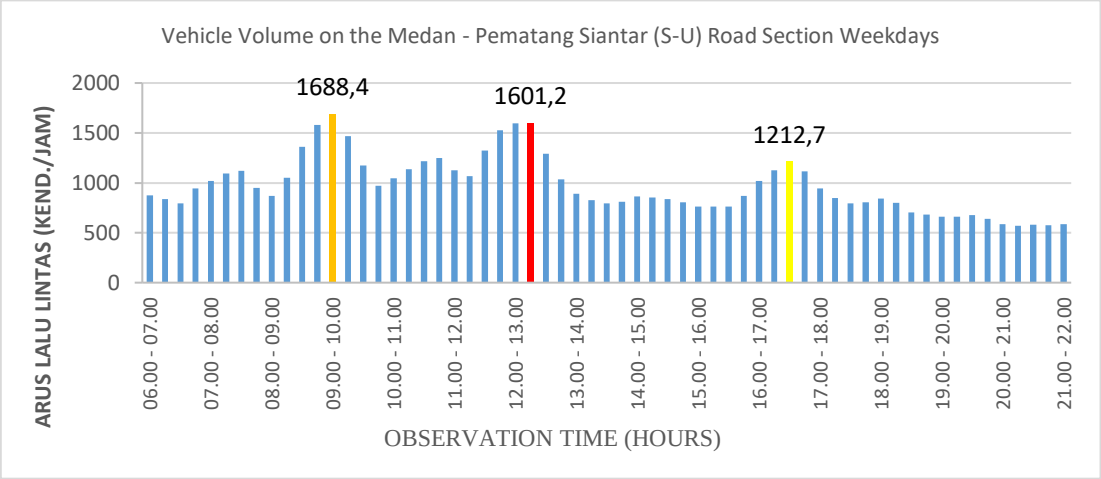


Figure 2. Fluctuations in traffic flow on Jl Medan Pematang Siantar (S-U) weekdays

From Figure 2, it is known that the highest amount of traffic flow on the Medan Pematang Siantar road section from South to North during working hours occurs at 09.00-10.00 with a total flow of 1688.4 smp/hour.

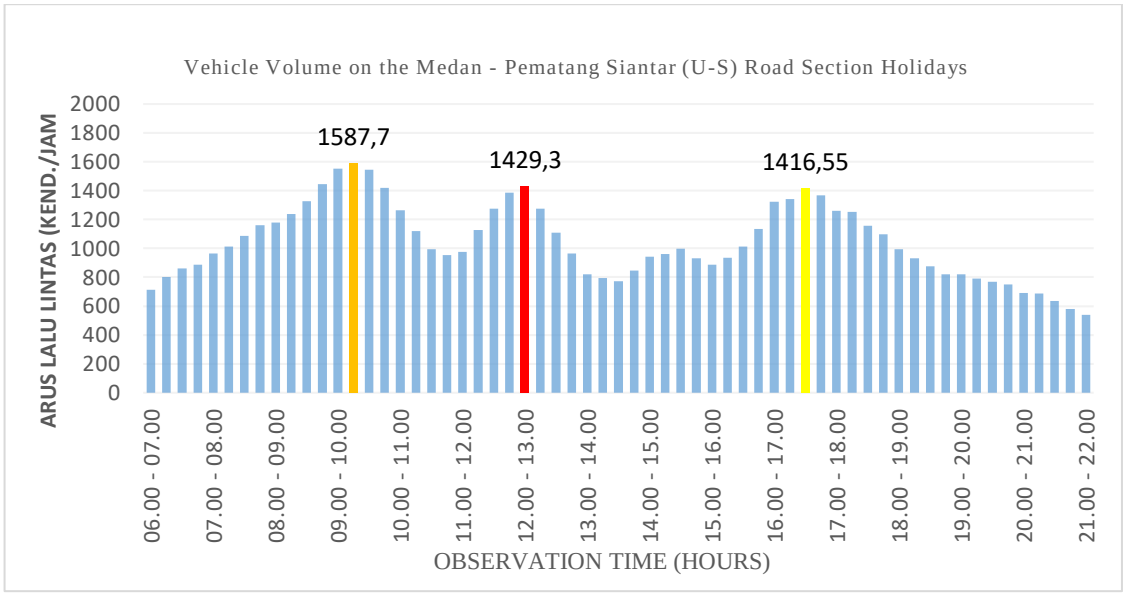


Figure 3. Fluctuations in traffic flow on Jl Medan Pematang Siantar (U-S) during holidays

From Figure 3, it is known that the highest amount of traffic flow on the Medan Pematang Siantar road section from North to South during holiday hours occurs at 09.15-10.15 with a total flow of 1587.7 smp/hour.

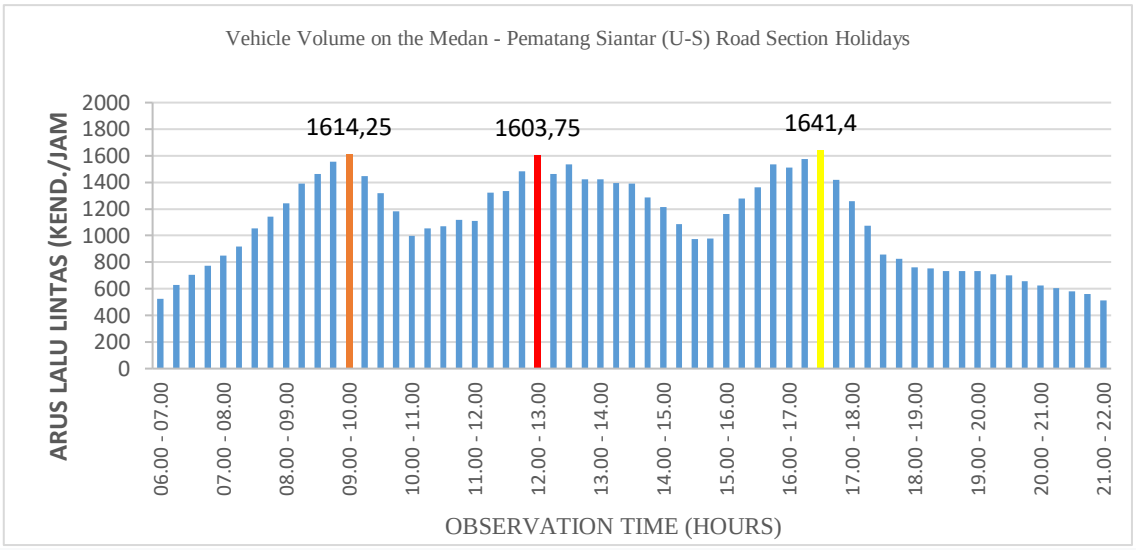


Figure 4. Fluctuations in traffic flow on Jl Medan Pematang Siantar (S-U) during holidays

From Figure 4, it is known that the highest amount of traffic flow on the Medan Pematang Siantar road from North to South during holiday hours occurs at 16.30-17.30 with a total flow of 1641.4 smp/hour.

Calculation

Calculation of performance measurements for the Jl. Medan Pematang Siantar refers to the Indonesian Road Capacity Manual (MKIJI) method.

Speed Calculation

Speed is determined based on the comparison between distance traveled and travel time in units of Km/hour. For the Jl Medan Pematang Siantar section, speed is based on measurement results as follows:

Data processing results

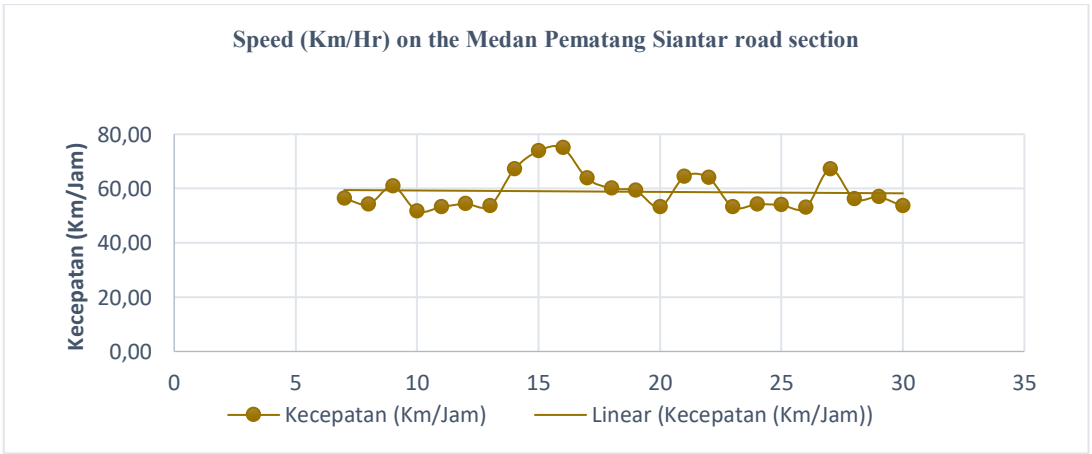


Figure 5. Speed graph on the Medan Pematang Siantar road section

From the results of the data processing above, it can be seen that the average speed on the Jl Medan Pematang Siantar section is 57.95 km/hour.

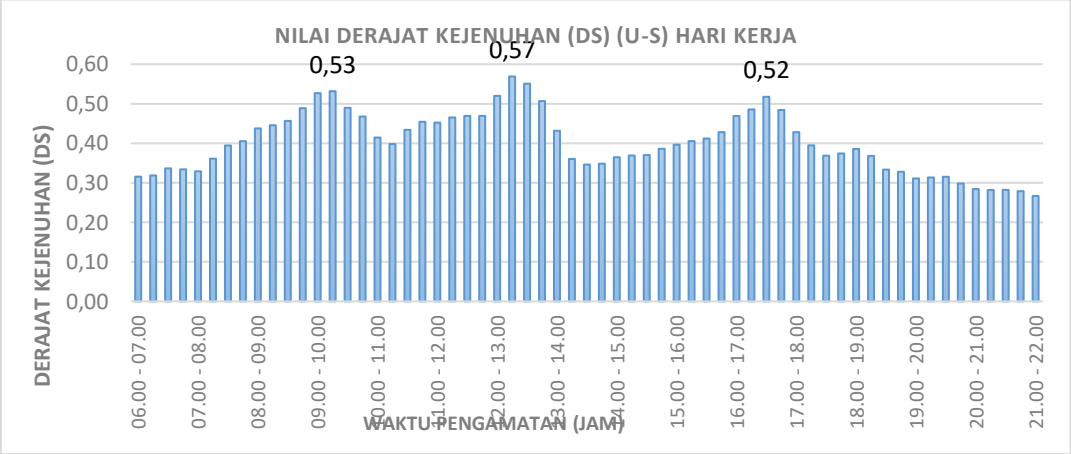
Capacity Calculation

Based on the results of calculations using the Indonesian Road Capacity Manual (MKJI), it is known that the existing capacity of the Jl Medan Pematang Siantar section is: For undivided roads, the analysis is carried out in both directions of traffic, from the calculation results it is known that the capacity of the Jl Medan Pematang Siantar section for the U-S direction is equal to 2568.7 pcu/hour, likewise in the S-U direction of 2568.7 pcu/hour.

Degree of Saturation

Based on the Indonesian Road Capacity Manual (MKJI), the degree of saturation is calculated based on the comparison of traffic volume with the capacity of the road section. From the calculation results, the value of the degree of saturation on weekdays and holidays is obtained as follows.

The Degree of Saturation (DS) value in the existing condition is calculated based on a comparison of the traffic flow volume in the existing condition with the Capacity (C) of the road section



Gambar 6. Grafik Derajat Kejenuhan (DS) pada Ruas Jalan Medan Pematang Siantar

From the graph above, it can be seen that the highest degree of saturation is in the morning during working hours in the direction of the U-S movement of 0.53, in the afternoon during working hours the direction of the U-S movement is 0.57, in the morning in the afternoon during working hours the direction of the U-S movement is 0.52.

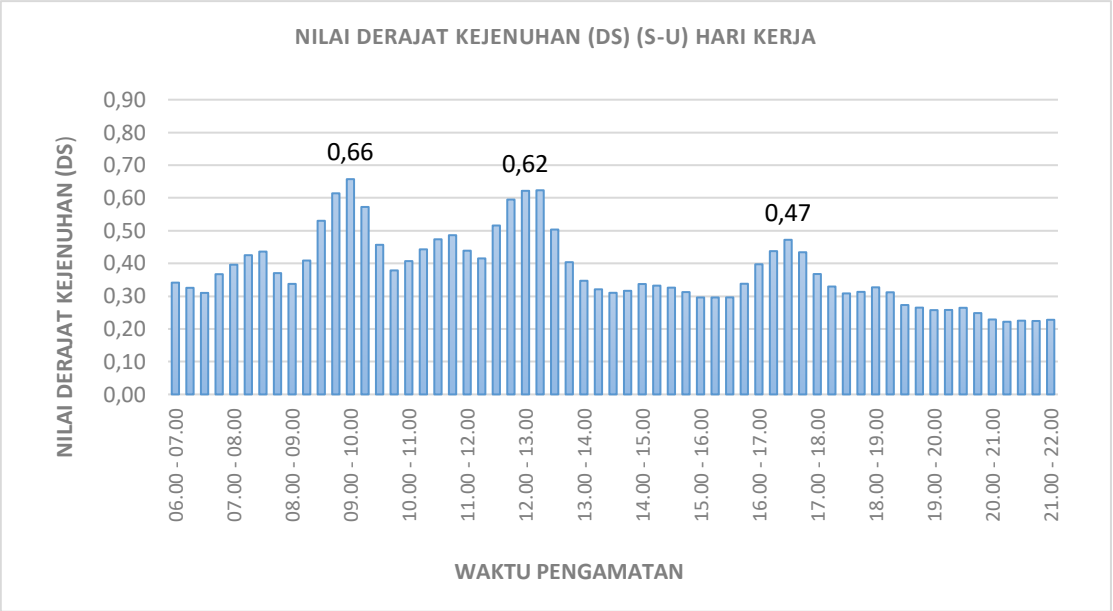


Figure 7. Graph of Degree of Saturation (DS) on the Medan Pematang Siantar Road Section

From Figure 7, the graph above can be seen that the highest degree of saturation is in the morning during working hours, the direction of the S-U movement is 0.66, in the afternoon during working hours, the direction of the S-U movement is 0.62, in the morning, afternoon during working hours, the direction of the S-U movement is 0.47.

CONCLUSION

From the results of calculations and data analysis of the Medan Pematang Siantar road section, several conclusions can be drawn as follows:

1. The Medan Siantar Road section is a road with National authority divided into 2 (two) directions with each direction having two undivided traffic lanes (4/2UD), the effective width of the traffic lane is 11.8 m and the shoulder on each -each direction is around 1.3 meters with the required sidewalk width for the Jl Medan Pematang Siantar section being >1.01 m, while the available road shoulder if intended for sidewalks is 1.3 m.

2. The average speed (V) on the Jalan Medan Pematang Siantar section is 57.95 km/hour with the capacity (C) on the Jalan Medan Pematang Siantar section of 2568.7smp/hour.

3. The value of the Degree of Saturation (DS) on weekday mornings (U-S) is 0.53, in the afternoon during working hours the U-S movement direction is 0.57, in the morning afternoon during working hours the U-S movement direction is 0.52, the S-U movement direction is 0.66, on During the day during working hours the S-U movement direction is 0.62, in the morning and afternoon during working hours the S-U movement direction is 0.47, in both directions for weekdays the service level indicator is C where the flow is stable but vehicle movements are controlled by higher traffic volumes at higher speeds. at least 60 (sixty) kilometers per hour, moderate traffic density due to increased internal traffic barriers, drivers have limitations in choosing speed, changing lanes or overtaking.

4. The highest degree of saturation in the morning during working hours in the direction of the S-U movement is 0.66, in the afternoon during working hours the direction of the S-U

movement is 0.62, in the morning in the afternoon during working hours the direction of the S-U movement is 0.47.

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