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MOTOR VEHICLE BEHAVIOR ANALYSIS OF SIDE OBSTACLES

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ABSTRACT
High side barriers cause road sections to experience traffic jams. On the Pantura road, Brebes Regency, many vehicles tend to stop or reduce their speed due to many side obstacles that interfere with the journey, including tricycles, parking vehicles and so on. This study aims to analyze the behavior of motorists on each type of motorized vehicle against side obstacles. The research method is carried out directly by observers and is qualitative in nature based on normative standards in the 1997 MKJI. The results of the research show that the driver's behavior is influenced by side barriers, in this case the vehicle speed that the larger the side obstacle class, the lower the vehicle speed. On roads with a higher left lane speed than the right lane, on that road heavy vehicles tend to choose the right lane, this condition is because heavy vehicles avoid side obstacles in the left lane and on the left lane more light vehicles pass. On the other hand, on roads with a higher right-hand lane speed than the left lane, heavy vehicles that pass tend to choose the left lane for this condition because the side barriers in the left lane do not have a major effect on traffic on that lane.

Keywords: density; jamming; side barriers; speed; traffic performance

INTRODUCTION
Roads have different levels of crowds, because roads are connecting access between one area and another. The crowds on the street are sometimes influenced by several factors, one of which is the central area of trade and industry. On roads that pass through industrial or trade areas, there tends to be a lot of vehicles stopping or slowing down because there are many side obstacles that interfere with travel, including rickshaws, parked vehicles and so on. In the north coast of Brebes Regency, the problems that occurred before are very common. Economic growth and population growth have resulted in many activities being carried out, while the capacity and performance of roads that accommodate the flow of vehicles are increasingly limited. In this condition often cause jams. The performance of traffic flow in commercial areas is reduced, because it is caused by various factors that occur on the side of the road. One of the factors that causes this is activity on the side of the road or side barriers in the form of vehicles going in and out, pedestrians, and slow vehicles (Marunsenge et al., 2015).

The development of a city coincides with the development of community demands as actors of activity, this means that physically and functionally, the intensity and quality of city activities is always changing, side barriers will greatly disrupt the smooth flow of traffic (Kurniawan, 2016). Road sections that should be used as a means of traffic experience obstacles due to the large number of vehicles parked on the road and other side barriers, such as street vendors and vehicles slowing down, disrupting traffic flow and causing congestion (Saputra & Tarigan, 2021). Several previous studies have revealed the effect of side friction on a road section, including revealing that the performance of traffic flow in commercial areas is reduced, due to various factors that occur on the side of the road. One of the factors observed is activity on the side of the road or side barriers such as vehicles going in and out, stopping vehicles, parking vehicles and pedestrians (Senduk et al., 2018). The side friction factor is one of the causes of

traffic congestion which can affect the level of service of a road. Where congestion is a traffic flow problem caused by an increase in the volume of vehicles on a road section and by side barriers (Kristanti et al., 2020).

High side barriers cause road sections to experience traffic jams during rush hours (Trianingsih & Hidayah, 2014). Side barriers also greatly affect traffic performance, because higher side barriers will affect vehicle volume and vehicle speed (Kristiawan & Najid, 2019). Community activities that occur beside the road, such as pedestrians, parking vehicles, slow vehicles and vehicles. Community activities that occur beside the road, such as pedestrians, parking vehicles, slow vehicles and vehicles (Faisal & Najid, 2021).

Previous research shows from the regression results that most of the causes of reduced vehicle speed are side obstacles either due to parking on the road or pedestrians (Yadi et al., 2017). Types of side barriers that have a dominant influence on performance are motorbikes coming out of three locations on the side of the road segment, with the difference in the R square value of the multiple linear regression equation in the existing conditions and the conditions under review of 7.8% with an existing R square value of 89 % (Muhammad et al., 2018). In several studies, it was stated that the side friction factor that had the most effect on vehicle speed was parking and vehicle stopping by 25.36% (Tataming et al., 2014). The main factors that affect speed are parking and stopping vehicles with an average value of 17.661% to 23.78% (Rauf Theo Sendow et al., 2015). The closest correlation was obtained, namely the correlation between side barriers and road access with R = 0.82 in the afternoon on Jalan Taman Daan Mogot Raya (Sibarani & Najid, 2018).

In addition to the age factor, the characteristics of motorists such as education level, job level, and income level of the driver are also taken into consideration for the driver's behavior towards traffic regulation policies. Other factors that cause traffic violations include damaged road conditions and the behavior of motorists who are not disciplined (Anggraini, 2013). Meanwhile, the factors that trigger aggressive driving behavior are traffic density, rush, traffic signs that are felt to be burdensome for the driver, and the presence of other drivers who violate the driver's territory (Herani Ika et al., 2017). Based on some of the studies that have been carried out above on side friction and some of the characteristic behavior of motorists, this research was developed with differences in analyzing the behavior of motorized vehicles towards side friction. The purpose of this research is to analyze the behavior of drivers on each type of motorized vehicle against side friction.

METHOD

The methodology used in this study is by processing primary data from field surveys and collecting some of the information needed as secondary data. The research was conducted directly by observers and was qualitative in nature based on normative standards in MKJI 1997. This research was carried out on the north coast road section of Brebes Regency with a flat topography, relatively small intersection disturbances and relatively good pavement conditions.

The data obtained is the result of a field survey conducted on two roads that have the same type, namely four two-way divided lanes (4/2D). This road section is a single unit of the Brebes pantura route, Central Java, but differs in segments, the first is the Pakijangan pantura road section which is located in the Bulakamba district with low side barriers. The second is the Pantura road section, the Bulakamba market road section, which is located in the center of the Bulakamba sub-district, this road segment often encounters congestion because it has a high level of side resistance.

Collecting data by making direct observations at the location by recording the volume of traffic flow, traffic speed, road geometric, type of vehicle and type of side barriers. Data retrieval was carried out with a video camera during peak hours which have been known from secondary data. In a matter of 1 hour will be divided per time interval every 15 minutes.

Side friction data is taken simultaneously with volume data collection at peak hour observations. The stages of data processing carried out are calculating the volume, speed of each lane, distribution of vehicles and classification of side obstacles with the following stages.

1. Calculation of traffic volume and speed of Pakijangan vehicles heading to Tegal
2. Calculation of traffic volume and speed of Pakijangan vehicles heading to West Java
3. Calculation of vehicle volume and speed of Bulakamba vehicles in the direction of Tegal
4. Calculation of vehicle volume and speed of Bulakamba vehicles heading to West Java
5. Calculation of vehicle traffic density on the Pakijangan road
6. Calculation of the traffic density of Bulakamba road vehicles
7. Classification of side friction
8. Analysis of the distribution of vehicles against side friction
9. Analysis of the effect of side friction with vehicle speed

After the data is processed at each stage, an analysis of the behavior of motorized vehicles is carried out on side friction in each lane using a comparison of each type of vehicle which is seen by its driving behavior when there are side barriers with varying levels of resistance.

RESULTS

Pakijangan Traffic Volume in the Direction of Tegal

Jalan Pakijangan in the direction of Tegal is a pantura road which has two lanes, namely the direction of West Java and the direction of Tegal. Pakijangan traffic volume towards Tegal is as follows.

Table 1.
Pakijangan Traffic Volume in Tegal Direction

Transportation type	Left Lane				Right Lane			
	Current (Kend/menit)			Total current (Kend)	Current (Kend/menit)			Total current (Kend)
	max	Min	Rata-Rata		max	min	Rata-Rata	
MC	24	3	10	1785	7	0	3	609
LV	13	0	2	369	8	0	3	582
MHV	7	0	1	184	9	0	2	397
LT	4	0	0,48	86	9	0	2	360
LB	2	0	0,22	39	2	0	0,21	38

The data in Table 1. is data taken from the Pakijangan road section towards Tegal. The left lane is a lane that is in direct contact with roadside activities while the right lane is a lane that does not directly intersect with roadside activities, but with pedestrians and narrowing of the road due to roadside activities, it also has an impact on right-lane traffic. From these data it can be recapitulated the percentage of lane selection for each type of vehicle. The following is the recap data for the percentage of choosing the Pakijangan road towards Tegal shown in Table 2.

Table 2.
Percentage of Vehicle Lane Use on Jalan Pakijangan in the direction of Tegal

Transportation	Persentase Per Lane	
	Lest (%)	Right (%)
MC	74,56	25,44
LV	38,80	61,20
MHV	31,67	68,33
LT	19,28	80,72
LB	50,65	49,35
Total	47,06	52,94

Pakijangan Vehicle Speed Direction Tegal

On Jalan Pakijangan in the direction of Tegal, the types of vehicles that pass vary, the speed of each varies. The following is the vehicle speed data obtained from Jalan Pakijangan in the direction of Tegal shown in Table 3 below.

Table 3.
Vehicle speed on the Pakijangan road in the direction of Tegal

Transportation Type	Current left			Current right		
	Speed Us (km/jam)			Speed Us (km/jam)		
	Us Max	Us Min	Us Rata-Rata	Us Max	Us Min	Us Rata-Rata
MC	96,80	38,35	66,60	95,58	33,56	63,54
LV	88,63	23,02	61,65	98,76	34,40	65,39
MHV	90,00	27,69	57,68	90,00	38,49	60,86
LT	71,46	32,60	47,42	89,83	34,35	52,83
LB	77,95	39,91	62,31	80,93	37,33	59,16
Rata-rata			59,13			60,35

From the results of calculating the speed of vehicles on the Pakijangan road in the direction of Tegal, the average speed value for each lane is obtained, with the left lane the average speed is 59.13 km/hour and the right lane is 60.35 km/hour.

Pakijangan Traffic Volume in West Java Direction

Jalan Pakijangan in the direction of West Java is a pantura road which has two lanes, namely the direction of West Java and the direction of Tegal. Pakijangan traffic volume in the direction of West Java is as follows.

Table 4.
Pakijangan Traffic Volume in West Java Direction

Transportation Type	Current left				Current right			
	Current (Kend/menit)			Total current (Kend)	Current (Kend/menit)			Total current (Kend)
	V max	V min	V rata-rata		V max	V min	V rata-rata	
MC	21	3	11	1957	5	0	2	311
LV	9	0	3	543	9	0	2	402
MHV	4	0	1	219	8	0	3	500
LT	6	0	1	152	5	0	2	296
LB	3	0	0,30	54	3	0	0,31	56

Jalan Pakijangan in the direction of West Java, the left lane is a lane that directly intersects with roadside activities while the right lane is a lane that does not directly intersect with roadside activities, but with pedestrians and road narrowing due to roadside activities, the impact on lane traffic right. From these data, the percentage of lane selection for each type of Pakijangan vehicle heading to West Java is shown in Table 5.

Table 5.
Percentage of Vehicle Lane Use on Jalan Pakijangan in the direction of West Java

Transportation	Persentase Per Lajur	
	Left (%)	Right (%)
MC	86,29	13,71
LV	57,46	42,54
MHV	30,46	69,54
LT	33,93	66,07
LB	49,09	50,91
Total	56,18	43,82

Pakijangan Vehicle Speed in West Java Direction

The speed of each vehicle passing in Pakijangan in the direction of West Java can be seen in Table 6 below.

Table 6. Vehicle speed on the Pakijangan road in the direction of West Java

Transportation Type	Current Left			Current Right		
	Current Us (km/jam)			Current Us (km/jam)		
	Us Max	Us Min	Us Rata-Rata	Us Max	Us Min	Us Rata-Rata
MC	97,62	40,51	73,12	98,90	43,56	75,31
LV	97,58	36,39	68,20	97,10	45,33	73,45
MHV	90,34	24,30	61,84	90,84	34,26	61,16
LT	72,29	27,23	41,34	74,88	31,86	50,04
LB	78,72	40,36	63,35	72,28	46,10	58,42
Rata-rata			61,57			63,68

From the results of calculating the speed of vehicles on Jalan Pakijangan in the direction of West Java, the average speed value for each lane is obtained with the left lane the average speed is 61.57 km/hour and the right lane is 63.68 km/hour.

Bulakamba Traffic Volume Tegal Direction

Bulakamba road in the direction of Tegal is a pantura road which is in the pantura area of Brebes Regency in the Bulakamba sub-district which has two routes, namely the direction to West Java and to Tegal. Bulakamba traffic volume towards Tegal can be seen in Table 7.

Table 7.
Bulakamba Traffic Volume in Tegal Direction

Transportation Type	Current Left				Current Right			
	Current (Kend/menit)			Total current (Kend)	Current (Kend/menit)			Total current (Kend)
	V max	V min	V rata-rata		V max	V min	V rata-rata	
MC	21	3	12	2072	8	0	2	386
LV	2	0	1	134	12	1	5	835
MHV	5	0	1	155	8	0	2	439
LT	1	0	0,01	2	8	0	2	413
LB	0	0	0	0	2	0	0,32	57

Jalan Bulakamba in the direction of Tegal, the left lane is a lane that directly intersects with roadside activities while the right lane is a lane that does not directly intersect with roadside activities, but with pedestrians and road narrowing due to roadside activities, it also has an impact on traffic lanes right. From these data it can be seen the percentage of lane selection for each type of vehicle. The following is the data for the percentage of selecting the Bulakamba road towards Tegal shown in Table 8.

Table 8.
Percentage of Bulakamba Vehicle Lane Use in Tegal Direction

Transportation	Persentase per lajur	
	Left (%)	Right (%)
MC	84,30	15,70
LV	13,83	86,17
MHV	26,09	73,91
LT	0,48	99,52
LB	0,00	100,00
Total	40,73	59,27

Bulakamba Vehicle Speed in the Direction of Tegal

The speed of each vehicle passing on the Bulakamba road towards Tegal can be seen in Table 9 below.

Table 9.
Vehicle speed on the Bulakamba road in the direction of Tegal

Tarnsportation Type	Current Left			Current Right		
	Current Us (km/jam)			Current Us (km/jam)		
	Us Max	Us Min	Us Rata-Rata	Us Max	Us Min	Us Rata-Rata
MC	42,42	17,29	31,66	45,98	13,82	28,53
LV	39,93	6,00	25,22	39,75	3,71	25,88
MHV	32,27	11,62	23,25	29,68	5,15	19,71
LT	19,40	18,69	19,05	22,16	13,25	18,63
LB	-	-	-	29,55	20,35	24,91
Rata-rata			24,71			23,53

From the results of calculating the speed of vehicles on the Bulakamba road in the direction of Tegal, the average speed value for each lane is obtained, with the left lane the average speed is 24.71 km/hour and the right lane is 23.53 km/hour.

Bulakamba Traffic Volume in West Java Direction
Traffic volume on the Bulakamba road towards West Java can be seen in Table 10.

Table 10.
Bulakamba Traffic Volume in West Java Direction

Transportation Type	Current Left				Current Right			
	Current (Kend/menit)			Total Current (Kend)	Current (Kend/menit)			Total Current (Kend)
	V max	V min	V rata-rata		V max	V min	V rata-rata	
MC	21	1	9	1603	23	3	7	1250
LV	3	0	0	42	13	0	5	811
MHV	3	0	1	121	9	0	2	434
LT	2	0	0	15	6	0	2	387
LB	1	0	0	11	3	0	0	86

Jalan Bulakamba West Java, the left lane is a lane that is in direct contact with roadside activities while the right lane is a lane that is not in direct contact with roadside activities. From these data, the percentage of lane selection for each type of vehicle on the Bulakamba road towards West Java is shown in Table 11.

Table 11.
Percentage of Use of the Bulakamba Vehicle Lane in the West Java direction

Transportation	Persentase per lajur	
	Left (%)	Right (%)
MC	56,19	43,81
LV	4,92	95,08
MHV	21,80	78,20
LT	3,73	96,27
LB	11,34	88,66
Total	30,31	69,69

Bulakamba Vehicle Speed in West Java Direction
The speed of each vehicle passing on the Bulakamba road towards West Java can be seen in Table 12 below.

Table 12.
Vehicle speed on the Bulakamba road in the direction of West Java

Transportation Type	Current Left			Current Right		
	Current Us (km/jam)			Current Us (km/jam)		
	Us Max	Us Min	Us mean	Us Max	Us Min	Us Mean
MC	69,46	17,94	46,97	88,41	29,22	58,01
LV	69,84	28,53	50,05	75,36	24,67	52,89
MHV	51,71	8,39	35,55	80,89	15,76	47,46
LT	32,47	25,52	28,05	62,43	21,43	41,29
LB	48,15	36,35	43,31	71,94	32,23	45,72
Mean			40,79			49,07

From the results of calculating the speed of vehicles on the Bulakamba road towards West Java, the average speed value for each lane is obtained with the left lane the average speed is 40.79 km/hour and the right lane is 49.07 km/hour.

Pakijangan Street Vehicle Traffic Density

Traffic on Jalan Pakijangan is fairly smooth and traffic jams rarely occur. Vehicle traffic on each road has different characteristics, one of which is vehicle density. The density of vehicles on a road is affected by the flow and speed of vehicles. Pakijangan road vehicle density in Table 13.

Table 13.
Vehicle Density Data on Jalan Pakijangan

Density (smp/km)	Street Pakijangan			
	Direction Tegal		Direction Jawa Barat	
	Current Left	Current Right	Current Left	Current Right
D Max	1,087	0,893	0,873	0,887
D Min	0,053	0,053	0,053	0,107
D rata-rata	0,484	0,423	0,430	0,458

From Table 13 above it is known that the highest density (D Max), lowest (D Min) and average density (D Average) values in each lane are known. Jalan Pakijangan in the direction of Tegal with an average density (d average) of the left lane is 0.484 pcu/km and the right lane is 0.423 pcu/km. Meanwhile for the Pakijangan road heading to West Java, the average density (D on average) of the left lane is 0.430 pcu/km and the right lane is 0.458 pcu/km.

Bulakamba Road Vehicle Traffic Density

The density of vehicles on a road is affected by the flow and speed of vehicles. Bulakamba road vehicle density in Table 13.

Table 14.
Vehicle Density Data for Bulakamba Road

Density (smp/km)	Street Bulakamba			
	Direction Tegal		Direction Jabar	
	Current Left	Current Right	Current Left	Current Right
D Max	1,853	2,627	1,080	1,333
D Min	0,427	0,240	0,053	0,107
D rata-	0,860	1,049	0,361	0,595

From Table 14 on the Bulakamba road towards Tegal with an average density (D average) the left lane is 0.860 pcu/km and the right lane is 1.049 pcu/km. Meanwhile, for the Bulakamba road towards West Java, the average density (d average) of the left lane is 0.361 and the right lane is 0.595.

DISCUSSION

Side Barriers

Side barriers include pedestrian/crosswalk data, stopped vehicles, vehicles entering and leaving the side of the road and vehicle data slowing down. The side resistance data will be used to find out how much side resistance is in the location. Side friction data was recapitulated every 1 minute for 3 hours at two study locations, namely the Pakijangan and Bulakamba pantura roads.

On the Pakijangan road section in the direction of Tegal with a frequency value of 54.73, this value is between 50 – 150 which is included in the category of low side friction (L). Jalan Pakijangan in the direction of Jawa Barata with a frequency value of 47.33 (<50) is included in the category of very low side friction (VL). Bulakamba road in the direction of Tegal has a frequency value of 368.8, the value is > 350, it is included in the very high resistance class (VH). high resistance (H). Classification of side friction classes for each road section can be seen in Table 15.

Table 15.
Classification of Side Resistance Classes

Jam ke	Pakijangan		Bulakamba	
	Current (frekuensi/kejadian)		Current (frekuensi/kejadian)	
	Tegal	Jabar	Tegal	Jabar
1	55,6	43,6	426,2	341,6
2	50,6	51,2	351,8	286,2
3	58	47,2	328,4	244,6
Rata-Rata	54,73	47,33	368,8	290,8
Kelas	L	VL	VH	H

From the results of the classification of the side friction classes shown in Table 15 above, the Pakijangan road in the direction of Tegal has a low side resistance class (L) and Pakijangan in the direction of West Java has a very low resistance class (VL). Meanwhile, the Bulakamba road towards Tegal has a very high side resistance class (VH) and the Bulakamba road towards West Java has a high class resistance (H).

Vehicle Distribution and Side Barriers

From the results of survey data calculations at the study location, the percentage value for selecting lanes on the road section was obtained. The percentage value is used as a passenger car unit (smp). The percentage values obtained from the survey varied greatly, some tended to choose the left lane, and some chose the right lane. The percentage of the use of the entire vehicle lane can be seen in table 16.

Table 16.
Percentage of total vehicle lane use

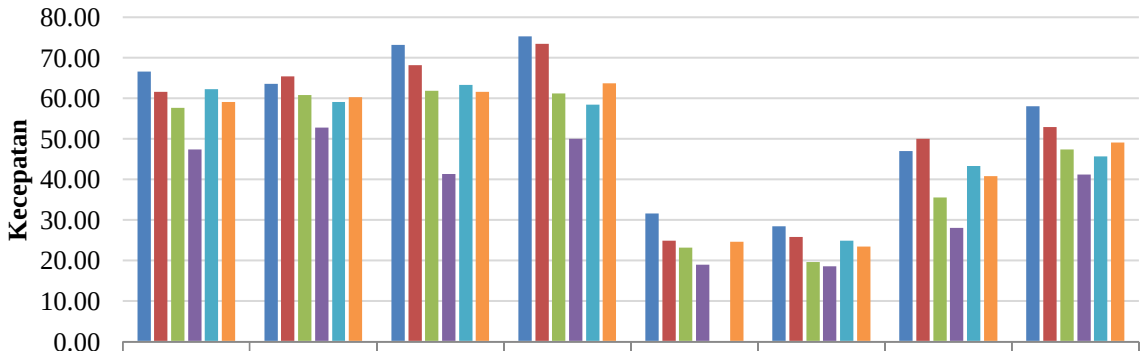
Roads	Direction	% Per Lajur (smp)		Obstacle Class
		Left	Right	
Pakijangan	Tegal	47,06	52,94	L
	Jabar	56,18	43,82	VL
Bulakamba	Tegal	40,73	59,27	VH
	Jabar	30,31	69,69	H

Jalan Pakijangan towards Tegal with low traffic class (L) vehicles tend to choose the right lane with a percentage of the left lane 47.06% and the right lane 52%, while Pakijangan towards West Java with very low traffic class (VL) vehicles tend to choose the left lane with a percentage value of the left lane 56.18% and the right lane 43.82%. Furthermore, on the Bulakamba road towards Tegal which has a very high level of side friction (VH) the percentage value of vehicles choosing the left lane is 40.73% and the right lane is 59.27%, while the Bulakamba road towards West Java with a high level of side friction (H) value the percentage of vehicles choosing the left lane is 30.31% and the percentage value of the right lane is 69.69%.

Side Barriers With Vehicle Speed

From the survey that has been carried out, the speed of vehicles in each location varies greatly if you look at the composition of the vehicles, each type of vehicle also varies in speed. Many factors affect vehicle speed, one of which is roadside activity. The following is the average speed of vehicles passing in the study locations that have different levels of obstacles shown in Table 17 below.

Table 17.
Side Barriers with Vehicle Speed



	Kiri	Kanan	Kiri	Kanan	Kiri	Kanan	Kiri	Kanan
	Arah Tegal Hambatan Rendah (L)		Arah Jabar Hambatan Sangat Rendah (VL)		Arah Tegal Hambatan Sangat Tinggi (VH)		Arah Jabar Hambatan Tinggi (H)	
	Kecepatan rata-rata Pakijangan (km/jam)				Kecepatan rata-rata Bulakamba (km/jam)			
MC	66.60	63.54	73.12	75.31	31.66	28.53	46.97	58.01
LV	61.65	65.39	68.20	73.45	24.89	25.88	50.05	52.89
MHV	57.68	60.86	61.84	61.16	23.25	19.71	35.55	47.46
LT	47.42	52.83	41.34	50.04	19.05	18.63	28.05	41.29
LB	62.31	59.16	63.35	58.42	0.00	24.91	43.31	45.72
Rata -	59.13	60.35	61.57	63.68	24.71	23.53	40.79	49.07

The data above shows that the speed on a road section that has two lanes and has different levels of side friction varies greatly. While the speed in each lane on a road section the difference in speed is not too significant, but when compared between each road segment and other road sections that have different levels of resistance, the difference in vehicle speed is very significant. For MC type vehicles on roads with very low side friction (VL) the average speed is 73.12 km/hour on the left lane and 75.17 km/hour on the right lane, for roads with low resistance levels (L) the average speed average is above 60 km/h left and right lane and below 70 km/h. Roads with high barriers (H) average speed is 46.97 km/hour on the left lane 58.01 km/hour on the right lane, while for roads with very high barriers (VH) the average speed is 31.66 km /hour left lane 28.53 right lane.

LV type vehicles on roads with VL barriers the average speed is 68.2 km/hour on the left lane 73.45 km/hour on the right lane, for roads with L type barriers the average speed is 46.24 – 61.65 km/hour left lane 52.76 – 65.39 km/hour right lane, for roads with class H barriers the average speed is 50.05 km/hour on the left lane and 52.89 km/hour on the right lane, while on roads with class VH barriers the average speed an average of 24.89 km/hour on the left lane and 25.88 km/hour on the right lane. MHV type vehicles on roads with VL barriers the average speed is 61.84 km/hour on the left lane 61.16 km/hour on the right lane, for roads with L type barriers the average speed is 51.17 – 57.68 km/hour left lane 46.73 – 60.86 km/hour right lane,

for roads with class H barriers the average speed is 35.55 km/hour on the left lane and 47.46 km/hour on the right lane, while on roads with class VH barriers the average speed an average of 23.25 km/hour on the left lane and 19.17 km/hour on the right lane.

LT type vehicles on roads with VL barriers the average speed is 41.34 km/hour on the left lane 50.04 km/hour on the right lane, for roads with L type barriers the average speed is 32.87 – 47.42 km/hour left lane 32.87 – 52.83 km/hour right lane, for roads with class H barriers the average speed is 28.05 km/hour on the left lane and 41.29 km/hour on the right lane, while for roads with class VH barriers the average speed an average of 19.05 km/hour on the left lane and 18.65 km/hour on the right lane. LB type vehicles on roads with VL barriers the average speed is 58.42 km/hour on the left lane 63.35 km/hour on the right lane, for roads with L type barriers the average speed is 45.32 – 62.31 km/hour left lane 44.46 – 59.16 km/hour right lane, for roads with class H barriers the average speed is 43.31 km/hour on the left lane and 45.72 km/hour on the right lane, while for roads with class VH barriers the average speed an average of 0 km/hour on the left lane because no one is passing, 24.91 km/hour on the right lane.

From the average vehicle speed data that has been obtained, then look for the average speed on the road. The average speed data that has been obtained is searched for the trend pattern of vehicle speed which is affected by side friction. The following is the average vehicle speed data which can be seen in Table 18 below.

Table 18.
Average vehicle speed data and side resistance

Side Barrier	Score (kejadian)	vehicle average speed (km/jam)
VL	47,33	62,62
L	54,73	59,74
H	290,8	44,93
VH	368,8	24,12

Next, look for how the trend pattern of the average vehicle speed is affected by side friction with varying values. The following is the relationship between vehicle speed and side resistance which can be seen in the following figure.

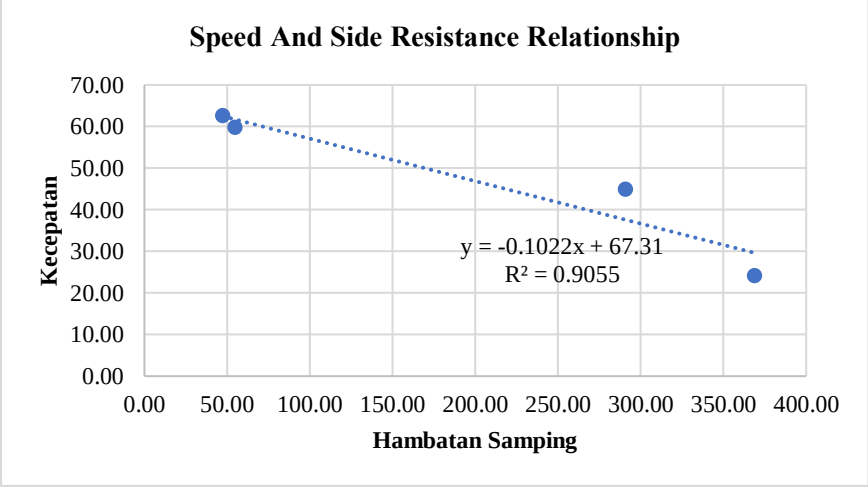


Figure 1. Relationship of Speed and Side Resistance

From Figure 1, the speed of vehicles that are affected by side friction is that the greater the value of the side resistance on a road section, the lower the speed of vehicles passing on that road. This is reinforced by a determination value (R^2) of 0.9055, which means that the vehicle speed is affected by side friction by 90.55% while 9.45% is influenced by other factors. From the figure above using a linear graph, the formula y = -0.1022x + 67.31 is obtained, where the value of y is the speed and x is the side resistance. From this formula it can be predicted what the average speed of vehicles passing on a road with varying side resistance values. The following prediction results can be seen in Table 19 below.

Table 19.
Predicted speed and side resistance

Side Barrier	Average Speed
0	67,31
50	62,2
100	57,09
150	51,98
200	46,87
250	41,76
300	36,65

From Table 19 the side resistance values range from 0 to 300 events. If the side friction is 0 events, the average speed of the vehicle is 67.31, the obstacle for 100 events is the speed of 57.09 km/hour, the obstacle for 300 events is the speed of 36.65 km/hour, the greater the side resistance the average speed of the vehicle will decrease .

CONCLUSION

The greater the side resistance class, the lower the vehicle speed. Driver behavior that is affected by side friction is the speed of vehicles that on roads with higher left lane speeds, heavy vehicles tend to choose the right lane, this condition is because heavy vehicles avoid side obstacles that are on the left lane and on the left lane more light vehicles pass. Conversely, on a road with a higher right lane speed, heavy vehicles passing tend to choose the left lane for this condition because the side barriers in the left lane do not have a major effect on the traffic in that lane. The distribution of vehicles for each vehicle composition includes MC type vehicles (motorcycles) in all classes of side barriers choosing the left lane. Type LV (light vehicles) on roads with very low barriers (VL) vehicles choose the left lane, but for classes of low side barriers to very high barriers the vehicles choose the right lane. MHV (medium heavy vehicle), LT (large truck) and LB (large bus) types of vehicles on all obstacle classes choose the right lane, even for LB (large bus) type vehicles on roads with very high barriers (VH) 100% choose the right lane right.

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