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Speed of Car, Safe Distance and Speed Response for Car Drivers in Simpang Tiga Songsong, Sub-District of Singosari, Lane of Surabaya-Malang

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Abstract: The number of private vehicles is increasing every day, with the increase in the number of private cars, the potential for traffic accidents is also increasing, one of them is in Malang Regency, namely on Singosari Simpang Tiga Songsong Street inSub District of Singosari, Land of Surabaya-Malang, from the results of interviews in the field of at least 1 accident times in one month. This is due to several things including the driver not realizing the importance of a safe response speed when driving a car, especially when entering the intersection area. This study uses a questionnaire to determine the model of the taillights of private cars that pass through Singosari Simpang Tiga Songong Street, Sub-District of Singosari, lane of Surabaya-Malang, calculate the weight of criteria using the Analytical Hierarchy Process (AHP) method, experimental models, to determine alternative models of distance, car speed and safe response speed when crossing the area. From the results of research and experiments found, the conditions in the morning the selected model is the second model with a speed of 50 km/h with a distance of 16.66 m which is safe to respond. For crowded conditions during the day the model does not affect the response speed and the distance of 13.88 m is the safe distance to respond. For crowded conditions in the afternoon the model does not affect the response speed and the distance of 11.11 m is the safe distance to respond. The conclusion to represent the three conditions in the morning, afternoon and evening is a recommendation in the morning because morning time is a critical condition than other time conditions where the safe speed is 50 km/h with a safe distance of 16.66 m, for respond.

Keywords: Vehicle Speed, Response Speed, Analytical Hierarchy Process (AHP)

I. INTRODUCTION

At this time, the number of private vehicle owners is increasing, especially private cars, along with the increasing number of private car owners, the number of traffic accidents has also increased (sources, traffic data). One of them is in the city of Malang, which is on Singosari Simpang Tiga Songong Street, Sub-District of Singosari, lane of Surabaya-Malang with an average number of accidents ± 1 time in a month (sources, discussions from local residents and data from traffic police). That is because the driver does not have a safe response speed when a traffic accident will occur. What is meant by speed of response is the speed of people clearly understanding the surrounding environment. (Hutabarat, 2017) said that the response speed of a city transport driver is strongly influenced by the mental burden of the driver, the high mental load can be influenced by several things including the situation and traffic density, raising and lowering passengers and the physical condition of the vehicle. (Recarte and Nunes, 2003) from the results of his research explained that accidents that occur on the highway for car drivers are caused by the response speed factor. (Hughes et al., 2005) said that relaxation becomes important to reduce stress levels and high mental workload when driving a car, in an effort to increase concentration in driving a car.

Related to this, the formulation of the problem in this study is How to provide recommendations to the people of Malang about safe response speed for car drivers to reduce the number of traffic accidents, especially on Singosari Simpang Tiga Songsong Street, Sub-District of Singosari, Lane of Surabaya-Malang.The purpose of this research is to conduct experiments with simulations to find out the speed and safe distance for private car drivers at Singosari Simpang Tiga Songsong Street, Sub-District of Singosari, Lane of Surabaya-Malang.

II. RESEARCH METHODS

This research was conducted in five steps, namely 1) Determination of criteria, 2) Weight of criteria, 3) Determination of car speed, 4) Development of Experiment models, 5) Determination of safe response distances.

III. RESULTS AND DISCUSSION

Determine the Number of Questionnaire Samples

The sample taken from this study is the number of drivers who passed the Surabaya - Malang route for 2 hours at 07.00-09.00 WIB. The sample measurements in this study use the Slovin formula, namely.

$$n = \frac{N}{1 + Ne^2}$$

With the number of drivers 1256 by determining the error of 10%, the minimum sample count is:

$$n = \frac{N}{1 + Ne^2} = \frac{1256}{1 + (1256)0{,}10^2} = 92.62 \text{ driver} \longrightarrow 93 \text{ driver}$$

Selection of Criteria

From the results of processing the questionnaire and interviewing the community, it can be seen in outline the desired criteria, including:

1. Lighting
2. Size
3. Shape

Weighting Criteria with AHP

From the results of data processing, we concluded that the weights for the main criteria are as follows.

TABLE 1. The Weight of Main Criteria

Criteria	Weight	Weight (%)
Lighting	1,2	40%
Size	1,2	40%
Shape	0,6	20%

TABLE 2. Car taillights table

	MODEL		SPECIFICATION
A			Car rear brake lights with a triangles shape, and have a length of ± 29.1 cm, width ± 22.7 cm, height ± 127 cm

B			Car rear brake lights with a square shape, and have a length of ± 14.9 cm., width ± 18.8 cm, height ± 104 cm
C			Car rear brake lights with a circle shape with a diameter ± 7 cm.

After conducting research it turns out the speed of the car driver in crowded conditions in the morning is 40 km / h, 50 km / h, and 60 km / h.

FIGURE 1: Crowd Model in the morning

TABLE 3. Crowd Model in the morning on Table

CAR SPEED	LAMP SHAPE	HIGH OF CAR BRIGHT LIGHTS ON THE ROAD	RESPONSE
40 km/h	 Car rear brake lights with a triangles shape, and have a length of ± 29.1	high ±127 cm	1.5 seconds

	cm, width ± 22.7 cm,		
	 Car rear brake lights with a square shape, and have a length of ± 14.9 cm., width ± 18.8 cm	high ±104 cm	2 seconds
	 Car rear brake lights with a circle shape with a diameter ± 7 cm.	high ±94,2 cm	2.5 seconds
50 km/h	 Car rear brake lights with a triangles shape, and have a length of ± 29.1 cm, width ± 22.7 cm,	high ±127 cm	2 seconds
	 Car rear brake lights with a square shape, and have a length of ± 14.9 cm., width ± 18.8 cm,	high ±104 cm	2.5 seconds
	 Car rear brake lights with a circle shape with a diameter ± 7 cm.	high ±94,2 cm	3 seconds
60 km/h	 Car rear brake lights with a triangles shape, and have a length of ± 29.1 cm, width ± 22.7 cm,	high ±127 cm	2.5 seconds

	 Car rear brake lights with a square shape, and have a length of ± 14.9 cm., width ± 18.8 cm,	high ±104 cm	3 seconds
	 Car rear brake lights with a circle shape with a diameter ± 7 cm.	high ±94,2 cm	3.5 seconds

Data processing with the crowd model in the morning.

From the above data a driver response rating can be made:

TABLE 4. Driver Response Rating

Distance	Crowd Model			Count	Mean
	1	2	3		
Distance A 11.11 m	71 71 73 70 68	73 78 80 80 82	75 76 78 73 78		
Count	353	393	380	1126	
Mean	70.6	78.6	76		225.2
Distance B 13.88 m	74 79 78 73 77	71 77 78 79 78	79 82 80 78 83		
Count	381	383	402	1166	
Mean	76.2	76.6	80.4		233.2
Distance C 16.66 m	81 79 78 77 77	79 81 77 86 80	79 79 76 77 82		
Count	392	403	393	1188	
Mean	78.4	80.6	78.6		237.6
Big Count	1126	1179	1175	3480	
Mean	225.2	235.8	235		696

From the data above, anava table can be made :

TABLE 5. Analysisi Varians (ANAVA)

Source	dk	JK	KT	F tset
Mean	1	269120	269120	
Treatment				
A (distance)	2	131.73	65.86	9.82
B (model)	2	116.13	58.06	8.6
AB	4	118.94	29.73	
Error	36	241.2	6.7	
∑	45	265230		

From the Anava table we can calculate the data if Ho is rejected. If it is rejected, further tests can be carried out, namely Newman-Keulls and the end result is,

TABLE 6. Uji Newman-Keulls test for model

No	Comparison	Note		Dominant treatment		
		Reject	Accept	1	2	3
1	PI1 vs PII1	✓		x	✓	x
2	PI1 vs PIII1	✓		x	x	✓
3	PII1 vs PIII1		✓	x	✓	
Count		2	1	0	2	1
No	Comparison	Note		Dominant treatment		
		Reject	Accept	1	2	3
1	PI2 vs PII2		✓	x	✓	x
2	PI2 vs PIII2		✓	x	x	✓
3	PII2 vs PIII2		✓	x		✓
Count		0	3	0	1	2
No	Comparison	Note		Dominant treatment		
		Reject	Accept	1	2	3
1	PI3 vs PII3		✓	x	✓	x
2	PI3 vs PIII3		✓	x	x	✓
3	PII3 vs PIII3		✓	x	✓	
Count		0	3	0	2	1

The preferred model is model 2

TABLE 7. Uji Newman-Keulls test for distance

No	Comparison	Note		Dominant treatment		
		Reject	Accept	1	2	3
1	PI1 vs PII1	✓		x	✓	
2	PI1 vs PIII1	✓		x	x	✓
3	PII1 vs PIII1		✓	x	x	✓
4	PI2 vs PII2		✓	✓		x
5	PI2 vs PIII2		✓	x	x	✓
6	PII2 vs PIII2		✓	x	x	✓
7	PI3 vs PII3		✓	x	✓	
8	PI3 vs PIII3		✓	x	x	✓
9	PII3 vs PIII3		✓	x	✓	x
Count		2	7	1	3	5

from the Newman-Keulls calculation that the most dominant distance (selected) is the third distance at a distance of 16.66 meters. So the chosen model is model 2, which is about a distance of 13.88 m, with the shape of a triangle lamp size (high cm), response 2 seconds, to a distance of 13.88 m, with the shape of a light box size (high cm), response 2.5 seconds, to a distance of 13.88 m, in the form of a circle lamp size (high cm), response 3 seconds And for daytime calculations the distance 13.88 m is the safe distance to respond, For the afternoon the distance 11.11 m is the safe distance to respond. And from the observations, the critical time is morning time.

IV. CONCLUSION

Based on the results of research with experiments, it can be concluded:

1. From the results of research and data processing. Obtained in the morning the selected model is the second model that is with a speed of 50 km / h with a distance of 16.66 m which is safe to respond, For crowded conditions during the day So the model does not affect the response speed and the distance of 13.88 m is the distance safe to respond, For noisy conditions in the afternoon the model does not affect the response speed and the distance of 11.11 m is the safe distance to respond.
2. Of the three recommendations, which can be used to represent three conditions in the morning, afternoon and evening are recommendations in the morning because morning time is a critical condition than other time conditions.

V. SUGGETION

1. This research can be developed for the next research towards traffic warning signs as well as designing the display of the signs.
2. This research is done by focusing on external environmental factors and for further research can be developed into internal factors of the driver.
3. For private car drivers, especially on Singosari Simpang Tiga Songsong Street, Singosari, Km 75-76, lane of Surabaya-Malang should pay more attention to speed and safe distance in driving so they can understand the surrounding conditions well and can avoid the risk of accidents.

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