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Model of The Distance Between The Readability of Word Messages on Conventional Signs and Electronic Signs

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Abstract: *Traffic signs are divided into conventional signs and electronic signs. The message conveyed is in the form of a pigtogram and/or electronic message.* (Budiati, 2014) *compared the legibility distance of letter dimensions on conventional signs, it was found that H=1.032+0.273D with H being the height of the letter and D being the reading distance.* (Budiati, 2023)*, examined the relationship between the driver's reading speed and the number of words and lines in the Variable Message Sigh. This research produces a reading speed of 1.37 words/second. The research was continued to obtain a modeling of the readability distance for conventional and electronic word message signs with the dependent variable (Y) reading distance. Data on reading distance and reading time in the field were analyzed using the SPSS v.23 approach, and the obtained was Y= 2.990 (X1) + 0.009(X2) + 0.001(X3) for conventional signs Y = 3.557 (X1) + 0.440 (X2) + 0.004 (X3), while Based on collineatity the modeling value of reading distance (2) versus reading distance 1 is as follows: Y = 5.463 + 0.513 (X1) + 0.10 (X2) + 0.009 (X3) + 0.004.*

Keyword: *Conventional signs, Electronic signs, Readability*

INTRODUCTION

Electronic traffic signs are signs whose information is regulated electronically. These electronic signs are used to provide traffic control information in the form of warnings, prohibitions, orders and instructions. In article 4 paragraph 6, electronic traffic signs are used to display warning messages, prohibitions, orders and instructions or traffic messages (Perhubungan, 2014) .In this regulation, the dimensions of electronic signs are adjusted to conventional signs. (CEN, 2007), provides guidelines for the height of letters and the permitted vehicle speed, while or it can be written that in general, to achieve a situation where all messages can be read by the driver, the planner must know 3 things, the speed of reading letters and numbers by the driver, the dimensions of the letters and the numbers on the panel and the permitted vehicle speed. (Zner et al., 2015), provides signal time limits on vehicle speed. Research (Budiati, 2014), the average reading speed is 2.5 syllables per second, and the driver's reading speed for electronic messages is 1.37 words/second. Several other studies (Taylor et

al., 2016), (Huang & Bai, 2014), state that there is a tendency for drivers to pay attention to electronic signs. This research needs to be carried out to obtain a comparison of the readability of signs in the form of modeling the reading distance of electronic signs and conventional signs in the form of words.

METHOD

This research was experimental in nature, the respondents were 33 students and 1 companion surveyor in the vehicle who recorded when the driver started reading and finished reading. Simulation data is carried out in the field in 2 stages,

a. In the first stage, respondents were asked to read the message on conventional signs. The surveyor records the distance between starting and reading the message.
b. In the second stage, respondents were asked to read the words on conventional signs.

The data collection scenario in the field can be seen in Figure 1. The data is then tested for validity and reliability. If it is met, a regression test is carried out to obtain a model of the relationship between reading distance on conventional signs and electronic signs. The dependent variable is reading distance, and the independent variables are number of syllables, reading speed (syllables per second) and reading time. The type of vehicle used in the research was a motorized bicycle (R2) with an average vehicle speed of 40 km/hour. For research properties, conventional and electronic message signs were used, inventory from the Department of Transportation was used.

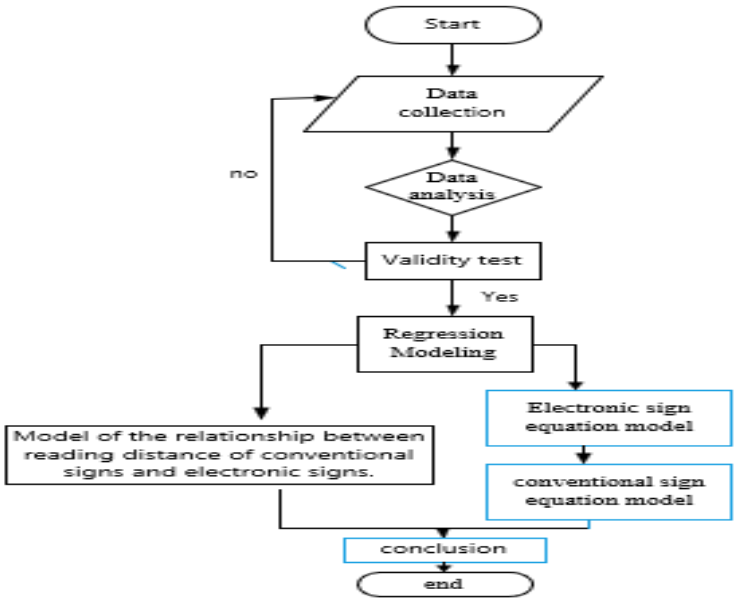

Figure 1. Research Method

RESULT AND DISCUSSION

From stage 1 field data, analyzed by SPSS v.23, the following results were obtained in Table 2, Table 3 and Table 3:

Table 1. Statistical description

	Mean	Std deviasi
Reading distance 1(m)	182,93	17,71
Reading distance 2(m)	155,57	15,86
Read time 1 (second)	3,00	0,29
Read time 2(seconds)	1,80	0,15
Reading speed 1(seconds)	2,28	0,14

Reading 2(seconds)	speed	1,83	0,16

The legibility of electronic signs is smaller than conventional signs or this means that electronic signs have greater readability for drivers. Meanwhile, based on reading time and reading speed, has a lower value or a higher readability level than conventional signs.

Table 2. Relationship between number of words, reading time and reading speed.

		reading distance 1	word count 1	reading time 1	reading speed 1
Pearson Correlation	reading distance 1	1.000	.	-.104	.172
	word count 1	.	1.000	.	.
	reading time 1	-.104	.	1.000	-.525
	reading speed 1	.172	.	-.525	1.000
Sig. (1-tailed)	reading distance 1	.	.000	.282	.169
	word count 1	.000	.	.000	.000
	reading time 1	.282	.000	.	.001
	reading speed 1	.169	.000	.001	.
N	reading distance 1	33	33	33	33
	word count 1	33	33	33	33
	reading time 1	33	33	33	33
	reading speed 1	33	33	33	33

Table 3. Relationship between number of words, reading time and reading speed on electronic signs

		reading distance 2	word count 2	reading time 2	reading speed 2
	reading distance 2	1.000	.	-.321	-.112
	word count 2	.	1.000	.	.
	reading time 2	-.321	.	1.000	-.229
	reading speed 2	-.112	.	-.229	1.000
Sig. (1-tailed)	reading distance 2	.	.000	.034	.267
	word count 2	.000	.	.000	.000
	reading time 2	.034	.000	.	.100
	reading speed 2	.267	.000	.100	.
N	reading distance 2	33	33	33	33
	word count 2	33	33	33	33
	reading time 2	33	33	33	33
	reading speed 2	33	33	33	33

Discussion.

Based on Tables 2 and 3, there is a negative correlation between the number of words and the reading distance, the farther the reading distance, the longer the reading time and reading speed required. There is a significant difference between conventional signs and electronic signs, in the sense that electronic signs have a greater/longer readability compared to conventional signs. The greater the number of words, the greater the reading time and reading speed required. Based on the Collinearity value, a model of reading distance (Y) is produced regarding the number of words, reading time (X2) and reading speed (X3). These models are as follows:

Model 1 : $Y= 2.990 + 0.009(X1) + 0.001(X2)$

Model 2. : $Y = 3.557 + 0.440 (X1) + 0.004 (X2)$

The correlation coefficient between conventional signs and electronic signs is shown in Table 4.

Table 4. Correlation coefficient for reading distance 1 against reading distance 2

Coefficient Correlations[a]							
Model			distance reading 1	reading speed 2	reading time 1	reading time 2	reading speed 1
1	Correlations	distance reading 1	1.000	.146	.002	.407	-.167
		reading speed 2	.146	1.000	.134	.257	.037
		reading time 1	.002	.134	1.000	-.048	.522
		reading time 2	.407	.257	-.048	1.000	-.110
		reading speed 1	-.167	.037	.522	-.110	1.000
	Covariances	distance reading 1	.003	.047	.000	.001	-.075
		reading speed 2	.047	31.908	2.816	.073	1.637
		reading time 1	.000	2.816	13.879	-.009	15.386
		reading time 2	.001	.073	-.009	.003	-.044
		reading speed 1	-.075	1.637	15.386	-.044	62.615

There is a correlation between reading speed 2 and reading speed 1 and has the value "-", which means that reading speed 2 has a greater reading speed and a shorter/closer reading distance. Based on collineatity, the modeling values for reading distance (2) versus reading distance 1 are as follows:

Y = 5,463 + 0.513 (X1) + 0.10 (X2) + 0.009

CONCLUSION

Based on data analysis and discussion it can be concluded

1. There is a relationship between the readability distance and the number of words and the average reading speed. The resulting model shows that conventional signs have a lower readability distance compared to electronic signs.
2. Based on reading distance, there is a strong correlation between reading distance and reading speed in model 2, while there is a high correlation between reading distance and reading time in model 1

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