The Correlation of Safety

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THE CORRELATION OF SAFETY INDICATORS OF TOLL ROAD IN INDONESIA

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ABSTRACT:
The Minimum Service Standard for Toll Roads is a requirement that should be completed by all toll roads in Indonesia. However, field monitoring still shows that some indicators in the Minimum Service Standard for are not met. The indicators which are not completed are related to safety, such as the availability and well function of road signs, road markings, guide posts, KM signs, road lightings, and right of way fence. In this study the monitoring data, from surveys conducted in 2012, 2013 and 2014, were explored and statistically examined. The results show that there is a strong positive correlation for the availability and well function of road signs and road markings for both urban and inter-city toll roads, that the accomplishment of road signs tend to be followed by the road markings. It is also found a strong positive correlation for the availability and well function of right of way fence and guide posts for inter-city toll roads, that the accomplishment of the indicators are interacted. The strongest correlation among the indicators is the correlation between road signs and road markings for inter-city toll road. On the other hands the indicators of KM Sign with road marking and road lighting have a negative and weak correlation with the provision of road signs and road markings for both urban and inter-city toll road. The results show that good provision of one or more indicators do not necessarily mean that other indicators are well provided.

Key Words: Minimum Services Standard, Safety Substance, indicators, toll roads

INTRODUCTION

The road infrastructure in Indonesia play a strategic role in supporting all the activities of the economic, social, cultural, and defense and security. Based on the report from Indonesian Monitoring and Evaluation of National Transport Policy team, 95% of freight logistic and 90% of passenger transportation using road as an infrastructure facility (Direktorat Jenderal Otonomi Daerah 2011). This condition has given the implications for the Indonesian Government to provide the best quality of road infrastructure for the community.

Toll road is the one of the alternative which provide services are more better than other roads, including the performance, accessibility and facility. One of the government's policy in realizing the implementation of the quality road infrastructure, especially for Toll Road is stated the Toll Road Minimum Service Standards (Toll Road MSS) as a reference for the fulfillment services for toll roads in Indonesia. Minimum Service Standards, or abbreviated in Indonesia to SPM Jalan Tol, issued through the Minister of Public Works 392/PRT/M/2005 on Minimum Service Standards Toll Road. Indonesian Toll Road Regulatory Agency, which abbreviated in Indonesia to BPJT (Badan Pengatur Jalan Tol) as a part of the Ministry of Public Work and Public Housing, arranges a regular monitoring to assess the fulfillment of indicators performance the Toll Road MSS by the Toll Road Operator (in Indonesian language is Badan Usaha Jalan Tol, BUJT).

Regarding to performance evaluation issue, the results of the field survey of monitoring and evaluation SPM Jalan Tol in 2012, in 2013 and in 2014, show that more of the indicators are still not met, including the Safety Service Substance. The indicators which are not always be met on this Safety Service Substance such as the availability and well function of road signs, road markings, guide posts, KM signs, road lightings, and right of way fence. In accordance with that facts are necessary to review the correlation between these accomplishment indicators of Toll Road Minimum Service Standards. Besides, they could be calculated to know the relevance among these accomplishment indicators of the Minimum Service Standards for Safety Service Substance. So it can be known the dependency between the accomplishment indicators and their correlation.

The purpose of this study was to determine the correlation between the indicators in the Safety Services Substance of the Toll Road Minimum Service Standards. The relevancy and dependency among them are needed and knowing the correlation between the indicators that contribute to the non-fulfillment of Substance Safety Services are also needed too that will be informed how to maintain the performance of toll road in future.

The approach taken is to collect secondary data from the accomplishment of indicators of Safety Services Substance for 27 toll roads in Indonesia, including urban and inter-city toll road. The data came from the routine field survey of Monitoring and Evaluation conducted by BPJT (Indonesian Toll Road Regulatory Agency) in 2012, 2013 and 2014. All indicators fulfilled are no longer discussed in this study, such as the indicator of the handling of accident and the indicator of security and law enforcement. Using statistical method of correlation, it will be shown the correlation between all indicators of the Safety Services Substance for Toll Road Minimum Service Standards in Indonesia from 2012 until 2014.

MINIMUM SERVICES STANDARDS OF TOLL ROADS

The Minimum Service Standards for toll roads in Indonesia refers to the Regulation of the Minister of Public Works No. 392/PRT/M/2005 on Minimum Service Standards Toll Road. Minimum Service Standards has 21 (twenty-one) indicator is incorporated in 6 (six) service substances. The substance of these services are: toll road conditions, the average of traffic speeds, accessibility, mobility, safety, rescue unit or the rescue and relief services. The substance of services that will be addressed in this study is the

Safety Services Substance. Safety Services Substance has the goal of safety and smoothness for toll road users. This substance consists of several indicators of traffic regulation means that the expected accomplishments all met or 100% of the benchmarks specified. The indicators of Service Safety Substance is an indicator of vehicle traffic control, namely: road signs, road markings, guide post/reflectors, KM Sign, road lighting, right of way fence, the handling of accidents, as well as security and law enforcement. The detailed of These Safety Service Substance will be shown on Table 1.

Table 1. The Safety Services Substance of Minimum Service Standard of Indonesian Toll Road

Traffic Facility Indicator	Scope of Assesment	Minimum Requirements of Minimum Service Standard of Indonesian Toll Road
a. Traffic Sign	Complete, availability, and well function (clear instruction and guiding)	100%
b. Road Marking	Well function and availability	100% & reflector ≥80%
c. Guide post	Well function and availability	100% & reflector ≥80%
d. KM Sign	Well function and availability	100%
e. Road Lighting	Well function and availability	100%
f. Right of way fence	Well function and availability	100%
g. The Handling of accidents	a. Accident victims	Free evacuation
	b. Vehicles accident	Free for towing
h. Security and Law enforcement	Toll road	Police patroly for 24 hours

ACCOMPLISHMENT INDICATORS OF SAFETY SERVICES STANDARD

The data, taken in 2012, 2013, and 2014, show that some of indicators of Safety Services Standard are not fulfilled as a minimum requirement of the Minimum Services Standard by some of toll road, both for urban and inter-city toll road. On the other hand, the indicators of the handling accidents and indicators of security and law enforcement are always be fulfilled.

Indonesia have 14 inter-city toll roads and 13 urban toll roads, which have been evaluated their performance indicators of Minimum Standard Services. The accomplishment result of Safety Services Substance are shown in Table 2 for inter-city toll road and Table 3 for urban toll road.

Table 2. The Accomplishment of Safety Service Substance Indicators for Inter-city Toll road

No	Inter-city Toll Road	Length (km)	Indicators of Safety Service Substance					
			Road Sign	Road marking	Guide Post	KM Sign	Road Lighting	Right of Way Fence
1	Jakarta-Bogor-Ciawi	59	89.91%	91.39%	76.94%	97.78%	86.30%	51.11%
2	Jakarta-Tangerang	33	88.80%	90.28%	85.93%	100.00%	86.57%	60.19%
3	Jakarta-Cikampek	83	91.67%	80.83%	77.50%	93.06%	87.87%	55.00%
4	Padalarang-Cileunyi	64.4	83.61%	89.17%	95.00%	97.78%	72.13%	63.24%
5	Cikampek-Purwakarta-Padalarang	58.5	88.52%	77.59%	93.98%	98.89%	65.56%	64.07%
6	Palimanan-kanci	26.3	86.67%	94.17%	85.93%	96.67%	96.67%	79.17%
7	Surabaya-Gempol	49	88.52%	80.46%	97.22%	98.89%	92.87%	84.17%
8	Belawan-Medan-Morawa	42.7	96.30%	95.83%	88.24%	94.72%	95.46%	65.93%
9	Jembatan Madura (Surabaya-Madura)	5.4	100.00%	97.22%	95.37%	100.00%	73.89%	91.76%
10	Tangerang-Merak	73	87.13%	81.57%	84.54%	99.17%	91.02%	57.78%
11	Surabaya-Gresik	20.7	95.46%	82.69%	81.20%	100.00%	95.19%	65.09%
12	Kanci-Pejagan	35	92.50%	94.17%	84.35%	94.44%	95.19%	67.50%

Table 3. The Accomplishment of Safety Service Substance Indicators for Urban Toll Road

No	Urban Toll Road	Length (km)	Indicators of Safety Service Substance					
			Road Sign	Road Marking	Guide Post	KM Sign	Road Lughting	Right of Way Fence
1	Cawang-Tomang-Cengkareng	23.55	89.91%	93.89%	95.56%	100.00%	78.89%	84.44%
2	Prof. Soedyatmo	14.3	95.00%	96.39%	95.56%	99.17%	79.44%	95.56%
3	JORR	50.42	88.43%	84.72%	94.07%	98.89%	87.69%	75.37%
4	Pondok Aren-Bintaro-Ulujami	5.55	92.59%	93.61%	80.93%	100.00%	92.50%	85.65%
5	Semarang Section A,B,C	24.75	98.89%	89.63%	99.17%	99.17%	97.13%	94.44%
6	Cawang-Tj.Priuk-Pluit	27.05	95.46%	95.00%	96.94%	100.00%	90.46%	100.00%
7	Serpong-Pondok Aren	7.25	98.89%	98.89%	88.15%	100.00%	88.43%	65.56%
8	Ujung Pandang (Seksi I dan II)	6.05	95.00%	98.06%	99.17%	95.83%	97.41%	66.02%
9	SS Waru-Bandara Juanda	12.8	98.06%	93.61%	100.00%	100.00%	97.22%	86.67%
10	Makasar Seksi IV	11.6	89.63%	94.44%	99.17%	98.89%	98.15%	93.52%
11	Bogor Ring Road (Seksi I)	3.85	91.30%	93.33%	90.74%	100.00%	86.94%	81.02%
12	JORR (W1-Kebon Jeruk-Pejaringan)	9.85	98.33%	99.17%	100.00%	100.00%	100.00%	100.00%
13	Cijago	3.7	96.30%	98.33%	95.46%	100.00%	92.78%	89.81%

Correlation of Safety Services Substance Indicators

Correlations are useful for measuring the strength of variable relationships with certain scales. One method is to use the correlation of Pearson, which using scale interval or ratio. The range of the correlation is from 0 to 1 (both positive and negative directions). The correlation between 0 to 1 has shown that two variables have a linear relationship.. As for the correlation 1 shows the very strong correlation between two variables, whereas if the value is 0 means no correlation between these variables. To make it easier to interpret the correlation between variables based on the value of the correlation coefficient is between 0 to 1, it can be categorized as follows: if the correlation coefficient value of between 0-0.3, it is interpreted that the correlation is very weak; if the correlation is worth 0.3 to 0.50, it can be interpreted there is a weak correlation; whereas if it has a value of about 0.5-0.70 correlation coefficient can be said that these variables have moderate correlation. As for the value of the correlation coefficient from 0.70 to 0.9 is mean that the coefficients have a strong correlation, whereas the value correlation coefficient from 0.9 to 1.0 interpreted to have a very strong correlation (Boediono,2001).

Correlation test was carried out for each indicator of Toll Road Minimum Service Standards in the Safety Services Substance for 14 inter-city toll road. The correlation test results are shown in Figure 1

Correlation: Road Signs (IC), Road Marking(IC), Guide Post (IC), KM Sign(IC), Road Lighting(IC), Right of way Fence(IC)

	Road Sign	Road Marking	Guide Post	KM Sign
Road Marking	**0.532**			
	0.050			
Guide Post	0.156	0.170		
	0.594	0.561		
KM Sign	0.142	-0.012	0.461	
	0.628	0.967	0.097	
Road Lighting	0.328	0.324	-0.270	-0.168
	0.253	0.258	0.351	0.565
Right of Way fence	**0.504**	0.433	**0.727**	0.374
	0.066	0.122	0.003	0.187
Road Lighting				
Right of Way fence	0.180	Cell Contents: Pearson correlation		
	0.538		P-Value	

FIG 1. Correlation Between The Fulfillment Indicators on Inter-city Toll Road

These results show that there is moderate and positive correlation between the indicators of availability and well function of road signs and road markings (correlation value 0.532); right of way fence indicator and road sign signs (with a correlation value 0.504); and right of way fence indicator and guide post indicator (with a correlation value 0.727). Because of the correlation value is greater than 0.5, the correlation between these indicators can be categorized a strong positive correlation. It means that there is a strong relationship between these indicators regarding to meet the requirement of Toll Road Minimum Services Standard.

As for the Urban toll roads, the correlation analysis result as shown in Figure 2

Correlation: Road Sign (U), Road Marking (U), Guide Post (U), KM Sign (U), Right of way Fence (U)

	Road Sign	Road Marking	Guide Post	KM Sign
Road Marking	**0.504**			
	0.079			
Guide Post	0.216	0.049		
	0.479	0.874		
KM Sign	0.107	-0.019	-0.322	
	0.728	0.952	0.284	
Road Lighting	0.402	0.137	0.352	-0.249
	0.173	0.656	0.238	0.412
Right of way fence	0.137	0.024	0.347	0.448
	0.656	0.939	0.245	0.125
Road Lighting				
Right of way fence	0.129Cell Contents: Pearson correlation			
	0.673P-Value			

FIG 2. Correlation Between The Fulfillment Indicators on Urban Toll Road

The correlation value obtained for urban toll roads shows moderate positive correlation between the availability and well functioning of the road signs and road markings, with a correlation value 0.504

Hypothesis Testing for Correlation Values

The hypothesis testing for the correlation value is obtained from the relationship indicators variable Safety Services Substance on the Toll Road Minimum Service Standards, with the following statement as H_o: $r = 0$, which means there is no correlation between two variables and H_a: $r \neq 0$, there are significant correlation between the two variables. Thus, H_o can be rejected if results of the statistical analysis provided the p-value <0.05. Base on the correlation value presented in Figure 1 and Figure 2, the hypothesis testing of correlation show that there are a significant correlation between road signs and road markings (p-value = 0.050) and between right of way fence and guide post (p-value = 0.003), whereas there is no significant correlation between road signs and right of way fence (p-value = 0.066). All of them are for inter-city Toll Road. On the other hand for Urban Toll Road, the analysis show tthat there is no significant correlation between indicators of road signs and road markings, with p-value = 0.079.

CONCLUSION

Understanding the correlation between the indicators in the Safety Service Substance of Toll Road Minimum Service Standard, a statistical method is used for analyzing whether an indicator will be mutually affected to one another to meet that standards. This will be a concern for operators in fulfilling the Toll Road Minimum Services Standard. Field Routine monitoring data in 2012, 2013, and 2014 are used for this study. Based on this correlation analysis, it can be concluded as follow:

a. There is a moderate positive correlation between the indicators of the availability and well function of road signs and road marking, both for inter-city and urban toll road. It indicates that the accomplishment of road signs may be followed by the

indicator of road markings.

b. For inter-city toll road, it also found that there are a strong positive correlation between the indicators of right of way fence and guide post, which indicates that accomplishment of their indicators are interacted.
c. Sometimes strong correlation do not always reflect the significance relationship and influence to others, such as between the indicators of road signs and the right of way fence (inter-city toll road) and between the right of way fence and guide post (inter-city toll road).
d. For both urban and inter-city toll road, there are very weak negative correlation between the indicators of road markings and KM sign and between the indicators of road lighting and KM sign. It means that the accomplishment of each indicators does not affected each other.
e. The correlation and relationship between the indicators of Safety Service Substance is not always same between inter-city and urban toll road.
f. These correlation between the Safety Service Substance indicators can be considered by Indonesian Toll Road Operator, when they do a routine maintenance.
g. Toll road operator should be concerned with the strong correlation indicators, because some of them have been interacted by their accomplishment.
h. These correlation of accomplishment indicators can be used for supporting BPJT (Indonesian Toll Road Regulatory Agency, Ministry of Indonesian Public Works and Housing) to do the routine monitoring for accomplishment of Minimum Service Standard for Indonesian Toll Road.

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REFERENCES

Boediono., Koster.W. *Teori dan Aplikasi Statistika dan Probabilitas*.(2001).Remaja Rosdakarya,PT.,Bandung, Indonesia

Direktorat Jenderal Otonomi Daerah. (2011). *Himpunan Produk Hukum Standar Pelayanan Minimal (SPM) Buku I*. Jakarta: Kementerian Dalam Negeri Republik Indonesia.Jakarta, Indonesia

Government of Indonesia. (2004). Regulation of Indonesian Government: *Peraturan Pemerintah Republik Indonesia no. 65 Tahun 2004 tentang Pedoman Penyusunan dan Penerapan Standar Pelayanan Minimal*. Jakarta, Indonesia

Government of Indonesia. (2005).Regulation of Indonesian Government: *Peraturan Pemerintah Republik Indonesia Nomor 15 Tahun 2005 Tentang Jalan Tol*. Jakarta, Indonesia.

Indonesian Toll Road Regulatory Agency (in Indonesian:Badan Pengatur Jalan Tol). (2012). *Final Report of Toll Road Minimum Service Standard Monitoring - 2012*. Jakarta,Indonesia.

Indonesian Toll Road Regulatory Agency (in Indonesian: Badan Pengatur Jalan Tol). (2013). *Final Report of Toll Road Minimum Service Standard Monitoring - 2013*. Jakarta,Indonesia.

Indonesian Toll Road Regulatory Agency (in Indonesian: Badan Pengatur Jalan Tol). (2014). *Final Report of Toll Road Minimum Service Standard Monitoring - 2014*. Jakarta,Indonesia.

Ministry of Public Works. (2005). Ministry Of Public Work Regulation: *Menteri Pekerjaan Umum No:392/PRT/M/2005*. Jakarta, Indonesia

Ott, R. L., & Longnicker, M. (2010). *An Introduction to Statistical Method and Data Analysis*.Cengage Learning. Canada.

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