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Investigating Public Perception Toward the Level Crossing Without Railway Gate Crossing (Case Study: at JPL 297 and 294 Lamongan)

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ABSTRACT

According to the Minister of Transportation regulation No. 36 article 4, year 2011 concerning the intersection of level crossings, the minimum distance between crossings is 800 meters. However, this regulation has not been well implemented at the level crossings of JPL 297, 295, and 294 at Sukodadi Village, Lamongan Regency. Since the regulations are not implemented yet, hence the accidents frequently occur. Therefore, this study was conducted to find out public perceptions of the planned closure of JPL 297 and 294. This study applied descriptive quantitative method by calculating LHR and vehicle queue lengths. Among the three JPLs, the JPL with the highest LHR was JPL 295 with the total of 249 vehicles per hour. Meanwhile, the longest queue of vehicles occurred at JPL 295 reaching 23 meters. Furthermore, the data were analyzed by using multiple linear regression. The findings claimed that the indicators of benefits involved convenience and safety in 180, 11,506 and 7,781, while the result of the public perception obtained 66.8%

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1. INTRODUCTION

The increasing number of accidents in the transportation sector has become a popular issue. Every year, the number of accidents related to the transportation especially in the land transportation and rail sectors are continue increase [1], [2]. The location of the intersection of highways and railroads are still become the collective work in the transportation area to be even better. The level crossing impact is also become a concern in motorized roads because it causes long queues of vehicles [3]–[6]. With a high volume of vehicles and trains being a top priority, it causes quite a long queue when the train is passing [7], [8].

The intersection of level crossings on highways frequently causes accidents between trains and motorized vehicles which cross the level crossings [9]. Congestion that frequently occurs at level crossings might be caused by various factors, for instance narrow roads, high traffic or vehicle volume, and inappropriate intersection locations [9]–[11]. Lamongan is one of the regencies which has high numbers of level crossings that frequently caused accidents. This issue happens due to unavailability of guards who stay in level crossings and the distance between adjacent crossings. This condition makes motorized vehicles freely pass through the crossings regardless of their safety.

Lamongan Regency has about 120 level crossings with crossing guards and those without crossing guards [12]. One of the level crossings in Lamongan Regency is located in Sukodadi Village. At JPL 297 with JPL 295, it only has 272 meters distance. On the other hand, from JPL 295 to 297 has 167 meters distance. This is no longer in accordance with the level crossings regulation of Ministry of Transportation (PM) No 36 Article 4 concerning the intersection and/or intersection between the railway line and other buildings. In this regulation, the minimum distance from one level crossing to another level crossing is at least 800 meters [13]. In addition, JPL 294 and JPL 297 do not have crossing guards and are located closed with other buildings, trees and crossing fences which make it difficult for motorists to see the arrival of trains at the crossing.

In accordance with the accident data taken from the East Java Provincial Transportation Service, the accidents frequently occur at JPL 294 with an average number of 5 incidents per month. On March 27 2021, there was an accident at JPL 297 which resulted 2 victims dead on the spot. This accident was caused by lack of understanding of level crossings and the absence of guards at JPL 297. This issue may lead to the possibility of crossing closure of JPL 294 and JPL 297 which are prone to accidents. The crossing has no guards and the position of JPL is closer with the distance less than 800 meters. The plan of JPL 294 and JPL 297 crossing closure will be diverted to JPL 295 where its condition is in line with PM regulation no 36 article 4 concerning the intersection and/or intersection of rail lines with highways.

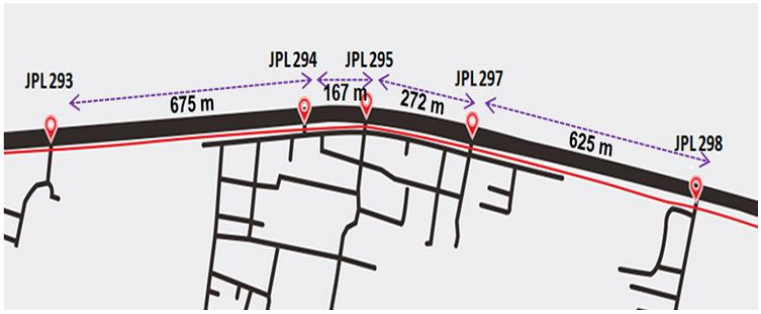
Therefore, this research aimed at determining the public perception especially from those who live at Sukodadi Village, Lamongan Regency on the JPL 294 and JPL 297 planned closure. From the research findings, it can be illustrated how the public perceptions regarding the JPL 297 and JPL 294 closure that will be diverted to JPL 295 as the main level crossings

2. RESEARCH METHOD

This study applied descriptive quantitative analysis, which in this study described the results of the crossing conditions on a plot of Sukodadi Village and LHR observations at JPL 297, 295, and 294. The samples were carried out by implementing *cluster sampling technique*. It means that the samples taken are representative of the entire sample which is made into a single population [14]. The survey data applied quantitative methods to describe traffic conditions and vehicle queue lengths. Meanwhile, perception survey data were analyzed by using multiple linear regression method to see the public perception regarding the closure plan of level crossing

3. RESULTS AND DISCUSSION

Referring to the data of level crossing accidents in East Java in 2021, level crossings in Lamongan Regency had an average of 10 – 20 accidents every month with many of the victims were die. From January 2021 to May, there had been 5 accidents with fatalities [15]. According to the survey results, there were several deficiencies at JPL 294 and JPL 297 for instance, the inventory and condition of the crossing locations which were not in accordance with the regulations.



Picture 1. The layout of level crossing at Sukodadi Village

Planned closure of JPL 294 and 297

This closure plan was carried out based on the survey in location with the minister of transportation regulation no 36 article 3 concerning level crossings. The survey result of crossing conditions were used as a basis for analysis and consideration for the Sukodadi Village society regarding the plan for closing level crossings. The results could be seen in the table below:

Table 1 - Condition of Survey Crossing Location

JPL	Width (m)	Point	Status	Description
297	2.8	Straight	Unguarded	Inter-Village Access Road
295	3.5	Curved	Guarded by Lamongan ministry of transportation	Access Road to Village, sub-district, school, office, etc.
294	3.2	Straight	Unguarded	Access road between villages

Traffic conditions

Table 2 - Number of Vehicles Passing at the Sukodadi Village Crossing

Traffic Volume/hour	JPL		
	297	295	294
Highest amount	69 vehicles/hour	324 vehicles/hour	132 vehicles/hour
at	09.00– 10.00 WIB	10.00 – 11.00 WIB	11.00 – 12.00 WIB
Lowest numbers	31 vehicles/hour	157 vehicles/hour	90 vehicles/hour
at	10.00– 11.00 WIB	09.00 – 100 WIB	10.00 – 11.00 WIB
Average	46 vehicles/hour	249 vehicles/hour	107 vehicles/hour

Vehicle Queue Length Condition

JPL 297

Table 3 - Queue Length at JPL 297

Closing	Time	Length of Time (s)	Queue Length (m)	Number of Light Vehicles	Number of Heavy Vehicles
1	09.44	30	5	0	1
2	10.12	58	5	1	0
3	10.41	45	5	2	0
4	11.11	46	5	2	0
5	11.40	72	0	0	0
6	11.46	57	0	0	0
7	12.05	30	0	0	0
8	12.36	32	0	0	0
9	12.2 1	53	5	0	1
10	13.35	71	5	0	1

JPL 295

Table 4 - Queue Length at JPL 295

Closing	Time	Length of Time (s)	Queue Length (m)	Number of Light Vehicles	Number of Heavy Vehicles
1	09.45	35	5	1	1
2	10.13	63	14	3	2
3	10.42	50	5	1	0
4	11.12	51	8	2	2
5	11.41	77	23	4	4
6	11.45	57	23	7	3
7	12.06	35	5	1	0
8	12.37	37	0	0	0

9	12.20	50	15	9	1
10	13.34	69	10	5	1

JPL 294

Table 5 - Queue Length at JPL 294

Closing	Time	Length of Time (s)	Queue Length (m)	Number of Light Vehicles	Number of Heavy Vehicles
1	09.46	33	5	1	1
2	10.14	61	0	3	0
3	10.43	48	5	1	0
4	11.13	49	10	5	2
5	11.42	75	0	0	0
6	11.44	57	5	4	1
7	12.07	33	0	0	0
8	12.38	35	5	0	1
9	12.19	48	10	3	1
10	13.33	66	10	3	2

Results of the Questionnaire

Characteristics of Respondents

Number of Respondents

This study was conducted with 100 respondents. The number of respondents was obtained from the distribution of the total number of societies around 5443 in Sukodadi Village. Hence, it can be formulated as follows:

$n = N/(1+Ne^2)$ (1)

Description:

n = Number of samples would be taken

N = Number of populations

e = Number of errors (the author assumes the number of errors is 10%)

The total population of Sukodadi Village was 5443 people with the total samples that were taken explained as follows:

$n = 5443/[1+5443(10\%)^2]$

$n = 99.98$

The total number of respondents would be taken was about 100 people.

This research involved the society at Sukodadi Village and there were 3 level crossings that lead to Sukodadi Village. Therefore, the 100 respondents were divided into 3 sampling locations around JPL 297, 295, and 294. The samples distribution result was described as follows:

Table 6. Total of Respondents

JPL	Number of Heads of Families x 4	Offices	School	Number of Communities	Total sample ($1+Ne^2$)	Total (Number of Communities: total sample)
297	820	-	-	820	54.44	16
295	2000	150	1000	3150	54.44	57
294	1480	-	-	1480	54.44	27

Characteristics of The Respondents

Table 7 - Characteristics of The Respondents

Description	Total	Percentage
Age of Respondents		
17 – 25 years old	26	26 %
26 – 34 years old	18	18 %
35 – 43 years old	18	19 %
44 – 52 years old	19	19 %
53 – 61 years old	11	11 %
62 – 70 years old	8	8 %
Gender		
Male	58	58 %
Female	42	42 %
Education		
Elementary School	0	0 %
Junior High School	20	20 %
Senior High School	54	54 %
Associate Degree	2	2 %
Bachelor Degree	23	23 %
Master Degree	1	1 %

Descriptive Analysis

Table 8 - Descriptive Statistics of Research Variables

		Descriptive Statistics			
Indicators	N	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
Benefit	100	27.00	38.00	32.7600	2.42512
Convenience	100	14.00	26.00	20.2500	3.30709
Safety	100	15.00	24.00	21.4200	1.53859
Closure	100	19.00	28.00	24.2200	1.87261
Valid N (*listwise*)	100				

Instrument Analysis Test

Instrument test was conducted to 30 respondents as aimed determining whether the results of each instrument was valid or not. In accordance with the testing result on 30 respondents, 30 statements were declared valid and were eligible for the sampling stage at Sukodadi Village.

Classical Assumption Test

Assumption test was completed to test whether the data had normal distribution, there was no multicollinearity, and there was no heteroscedasticity. The results of the classical assumption test were carried out after the questionnaires were distributed to 100 respondents at Sukodadi Village.

Normality test

Table 9 - One Sample Kolmogorov-Smirnov Test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		100
Normal *Parameters*[a,b]	*Mean*	.0000000
	Std. Deviation	1.07878761
Most Extreme Differences	*Absolute*	.088
	Positive	.073
	Negative	-.088
Kolmogorov-Smirnov Z		.878
Asymp. Sig. (2-tailed)		.423

a. Test distribution is Normal.
b. Calculated from data.

The analysis test results in above table claimed that in the *Kolmogorov-Smirnov* line, it could be seen for the *Asymp value. Sig. (2-tailed)* was 0.423. This number was higher than the value of the *Kolmogorov-Smirnov* provision which was 0.050. Therefore, it could be concluded that the results of the *one sample Kolmogorov-Smirnov test* were normally distributed.

Multicollinearity Test

Table 10 - Multicollinearity Test Results

Coefficients*

Model	**Unstandardized Coefficients**		**standardized Coefficients**	**t**	**Sig.**	**Collinearity Statistics**	
	B	**Std.Error**	**Beta**			**tolerance**	**VIF**
1. (Constant)	16.638	2.015		8.256	.000		
Manfaat	-.390	.048	-.505	-8.180	.000	.906	1.104
Kemudahan	.392	.034	.692	11.506	.000	.954	1.048
Keselamatan	.580	.075	Scatterplot .477	7.781	.000	.922	1.085

a. Dependent Variabel: penutupan

The correlation result value between the independent variables namely the benefit variable (X1), the convenience variable (X2), and finally the safety variable (X3) all had VIF value less than 10. X1 with 1.104 value, X2 with 1.048, and X3 1,085. Meanwhile, the output *tolerance* for X1 was 0.906, X2 was 0.954, and X3 was 0.922, all of those results were lower than 0.1. To sum up, there was no multicollinearity in this stage.

Heteroscedasticity Test

Heteroscedasticity test was conducted to determine whether in the regression model there was variance inequality of the residuals from one to another observation or not. Heteroscedasticity purposed to describe the spread of the independent variables [16]. Good results of Heteroscedasticity test were illustrated the random pattern. The results of the heteroscedasticity test in this study was explained as follows:

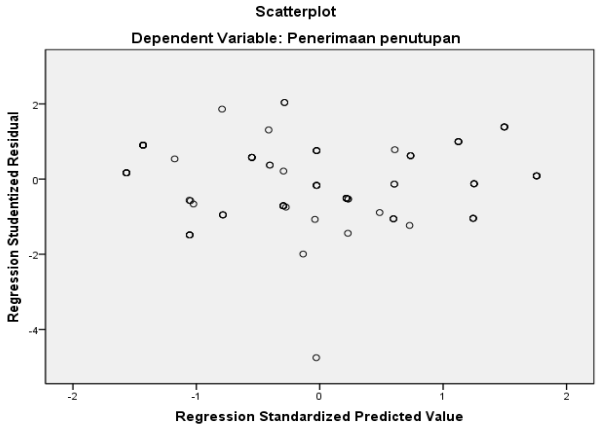


Figure 2. Heteroscedasticity Test Result

The graph above was a *scatter plot*. The graph result illustrated that the patterns spread around the X axis (horizontal line 0) and Y (vertical line 0). The random distribution and spread in the top, below, left, and right of the X and Y axes on line 0 indicated that there was no heteroscedasticity in the regression model.

Autocorrelation

Table 11 - Autocorrelation Test Results

Model	R	R Square	Adjusted R Square	Std. Error the Estimate	Durbin-Watson
1	.817a	.668	.658	1.09551	1.884

a. Predictors: (Constant), keselamatan, kemudahan, manfaat
b. Dependent Variabel: penutupan

From above results, it could be seen that the DW value= 1.884 was higher than dU value = 1.736 and DW value = 1.884 was less than (4 – dU) value = 2.264. In conclusion, it could be stated that there was no autocorrelation in the results of this study.

Multiple Linear Regression Results

$Y = a + b1.X1 + b2.X2 + b3.X3$ (2)

Description:
Y = dependent variable
a = constant (*intercept*)
b = regression coefficient
X = independent variable
Y = 16,638 + 0.390 + 0.392 + 0.580

The interpretation was described as follows:
The a value 16,638 was a constant/state when the closing variable had not been influenced by other variables such as benefits (X1), convenience (X2), and safety (X3). If the independent variable didn't exist, then the closing variable wouldn't change.
B1 = 0.390 value (X1) had positive value for each increasing in 1 variable X1. It affected the benefits role in this closure plan of 0.390 with the assumption that other variables were not examined by this study.
B2 = 0.392 (X2) had positive value for each increasing in 1 variable X2. It affected the convenience role in this closing plan of 0.392 with the assumption that other variables were not examined by this study.
B3 = 0.580, that (X3) had positive value for each increasing in 1 variable X3. It affected the safety role in this closure plan of 0.580 with the assumption that other variables were not examined by this study.

Hypothesis Test Results

t test

Table 12 - Hypothesis Test Results

Coefficients[a]					
Model	*Unstandardized Coefficients*		*Standardized Coefficients*		
	B	*Std. Error*	*Beta*	t	*Sig.*
(Constant)	16.638	2.015		8.256	.000
Benefit	.390	.048	.505	8.180	.000
Convinience	.392	.034	.692	11.506	.000
Safety	.580	.075	.477	7.781	.000
a. *Dependent Variabel*: Closure					

F Test (Simultaneous Test)

Table 13 - Simultaneous

ANOVA[b]					
Model	*Sum of Squares*	df	*Mean Square*	F	Sig.
Regression	231.946	3	77.315	64.421	.000[a]
Residual	115.214	96	1.200		
Total	347.160	99			
a. *Predictors: (Constant*): Safety, Convenience, Benefit					
b. *Dependent Variable*: Closure					

Table 13 described that the results of the F test for variables (X1), (X2), (X3) had F count value 64.421 with significance value 0.000. The F count value of 64,421 was higher than the F table value 2.70. In addition, the significance value of the variables X1, X2, and X3 was 0.000 and it lower than 0.05.

Coefficient of Determination (R2 Test)

Table 14 - Results of the Coefficient of Determination

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error the Estimate**
1	.817[a]	.668	.658	1.09551

a. Predictors: (Constant), keselamatan, kemudahan, manfaat
b. Dependent Variabel: penutupan

Table 14 confirmed that the value of *R Square* was 0.668 = 66.8%. Therefore, it could be concluded that the influence magnitude of the independent variable was 66.8% on the dependent variable.

4. CONCLUSION

According to the analysis results and discussion that had been carried out, the conclusion could be described as follows:

1. The results of traffic conditions at JPL 297 had the highest number of vehicles; 69 vehicles per hour and the lowest 31 vehicles per hour. The results of LHR JPL 297 were 46 vehicles per hour. at JPL 295, the highest number of vehicles passing was 324 vehicles per hour and the lowest was157 vehicles per hour with the number of LHR was 249 vehicles per hour. At JPL 294, the highest number of vehicles was 132 vehicles per hour and the lowest was 90 vehicles per hour with LHR was 107 vehicles per hour. The traffic conditions for JPL 297 were quite reticent, JPL 295 was quite crowded, and for JPL 294 the traffic conditions were moderate.
2. The longest vehicle queue condition at the Sukodadi Village crossing was at JPL 295 with queue length of 23 meters at 11.41 and 11.45 WIB. Furthermore, the longest queue at the JPL 294 crossing was10 meters at 11.13, 12.19, and 13.33 WIB. Meanwhile, at JPL 297, the queue length was relatively the same at each crossing closure which was 5 meters.
3. Based on the data analysis result by using SPSS application, the results obtained for the benefits of closure crossings at JPL 297 and JPL 294 were 8,180. Furthermore, the result of convenience access to Sukodadi

Village and vice versa after JPL 297 and JPL 294 closed was 11.506. Finally, the safety factor received by the society at Sukodadi Village with this closure plan was 7,781. The final result of this study showed that the characteristics of the Sukodadi Village society whom frequently crossed the JPL 297 and JPL 294 crossings. In addition, around 66.8% of the society agreed with this closure plan

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REFERENCES

[1] Z. Zhang, X. Liu, And K. Holt, "Positive Train Control (Ptc) For Railway Safety In The United States: Policy Developments And Critical Issues," *Util. Policy*, Vol. 51, Pp. 33–40, 2018.

[2] F. Septiadi, "Makalah Kebijakan Publik: Penyediaan Transportasi Darat Di Daerah Perkotaan Padat Penduduk," 2018.

[3] I. S. Lubis, S. E. Priana, And A. S. Yusman, "Pengaruh Perlintasan Kereta Api Terhadap Arus Lalu Lintas Disimpangtunggulhitam Kotapadang," *Ensiklopedia Res. Community Serv. Rev.*, Vol. 1, No. 1, Pp. 38–48, 2021.

[4] D. Herianto And A. M. Siregar, "Analisis Solusi Kemacetan Pada Simpang Sebidang Kereta Api Jalan Urip Sumoharjo," *J. Rekayasa Sipil Dan Desain*, Vol. 9, No. 3, Pp. 491–502, 2021.

[5] M. Tri, "Analisis Faktor-Faktor Yang Mempengaruhi Kemacetan Lalu Lintas Di Perlintasan Sebidang (Studi Kasus Di Perlintasan Sebidang Mranggen-Kab. Demak)," *Skripsi*, 2019.

[6] S. Asfiati And D. T. Mutiara, "Studi Keselamatan Dan Keamanan Transportasi Di Perlintasan Sebidang Antara Jalan Rel Dengan Jalan Umum (Studi Kasus Perlintasan Kereta Api Di Jalan Padang, Bantan Timur, Kecamatan Medan Tembung)," *Prog. Civ. Eng. J.*, Vol. 1, No. 2, 2021.

[7] R. Mounce And J. D. Nelson, "On The Potential For One-Way Electric Vehicle Car-Sharing In Future Mobility Systems," *Transp. Res. Part A Policy Pract.*, Vol. 120, Pp. 17–30, 2019.

[8] W. F. Yanti, "Studi Pengaruh Perlintasan Sebidang Jalan Dengan Rel Kereta Api Terhadap Karakteristik Lalu Lintas (Studi Kasus: Perlintasan Kereta Api Jalan Hj. Ani Idrus)," 2018.

[9] O. F. Abioye *Et Al.*, "Accident And Hazard Prediction Models For Highway–Rail Grade Crossings: A State-Of-The-Practice Review For The Usa," *Railw. Eng. Sci.*, Vol. 28, No. 3, Pp. 251–274, 2020.

[10] J. Liu And A. J. Khattak, "Are Gates At Rail Grade Crossings Always Safe? Examining Motorist Gate-Violation Behaviors Using Path Analysis," *Transp. Res. Part F Traffic Psychol. Behav.*, Vol. 55, Pp. 314–324, 2018.

[11] P. Singh, J. Pasha, A. Khorram-Manesh, K. Goniewicz, A. Roshani, And M. A. Dulebenets, "A Holistic Analysis Of Train-Vehicle Accidents At Highway-Rail Grade Crossings In Florida," *Sustainability*, Vol. 13, No. 16, P. 8842, 2021.

[12] D. Jatim, "Retrieved From Sijaka," 2018, [Online]. Available: Https://Monika.Dishubjatim.Id/Map/

[13] J. Liang, K. M. Koo, And C. L. Lee, "Transportation Infrastructure Improvement And Real Estate Value: Impact Of Level Crossing Removal Project On Housing Prices," *Transportation (Amst).*, Vol. 48, No. 6, Pp. 2969–3011, 2021.

[14] N. P. Murnaka And S. R. Dewi, "Penerapan Metode Pembelajaran Guided Inquiry Untuk Meningkatkan Kemampuan Pemahaman Konsep Matematis," *J. Medives J. Math. Educ. Ikip Veteran Semarang*, Vol. 2, No. 2, Pp. 163–171, 2018.

[15] D. Jatim, "Data Kecelakaan Perlintasan Sebidang Jawa Timur 2021.," Jawa Timur, 2021.

[16] T. Sudarwanto, "Pengaruh Kualitas Layanan Dan Harga Terhadap Kepuasan Pelanggan Jasa," *e-Journal UNESA, 6.*, 2018.