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Factors that Affecting the Pedestrian Movement in Wonokromo (Case Study: The Corridor of Jalan Raya Wonokromo, Jalan Stasiun Wonokromo, and Jalan Raya Darmo)

Atikah
Department of Architecture
Sepuluh Nopember Institute of Technology
Surabaya, Indonesia

Haryo Sulistyarso
Eko Budi Santoso
Department of Architecture
Sepuluh Nopember Institute of Technology
Surabaya, Indonesia

***Abstract*— Wonokromo has a main function as a trading and service area supported by residential facilities and public facilities, especially on Jalan Raya Wonokromo's corridor, Jalan Stasiun Wonokromo's corridor and Jalan Raya Darmo's corridor [1]. The activity in Wonokromo has a close proximity so it will be easier to reach on foot. The existence of a transit place such as Terminal Joyoboyo and Wonokromo Station as the entrance of the region, which making Wonokromo as a pedestrian-oriented area. In fact the movement of pedestrians is still minimal, so it need research to see things that affect the movement of pedestrians. This study aims to determine the factors affecting the movement of pedestrians in Wonokromo, especially on Jalan Raya Wonokromo's corridor, Jalan Stasiun Wonokromo's corridor and Jalan Raya Darmo's corridor. The analysis tool that will be used to identify the factors that affect the movement of pedestrians, is multiple linear regression. From the analysis results obtained three factors that affect the movement of pedestrians, travel time travel, public facilities, and availability of main transport.**

Keywords—Factors; Pedestrian; Wonokromo

I. INTRODUCTION

The development of a city is always accompanied by an increase in the number of population, which causes the increase in population activity, due to increased activity, the need for infrastructure and supporting facilities become very important. This is because transportation is a strategic aspect in the development and growth of the city [2]. However, the consequences of the need for infrastructure and transportation facilities cause new problems, such as the unbalanced growth of transportation infrastructure (roads) and transportation facilities (vehicles). Increasing the number of vehicles is not balanced with the growth of roads, resulting in traffic density [3]. One solution to anticipate the traffic density is by walking.

Walking is part of the transportation system or the linkage system which is quite important. Because by walking, we can reach all corners of the city that can not be reached by using a vehicle [4]. Walking is included in the transport system that can connect various functions between regions, creating a humane city environment [5]. Things to consider for walking activity is the need for running space within a city, the need for integration with other systems, and the need for connections with transport elements such as parking lots, shelters, stations, land use [6]. Whatever means of transportation is used, walking is the most recently used mode of transportation that connects land and travel by motor vehicle [7].

The city of Surabaya is the second metropolitan city after Jakarta, with a large population and always increasing all day. Resulting in the demand for transportation continues to increase, especially private transportation. The length of the road in Surabaya over the last three years has increased by an average of 0.15% per year, while the number of motor vehicles in Surabaya increased by an average of 6.4% per year [8]. This indicates that there is an imbalance between the number of vehicles with the length of the road, so that congestion appears. To anticipate this the Surabaya City government made a policy on infrastructure and facilities for pedestrians that existed in the RTRW Surabaya 2016-2021.

Wonokromo is an area that has the potential as a pedestrian area, the road corridors that have great potential are Jalan Raya Wonokromo's corridor, Jalan Stasiun Wonokromo's corridor and Jalan Raya Darmo's corridor. On Jalan Raya Wonokromo, there is a huge point of rise of trading and service activities, namely Darmo Trade Center (DTC) / Wonokromo market. The existence of DTC is causing the accumulation of vehicle flow due to up and down passenger mikrolet, causing congestion on the road corridor, especially during working hours. On Jalan Raya Darmo there is a transit point that is Joyoboyo's Terminal and recreational activity that is Surabaya Zoo (KBS). The existence of Joyoboyo and KBS Terminals is a great potential for people coming from outside the Wonokromo region to utilize KBS as a place of recreation. At Jalan Stasiun Wonokromo there is a transit point of Wonokromo, that is Wonokromo's station and DTC (east side of the building), on this road corridor there are potential and problems, the potential is DTC, which is the biggest trading and service center in South Surabaya, strategic location and easy to reach trategic location and easy to reach makes DTC crowded visited. While Wonokromo station is a station located in the south of Surabaya and become the gate of the train entrance from the south (Malang / Banyuwangi) and southwest (Madiun) to Surabaya. Due to the large number of activities on the corridor of Jalan Stasiun Wonokromo, the roads are jammed, especially during working hours.

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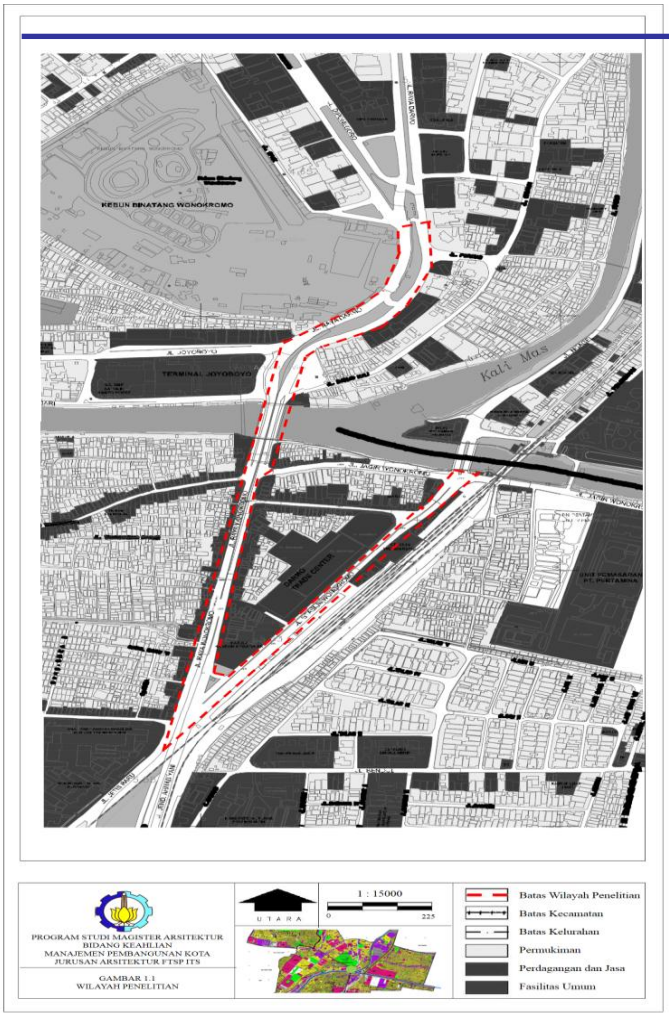

Fig. 1. Study Area

Based on RDTRK UP Wonokromo 2016 - 2021, there is a pedestrian network system development program to support pedestrian movement on road corridors in Wonokromo, with the aim of improving accessibility. Pedestrian activity can be supported by integrating the provision of mass transit facilities and the function of the surrounding public land, this is done to avoid the emergence of congestion on the road corridor in Wonokromo. The plan is still far from expectations, where the movement of pedestrians in Wonokormo still minimal, it is necessary to do research on factors that affect the movement of pedestrians in Wonokromo.

II. METHODOLOGY

A. Population

The population in use consists of pedestrians in Wonokromo Highway corridor, Wonokromo Street Station, and Jalan Raya Darmo.

B. Sample

The sample is the part or number and characteristics possessed by the population [9]. When the population is large, and researchers are unlikely to study everything in the population, eg due to limited funding, energy and time, the researchers will take samples from that population. What is learned from the sample, the conclusion will be applied to the population. For that sample taken from the population must be really representative [9].

Accidental sampling is a sampling procedure that selects samples from the most accessible and accessible person or unit [10]. Accidental sampling takes the respondent as a sample by chance, that is anyone who by chance met with the researcher can be used as a sample, if the person encountered in accordance with the main criteria, that is pedestrians who are active in the area Wonokromo .[11] In this study the population used is the pedestrian in the area Wonokromo Surabaya. In this study the population is not known, so to facilitate the determination of the number of samples taken is determined by the formula;

$$n=[(Z\ ½.\propto)/E]^2 \quad (1)$$

$$n=[(Z\ ½.0,05)/0,20]^2$$

$$=[1,96/0,20]^2 = 96,04$$

n = Number of samples

Z½ = Table of normal distribution of samples

∝ = Sampling error

E = Error of estimate

The confidence level in this study is 95%, then the value Z½ is 1.96. The sample error rate is determined at 10%. Based on the above formula taken a sample of 96.04 people. To facilitate the calculation then rounded up to 100 people.Tingkat keyakinan dalam penelitian ini sebesar 95 %, maka nilai Z½ adalah 1,96.

C. *Analysis of the Factors Affecting the Pedestrian Movement on the Road Corridor in Wonokromo*

The technique used in analyzing the factors influencing pedestrian movement by using multiple linear regression analysis, this analysis is used to know the influence between several independent variables (x) to one dependent variable (y).

The stages of multiple linear regression analysis is by performing classic assumption test (normality test, multicolonierity test, and heteroscedasticity test), goodness of fit test and hypothesis test, where the stages will use SPSS (Statistical Product and Service Solution) program. The equations of the multiple linear regression are;

$$Y = a+b1\ X1+b2\ X2+b3\ X3+b4\ X4+b5\ X5+b6\ X6+b7\ X7+b8\ X8+b9\ X9+b10\ X10+\ b11\ X11+\ b12\ X12+\ b13\ X13+\ b14\ X14+\ b15\ X15+\ e \quad (2)$$

III. DISCUSSION

A. *Multiple Linear Regression Test*

- Partial Test

Based on the significance value obtained by using α = 5%, there are 3 variables that significantly influence the frequency of pedestrian movement, that is travel time (X4), public facility land use (X8), availability of main transport (X9).

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TABLE I PARTIAL TEST

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	3.099	.531		5.839	.000		
X4	-.290	.100	-.254	-2.909	.005	.970	1.030
X8	.689	.139	.465	4.949	.000	.838	1.193
X9	.437	.123	.339	3.558	.001	.815	1.226

a. Dependent Variable: Y

Sources : Result of Regression Analysis, 2016

- Normality Test

The ρ-plot graph shows the spreading dots around the diagonal line, as well as its distribution following the normal line. While the form of histogram resembles a bell indicates that the data used is normally distributed. To strengthen the test results are used Kolmogorov-Smirnov test.

Based on KS test result is 0,139 and significance value greater than 0,05 (>5%), so H0 is rejected. Therefore it can be concluded that the residual has fulfilled the normality assumption. From the table above can be seen that the value of significance is equal to 0.139 > 0.05, which means the residual value has been normally distributed.

TABLE II. NORMALITY TEST

One-Sample Kolmogorov-Smirnov Test

		Standardized Residual
N		100
Normal Parameters[a,,b]	Mean	.0000000
	Std. Deviation	.98473193
Most Extreme Differences	Absolute	.115
	Positive	.115
	Negative	-.059
Kolmogorov-Smirnov Z		1.155
Asymp. Sig. (2-tailed)		.139

a. Test distribution is Normal.

b. Calculated from data.

Sources : Result of Regression Analysis, 2016

- Multicolinearity Test

The model is declared free of multicollinearity if it has a VIF value below 10 or tolerance above 0.10. The identification of multicollinearity testing is done by checking the VIF value, if the VIF value generated is less than 10 then there is no multicollinearity among the predictive variables. In the table above can be seen all VIF values below 10 or tolerance values above 0.10, which means there is no case multicollinearity between predictive variables because in each variable predicator has a VIF value smaller than 10.

TABLE III. MULTICOLINEARITY TEST

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
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X8	.689	.139	.465	4.949	.000	.838	1.193
X9	.437	.123	.339	3.558	.001	.815	1.226

a. Dependent Variable: Y

Sources : Result of Regression Analysis, 2016

- Heterocedasticity Test

Heteroscedasticity testing was performed by gletjser, yang meregresikan absolut residual terhadap ketiga variabel test, which regresses residual absolute against the three predictive variables that are significant to the frequency of pedestrians. The hypothesis used is;

H0: no heteroscedasticity occurs

H1: heterokedastisitas occur

On the basis of decision-making, if the probability (sig value) is greater than 0.05 then H0 is not rejected. And if the probability (sig value) is less than 0.05 then H0 is rejected.

TABLE IV. HETEROKEDASTICITY TEST

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.858	.328		2.618	.010
X4	.070	.062	.115	1.133	.260
X8	-.100	.086	-.128	-1.168	.246
X9	-.084	.076	-.122	-1.103	.273

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	X9	-.084	.076	-.122	-1.103	.273

a. Dependent Variable: AbsRes

Sources : Result of Regression Analysis, 2016

The identical residual assumption assay results indicate that all predictive variables have a sig value greater than 0.05 where;
X4 = 0.260 > 0.05
X8 = 0.246 > 0.05
X9 = 0.273 > 0.05
So H0 is not rejected, which means there is no heterokedastisitas on the whole variable.

- Autocorrelation Test

The autocorrelation test aims to test whether in the linear regression model there is a correlation between the observation of the i-th sample with the i-1 observation. The autocorrelation assumption in this study used durbin watson analysis. Decision making is done by comparing d test result with indigo dU and dL value, if significance level is α apply decision rule as follows;
d < dL: reject H0 (no autocorrelation occurs)
d < (4 - dL): reject H0 (no autocorrelation occurs)
dU < d < (4 - dU): failure to reject h0 (autocorrelation occurs)

Independent residual assumption testing is used to test whether there is correlation between residuals, test statistic used is durbin watson with hypothesis as follows:
H0 : ρ = 0 (residual independent)
H1 : ρ ≠ 0 (residual not independent)

The independent residual assumption test is performed with durbin watson test. The result of statistical test of watbin durbin is 2,119. Based on table significance α = 5%, durbin watson statistic calculation result for n = 100, K = 3 is dL equal to 1,482 and dU equal to 1,604. Thus the value of watbin durbin test statistic is greater than dL therefore, H0 fails to be rejected which means that no residual or residual correlation has met the independent assumption

TABLE V. AUTOCORRELATION TEST

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.539[a]	.291	.269	1.268	2.119

a. Predictors: (Constant), X9, X4, X8

b. Dependent Variable: Y

Sources : Result of Regression Analysis, 2016

- Goodness of Fit Test

Goodness of Fit test is to see the suitability of the model, or how much the ability of the independent variable in explaining the variance of the dependent variable. R value of 0,539. In the research model and the coefficient of determination of 0.291. It appears that the ability of independent variables in explaining the dependent variable is 29.1%, so there is still 70.9% variance of dependent variable which has not been explained by independent variable in this research model. Although the contribution is only 29.1% it can still be tolerated, because the assumption of inferences obtained in this study is in accordance with the existing theory, so the result will be more consistent and stable [12].

TABLE VI. GOODNESS OF FIT TEST

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.539[a]	.291	.269	1.268

a. Predictors: (Constant), X9, X4, X8

b. Dependent Variable: Y

Sources : Result of Regression Analysis, 2016

Based on the results of multiple linear regression analysis with stepwise method, it was found that the variable that has the greatest contribution to the frequency of pedestrian movement is variable X9, that is the availability of main transport. Where the variable gives influence of 29,1%, while settlement land use (X8) gives influence 22,8% and travel time (X4) give influence equal to 10,4%. According [12] significant not mean much or big, which is usually associated with the effect size or effective contribution. The effect size may be small but the result is more reliable or otherwise with a large but unbelievable effect size, as if X affects Y significantly but its effective contribution is small. This happens, because statistical tests such as regression, aims to prove the presence or absence of influence, not the amount of influence.

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TABLE VII. STEPWISE TEST

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.322[a]	.104	.095	1.411
2	.478[b]	.228	.213	1.316
3	.539[c]	.291	.269	1.268

Sources : Result of Regression Analysis, 2016

- Anova Test

Anova test is to see the effect of independent variables on the dependent variable simultaneously. The hypothesis used is;

H0: β = 0 (the regression model Y to X is not significant / not appropriate)

H0: β0 ≠ 0 (regression model of X significant / appropriate)

Significance used in this study is α = 5%. The value of F arithmetic in this study;

TABLE VII. ANOVA TEST

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	63.345	3	21.115	13.132	.000[c]
	Residual	154.365	96	1.608		
	Total	217.710	99			

a. Predictors: (Constant), X8, X9, X4

b. Dependent Variable: Y

Sources : Result of Regression Analysis, 2016

With a significance value of 5%, degrees of numerator dk = 3 and degrees freely denominator df = n - k - 1 = 100 - 3 - 1 = 96. Then obtained F table of 2.70. It appears that the value of F arithmetic in the research model is 13.132 with a significance level of 0.000. The significant value is below 0.05 indicating that the independent variables simultaneously have significant influence on the frequency of pedestrian movement at 5% significance. Because the value of F arithmetic (13,132) > F table (2.70) and Sig (0,000) < 0.05 then the decision is rejected H0, which means the regression model Y to X is appropriate / significant or with 5% significance of travel time, Land use of public facilities and the availability of main transport together affect the frequency of movement of pedestrians in the area Wonokromo.

- Multiple Linear Correlation Coefficient

From the value of R can be seen that the interval value is in the range 0.40 - 0.5999, which is 0.539, which means the level of relationship between variables Y to X4, X8, and X9 is enough.

B. Interpretation of Multiple Linear Regression

Based on the result of multiple linear regression analysis obtained that there are 3 variables that affect the frequency of movement of pedestrians in Wonokromo. So it can be composed of multiple linear regression equation as follows;

$$Y = 0{,}3099 - 0{,}290\ X4 + 0{,}689\ X8 + 0{,}437\ X9 + e \quad (3)$$

Where :

Y = frequency of pedestrian movement

X4 = travel time

X8 = land use of public facilities

X9 = availability of main transport

Constant value of 0.3099. This means that if the travel time, land use of public facilities, and the availability of the main transport, will experience changes or reductions, the frequency of pedestrian movement of a constant value of 0.3099.

The coefficient of travel time (X4) is - 0,290 and its value is negative, this indicates that the travel time has a relationship in opposite direction to the frequency of pedestrian movement. This implies that any increase in the value of travel time of one unit, then the frequency of pedestrian movement will decrease by 0.3099 with the assumption that other independent variables of the regression model is fixed. So, when travel time in Wonokormo increasing, then the movement of pedestrians in Wonokromo will decrease further. Where based on interviews of pedestrian questionnaires in Wonokromo, as many as 34% of pedestrians declare travel time more than 20 minutes walk to get to the destination.

The coefficient of public facility land use (X8) is 0,689 and its value is positive. This implies that each rise in the value of a one-unit public facility land use, the frequency of pedestrian movement will rise by 0.3099 with the assumption that the other independent variables of the regression model are fixed. So when the land use of public facilities increases then the movement of pedestrians will also increase. Where based on the questionnaire, public facilities land use at this time as much as 36% still not support the emergence of movement of pedestrians in Wonokromo.

The value of the main transport availability coefficient (X9) is 0.437 and the value is positive. This implies that for every increase in the value of the availability of a single unit of transport, the frequency of pedestrian movement will go up by 0.3099, assuming that the other independent variables of the regression model are fixed. So when the availability of public transport is increasing, the movement of pedestrians will also increase. Where based on interviews of pedestrian questionnaires in Wonokromo region, as many as 39% of pedestrians said the availability of existing major transportation is enough to help the needs of pedestrian mobility in Wonokromo.

IV. CONCLUSION

Based on the analysis of factors affecting the movement of pedestrians in Wonokromo, especially on the corridor of Jalan Raya Wonokromo, Jalan Raya Darmo, and Jalan Stasiun Wonokromo, there are three influential factors, namely travel time, land use of public facilities, and availability of transportation main. Sequentially the most influential factors

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are the availability of main transport, then land use of public facilities, and the last time travel.

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