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## Analysis of Backward Methods for Determining Trip Attraction Model on Commercial and Service Area in Sukun Raya Road, Banyumanik, Semarang.

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**Abstract.** One strategy for sustainable development planning is to minimize future problems. To minimize future problems modelling is needed to predict future conditions based on current characteristics. Commercial areas located in the Sukun Raya Road Corridor, Banyumanik Sub-district are small-scale trade and trade areas in the central government area. Development of trade and small-scale areas must be supported by the existence of a trip attraction model that can be used to predict future trips in the region. The aim of this article is to develop trip attraction model. The model is multiple linear regression analysis. Multiple linear regression analysis using the backward method shows that there is a relationship between the Y variable which consists of the total visitor's attraction (pcu/hour) with the independent variable  $X_2$  (store area),  $X_3$  (store parking area), and  $X_4$  (sales income) . The relationship between the dependent variable Y with the independent variables  $X_2$ ,  $X_3$ , and  $X_4$  is very influential with the value  $R^2$  0.820 with the resulting equation model  $Y = -1.504 + 0.021 X_2 - 0.085 X_3 + 9.847E-7 X_4$ . This model can be used to estimate and anticipate trip attraction in small-scale commercial and services areas based on store area plans, large parking areas, and sales income. This model can be used as a consideration in planning and structuring commercial areas small scale to anticipate transportation problems because they contribute to the flow of traffic in Sukun Corridor.

**Keywords:** trip attraction model, multiple linear regression, backward method, commercial and service areas

### 1. Introduction

The city transportation system is very influential on urban development in both developed and developing countries [1]. The development of a city goes parallel with the development of the problem of urban transportation. The problems of city transportation include the density of traffic flows, congestion, vehicle queues, and side frictions. The transportation problem is caused by the high level of urbanization in a city. The high level of urbanization in a city is a major problem that must be faced especially for developing countries [2]. The rapid flow of urbanization will affect the increase in travel demand and the need to use transportation services to carry out a travel movement [3].



Transportation modeling is a concept that applies development to transportation infrastructure systems, movement systems, and forecasting the need for transportation to efficiently plan movements [3,4]. Transportation modeling is done by collecting detailed and complete data on traffic flow conditions. Modeling analysis conducted aims to estimate the needs of transportation facilities and infrastructure such as the need to provide parking spaces in the transportation movement environment [3,5,6]

Land use that creates travel traction includes commercial and services, work zones, and density of buildings, these factors form new urban concentration [7,8]. Trip attraction is determined based on two types of shopping centers: one with medium scale and small-scale shopping centers [8,9]. By type, small-scale shopping centers have a higher average travel rate compared to mid-scale shopping centers. From previous studies it was found that the level of travel in small-scale shopping centers was much higher than the level of travel in medium-scale shopping centers [2]. This suggests that the high average rate of travel in small-scale shopping centers is influenced by the scale of the shopping center and the size of shopping centers.[8]

Banyumanik Subdistrict is one of the regions that has developed commercial and service areas from the development of residential areas [10]. Jalan Sukun Raya Banyumanik is one of the entrances to the residential area. Jalan Sukun Raya Banyumanik is the main attraction for businesses to develop commercial and service areas. Development of commercial and services areas, visitor attraction activities can affect road conditions, one of which is traffic flow [11]. Research on trade zones like this is needed to anticipate problems that arise because of their development.

## 2. The Aim of Study

The purpose of this study is to make a trip attraction model in small scale commercial and service area in road corridor in Sukun Road, Banyumanik, Semarang City

## 3. Data and Methods

The data was collected in 51 outlets of commercial and service area along 200 meters from the area entrance from Jalan Setiabudi. The commercial and service area on Jalan Sukun Raya Banyumanik was chosen as the research location because the area developed into a service sub-center. The data is based on dependent variable the number of visitors attracted by outlet (passenger car unit / hour). These data obtained from the field observations conducted at the peak of outlets activity for 1 hour. As independent variables the data collected by  $X_1$  = Number of store employees (people),  $X_2$  = Area of shop floor ( $m^2$ ),  $X_3$  = Storehouse parking area ( $m^2$ ),  $X_4$  = sales income (rupiah). The independent variables chosen were collected through interviews with store managers on outlets commercial and services.

The trip attraction model in this study will be carried out using multiple linear regression with the backward method. The backward method is a reverse elimination procedure that works inversely. All independent variables are initially added to the equation. Variables with the weakest coefficients (as defined by the level of significance) are deleted, and the model is estimated to return. Furthermore, the variable with the weakest coefficient on the second model is omitted, and the model is re-estimated. This procedure is repeated until no independent variables are left in the model or the stop criteria are met. The usual criteria is that all remaining variables pass a certain level of significance (called p-to-remove). Statistical tests carried out include test coefficient of determination, F test, coefficient analysis / model interpretation, ANOVA test or t table value and heteroscedasticity test.

## 4. Result and Discussion

The model of trip attraction and service areas is shown in the coefficient table where the number of trip attraction can be seen by the forming coefficients of the model equation.

**Table 1.** Coefficient for Each Variable Using Backward Method

Variable	B coefficients	t	significant
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Variable	B coefficients	t	significant
Constanta	-1.504	-.670	.506
X2	.021	2.585	.013
X3	-.085	-3.760	.000
X4	9.847E-7	8.449	.000

Regression models obtained a  $Y = -1.504 + 0.021 X_2 - 0.085 X_3 + 9.847E-7 X_4$ . Based on the linear regression equation model it can be concluded that the independent variables that determine the magnitude of the travel attraction are variables  $X_2$ ,  $X_3$ , and  $X_4$ .

Based on the model of attraction of visitor vehicles traveling in the commercial and services area on Jalan Sukun Raya, the equation is used to predict the trajectory of the travel of the trade area on the road corridor. The attraction model shows the variables that influence vehicle trip attraction, namely the variable sales turnover of the store at peak time. The equation obtained in this study is different from the previous research equation model which lies in the independent variables that come out to be the model. The characteristics of small-scale commercial and services on Jalan Sukun Raya are not influenced by the size of the store area, the number of employees and the parking area, but from the amount of sales turnover obtained by each store that most influences the attraction of visitor vehicle trips. This shows that each type of commercial and services area and shopping center has different travel influences.

In the table IV.1 explained about the T-test or the value of each coefficient. The value of t will be significant if it has a sig value  $<0.05$ . This significant value means that the variable has a significant effect on the dependent variable. In model 1, significant variables include  $X_2$ ,  $X_3$ ,  $X_4$ . In model 2 is a variable that already has sig  $<0.05$  so that the variables in model 2 have a significant influence on the dependent variable.

Research on the trip attraction to shopping center with multiple linear regression methods has the equation  $Y = 167.17 + (-1.0774 X_2) + (0.0031 X_4)$  [3]. The variables that came out became the model in the form of a variable parking area for two-wheeled vehicles, and the floor area of the mall. The pulling equation on variable  $X_2$ , which is a parking lot for two-wheeled vehicles, is negative, which means that every reduction in the parking area for two-wheeled vehicles contributes to increasing travel attraction to the mall.

This model consist R square 0.820, which means that between the independent variables  $X_2$ ,  $X_3$ , and  $X_4$  has a very strong relationship to the dependent variable, namely the attraction of the visitor's vehicle volume (pcu / hour). In previous studies, namely at points of commercial and services areas spread in medium-sized cities in Kerala, the value of Adjusted R Square was 0.9997 from the results of multiple linear regression analysis [5]. The value of adjusted R Square has a meaning where the contribution of the influence of independent variables on visitor car traction is 99% while the value of R Square is 0.9999 which indicates 99% of the variation in travel is influenced by variable number of employees and percentage of office variables at node, while 1% is influenced by other factors.

Based on this, it can be concluded that each independent variable produced from the model has different effects depending on the dependent variable and the characteristics of the research location. The commercial and services in the Sukun Raya Corridor are obtained by the R Square value of 0.757 which indicates the trip attraction is influenced by the variable sales turnover of 75% while 25% is influenced by other factors. This high R Square value shows a high correlation between the observed and predicted trip, the valid model.

From F test, obtained F count for the model obtained 71.520. By using a significance level of 0,000. Because the probability of 0,000 is far less than 0.050, the regression model can be used to predict the attraction of vehicle travel. Variables  $X_2$ ,  $X_3$ , and  $X_4$  can also be said as variables that influence the attraction of vehicle travel.

In previous studies that were conducted at points of commercial and services areas spread in medium-sized cities in Kerala had a significance of F value of 0.0083, where the significance value

was smaller than 0.050 meaning that there was a linear relationship between all independent variables with dependent variable [5]. The significance of the F value in the first model is 0,000, where the value is less than 0.50, meaning that there is a linear relationship between the variable sales turnover at the peak time to the travel attraction of the total vehicle and motor vehicle visitors.

t-test statistic is used to test the significance of constants and regression coefficients. This test based on hypotetic :

$H_0$  = regression coefficients and constants are not significant

$H_1$  = regression coefficients and constant are significant

Decision-making

Based on statistics on t table values

If the statistic value is  $t_{Calculate} < t_{Table} (2,012)$ , then  $H_0$  is accepted

If the statistic value is  $t_{Calculate} > t_{Table} (2,012)$ , then  $H_0$  is rejected

Based on probability

If the probability is  $> 0.05$ , then  $H_0$  is accepted

If the probability is  $< 0.05$ , then  $H_0$  is rejected

In this model with variables  $X_4$  and  $X_2$  it can be explained that statistics  $t_{Calculate} > t_{Table}$ , and the value of Sig.  $< 0.05$ , then  $H_0$  is rejected, meaning that the regression coefficients and constants really have a significant effect on non-independent variables. In model 1 with  $X_3$  variable statistics  $t_{Calculate} < t_{Table}$  statistics, and Sig.  $< 0.05$ , then  $H_0$  is accepted, which means that the regression coefficients and constants do not significantly influence the non-independent variables.

In this study heteroscedasticity test is a test that assesses whether there is an inequality of variants from residuals for all observations on the model produced in multiple linear regression. This test is one of the classic assumption tests that need to be done in linear regression analysis. In the discussion of this test the results can be seen through a graph of scatterplots.

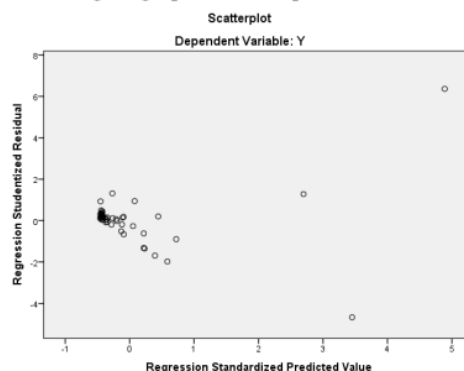


Figure 1. The Scatter Plot

Based on the results of the scatterplots graph it can be seen that the data points spread above and below or around the number 0. The points do not gather at the position above or below. The spread of the data points does not form a wavy pattern then narrows and widens again. Distribution of non-patterned data points. This it can be concluded that the heteroscedasticity problem is not detected on the model, so the resulting regression model is good and ideal for predicting trip attraction.

In previous studies that were conducted at points of commercial and services areas spread in medium-sized cities in Kerala, the model of travel traction  $Y = 93.579 + (0.169 X_1) - (5.653 X_7)$ . The variable  $y$  is 10% of commercial node trip attraction, variable  $X_1$  is the total number of employees and  $X_7$  is the percentage of the number of offices in commercial nodes [5]. The interpretation of the model where travel will increase by an average of 0.169 trips per day for each addition of 1 employee and the trip will decrease by an average of 5,653 trips for each 1% increase in the percentage of offices in the

**commercial node.** Research on the travel attraction to the mall with multiple linear regression methods has the equation  $Y = 167.17 + (-1.0774 X_2) + (0.0031 X_4)$  [12]. The variables that came out became the model in the form of variable parking area for two-wheeled vehicles, and the floor area of the mall. The pulling equation on variable  $X_2$ , which is a parking lot for two-wheeled vehicles, is negative, which means that every reduction in the parking area for two-wheeled vehicles contributes to increasing travel attraction to the mall.

A trip attraction study conducted in Kerala [8] which found model 1:  $Y = 35,480 + 0,077 X_1 + 63,136 X_2 + 23,739 X_3$ , which is a variable that affects 15 minutes of people traveling to shopping centers in the form of gross floor area per 1000 square feet, parking availability. In model 2, the equation  $Y = 34,010 - 0,10 X_1 + 53,984 X_2 + 23,778 X_3$  is found, which is the variable that influences the 15-minute trip of people to the shopping center in the form of the total number of stores, parking availability. Based on the equations obtained, it can be shown that the attraction of people's trips to the shopping center is influenced by the number of shops and parking lots available at the shopping center.

Based on the model of attraction of visitor vehicles traveling in the commercial and services area on Jalan Sukun Raya, the equation  $Y = -1.504 + 0.021 X_2 - 0.085 X_3 + 9.847E-7 X_4$  is used to predict the trip attraction of the commercial area on the road corridor. The trip attraction model shows the variables that influence the attraction of vehicle travel include the variable area of the floor, parking area, and store sales turnover at peak time. The equation obtained in this study is different from the previous research equation model which lies in the independent variables that come out to be the model. The characteristics of small-scale commercial and services on Jalan Sukun Raya are not influenced by the size of the store area, the number of employees and the parking area, but from the amount of sales turnover obtained by each store that most influences the attraction of visitor vehicle trips. This shows that each type of commercial and services area and shopping center has different travel influences.

## 5. Conclusion

Based on the analysis of the travel attraction model in the commercial and services area on Jalan Sukun Raya Banyumanik Semarang, it can be concluded that the travel attraction in the small-scale trading area and services is influenced by socio-economic character, namely sales income in the form of pull models  $Y = -1.504 + 0.021 X_2 - 0.085 X_3 + 9.847E-7 X_4$  where  $Y$  is the total attraction of the visitor's car and motorbike (pcu/hour) and  $X_2, X_3, X_4$  (store area, parking areas, sales income). This model can be used as input in planning and structuring trade areas and small-scale service services to anticipate transportation problems because they contribute to the flow of traffic.

## Acknowledgement

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