An analysis of population using Multiple Linear Regression Analysis

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Abstract. Makassar is one of the metropolitan cities located in South Sulawesi Province, the rapid progress of Makassar city makes Makassar as the destination of Eastern Indonesia as a center of education, health, job search and so on. Of course, this led to the emergence of new activity centers or new settlements that led to the rise of travel, resulting in a decrease in the level of road services. The purpose of this study is to analyze the trip generation of residents in the Puri Yuhana Permai housing and Bukit Khatulistiwa housing estates by using variables of the number of family members, the number of family members working, the number of families attending school/college, income, motorcycle ownership and private car ownership. Use the multiple linear regression method SPSS 25.0. The results of the research on each housing estate show that the variables that have a significant effect on the rise of the population journey on the housing of Puri Yuhana Permai and Bukit Khatulistiwa are the number of working (X5) and the number of who attend school (X6). This can be seen in the model of multiple linear regression equations namely $Y = 0.202 + 0.570X5 + 0.501X6$ for Puri Yuhana Permai housing. $Y = 0.182 + 0.378X5 + 0.249X6$ for Bukit Khatulistiwa housing.

1. Introduction

Travel is a person's movement from one place to another. The journey is formed because of activities carried out not in the place where he lives. The characteristics of a resident's trip depend on the purpose of the trip. The form of this activity will greatly determine the movement pattern of a system, let alone associated with a zone / region, where the movement of individuals in one zone will be different from other zones which are also greatly influenced by the characteristics of each traveler [1] [2]. This is the phenomenon of Makassar City.

Makassar City is one of the metropolitan cities located in the South Sulawesi Province of the Republic of Indonesia. The rapid progress of the city of Makassar has made the city of Makassar a destination for the people of East Indonesia as a center for education, health, seeking employment and so on. Of course this has led to the emergence of new activity centers or new settlements which have resulted in a trip generation, resulting in a decrease in the level of road services. Therefore, the facilities and infrastructure of the city of Makassar should be proportional to the population of the city of Makassar. Especially the transportation facilities and infrastructure in the city of Makassar in order to meet all the needs of the community in carrying out their activities.

Basically, an area or residential complex will generate trips or movements that can add to the traffic load on the existing road network so that later it can affect the degree of service on the road. Trip generation is the first step in four-stage transportation planning, followed by trip distribution, mode choice and network assignment, used in estimating the number of trips originating or destined for a zone in traffic analysis [3] [4] [5].
Housing development in Biringkanaya Subdistrict, Makassar City in the eastern part is due to the increasing demand for housing. Middle and large-scale housing developments in this districts are increasing in line with the population growth rate. The growing need for housing has attracted the interest of housing developers to build a housing complex with a comfortable residential environment. This situation can be seen in the residential areas of Puri Yuhana Permai and Bukit Khatulistiwa, Biring Kanaya District, Makassar City. Most of this area is a residential area inhabited by residents with many activities outside the residential area, including in office areas, schools, markets, and so on in order to meet community needs. So as to cause a trip bagkitan.

This trip generation will increase the traffic load on the main roads leading to their respective activities so that it will affect the level of existing road services. By producing a trip generation model, it is hoped that it can become an example to estimate the number of trips made by residents in the residential areas of Puri Yuhana Permai and Bukit Khatulistiwa, so that it can be an input in planning the transportation system in the area to reduce the reduction in road service levels.

Some of the previous researchers who examined population travel and resident travel generation include: A Departure Time Choice Model [6], An analysis of the travel time [7] [8]. Meanwhile, research on populations trip generation, among others, is the Study of Commuter Movement Generation in Housing located on Makassar City Sub-urban [9]. The Trip Generation Model of Coomuters in Makassar City Sub-urban (Case Study of Tirasa Pratama Housing) [10]. Analysis of Trip Generation Home-Based at Bumi Tamanlarea Permai Housing, Makassar City [11]. Study of Traffic Generation and Attraction Using Regression Analysis Method: Case Study in the Region Bandung Raya [12], Urban Travel Generation Modeling Study [13].

The purpose of this study is to analyze the travel generation of residents in the Puri Yuhana Permai and Bukit Khatulistiwa housing estates by using the variables of the number of family members, the number of family members working, the number of families attending school / college, income, motorcycle ownership and private car ownership.

2. Methodology
2.1. Research location
This research was conducted in 2 different housing estates, namely Puri Yuhana Permai Permai and Bukit Khatulistiwa which are located on Perintis Kemerdekaan Street Km. 13 sub-district Daya, Biringkanaya district, Makassar City. Where the two houses have opposite positions and are separated by Perintis Kemerdekaan Road as shown in Figure 1.

2.2. Data Analysis
In this case, the data processing from the survey results is in numerical form and will be analyzed with an empirical statistical-mathematical formula. The stages of the data analysis technique are described as follows:

2.2.1. Analysis of Population Characteristics
At this stage, an analysis of the characteristics of the population's work is carried out by classifying the data which is done by processing the data that has been obtained through the survey in the questionnaire on the code sheet. Later, the code sheets are arranged based on each variable studied using a frequency table so that additional information can be obtained through observations, interviews, and literature studies.

2.2.2. Trip generation analysis
The trip generation analysis is in the form of the best model in the form of linear equation models and multiple equations. The analysis will use the linear regression equation method and multiple regression equation. The output of this analysis is in the form of a mathematical model which states the factors that influence the trip generation.
2.2.3. Regression Analysis
At this stage, data analysis of the trip generation is processed using the Regression Analysis Method (MAR). Data processing with MAR was carried out with the help of the Statistical Program for Special Science (SPSS) program. The result obtained is a trip generation model with the largest $R^2$. The analysis is carried out to detect the amount of traffic flow by conducting a study of the existing trip generation with more attention to the value of the dependent variable and the value of the free variable. Which later results in the number of trips by residents who live in the settlements of Puri Yuhana Permai and Bukit Khatulistiwa in mathematical form.

3. Result and Discussion
3.1. Characteristics of the population
Data collection for the number of samples from the population of Puri Yuhana Permai Permai Housing was carried out by means of Proportionate Stratified Random Sampling with calculations using the Slovin formula [14]. From the calculation results, the total sample size is 55 samples of Puri Yuhana Permai Permai Housing and 75 samples for Bukit Khatulistiwa Housing.

3.1.1. Puri Yuhana Permai Housing
From the results of the data collection on the characteristics of the population of Puri Yuhana Permai housing, it can be seen that the percentage of family members is as shown in Figure 2. The percentage of the number of family members in this housing between 1 to 4 people is 61.8% and between 5 to 7 people is 38.2% while the percentage There are 83.6% of family members who work for 1 person and 16.4% for 2 people who work. The percentage of total family members attending school / college is 49.1% for 1 person, 41.8% for 2 people and 9.1% for 3 people who attend school / college in each household. In this housing, there are 7.3% who earn 1 million to 3 million, 61.8% who earn 4 million to 6 million, 16.4% who earn 7 million to 9 million and 14.5% who earn $> 9$ million. The percentage of motorcycle ownership in this housing estate is 3.6% who do not own motorbikes, 72.8% who own 1 unit and 23.6% who own 2 motorbikes. For private car ownership in this housing estate, there are 12.7% who do not own a private car, 69.2% own 1 car, 14.5% own 2 cars and 3.6% own 3 cars.
Based on the results of the survey that has been conducted, the number of trip generation at Puri Yuhana Permai Housing is as shown in table 1.

| Trip generation | Percentage |
|-----------------|------------|
| 3 Trip          | 41.82      |
| 4 Trip          | 40.00      |
| 5 Trip          | 18.18      |

From table 1, it can be seen that the number of trip generation in this housing complex is 41.82% with 3 trips, 40% with 4 trips and 18.18% with 5 trips.

3.1.2. Bukit Khatulistiwa Housing
The results of the survey conducted on the characteristics of the population are visualized as shown in Figure 3. In this housing there are 61.3% of each household with 1 to 4 family members and 38.7% having 5 to 7 family members. The number of family members who work in each household is 72% who work for 1 person, 26.7% for 2 people and 1.3% for 3 people who work. The number of families attending school / college is 4% who do not attend school or college, 29.3% for 1 person, 36% for 2 people, 28% for 3 people and 2.7% for 4 people who attend school / college. The income of the population in this housing consists of 5.3% of the population who have an income of 1 million to 3 million, 61.4% who have an income of 4 million to 6 million, 17.3% have an income of 7 million to 9 million and 16% have an income of > 9 million. Ownership of motorcycles, 5.3% did not own a motorbike, 73.4% owned 1 motorbike and 21.3% owned 2 motorbikes. For private car ownership, 65.3% do not own a private car, 26.7% own 1 private car and 8% own 2 cars.
Based on the results of the survey that has been conducted, the number of trip generation on Bukit Khatulistiwa Housing is as in table 2. From table 2, it can be seen that the number of trip generation in this housing is 12% with 2 trip generation trips, 21.33% with 3 trips, 37.33 with 4 trips and 29.33% with 5 trips.

### Table 2. Trip Generation at Bukit Khatulistiwa Housing

| Trip Generation | Percentage (%) |
|-----------------|----------------|
| 2 trip          | 12.00          |
| 3 trip          | 21.33          |
| 4 trip          | 37.33          |

#### 3.2. Correlation Analysis

To determine whether a variable has a level of correlation with problems or with other variables, a correlation theory can be used [12]. To find out whether there is a correlation between each variable the number of family members (X1), the number of motorbike owners (X2), the number of car ownership (X3), the average family income (X4), the number of people working (X5) and the number of students attending school (X6) to the number of generation (Y), can be done with the Pearson Product Moment correlation test.
Based on the results of the Puri Yuhana Permai Housing correlation matrix, it can be seen that at the 5% real level there is a significant correlation between the variables of the number of family members (X1), the number of motorbike ownership (X2), the number of car ownership (X3), the average family income (X4), the number of workers (X5) and the number of people who attend school (X6) against the number of generations (Y). This is evidenced by the p value < level of significance (α = 5%) on each variable. Based on the identification above, it can be concluded that at the 5% real level all independent variables have a significant correlation to the dependent variable. All the correlation coefficients of the independent variables on the dependent variable are positive, meaning that there is a positive (positive) relationship between the independent variables and the dependent variable.

Based on the correlation matrix for Bukit Khatulistiwa Housing, it can be seen that simultaneously the correlation level of the number of family members (X1) is very strong, the number of motorbike ownership (X2) is low, the number of car ownership (X3) is very strong, the average family income (X4) is low, the number of workers (X5) is very strong and the number who goes to school (X6) is very strong against the number of generations (Y), and based on table 25, it can be seen that simultaneously the correlation level of the number of family members (X1) is very strong, the number of motorcycle ownership (X2) is low, the number of car ownership (X3) is low, the average family income (X4) is very strong, the number of people working (X5) is very strong and the number of people who go to school (X6) is very strong against the number of generations (Y).

3.3. Multiple Linear Regression Analysis

Multiple regression is a regression or predictive model that involves more than one independent variable or predictor. The term multiple regression can also be referred to as multiple regression. In the multiple linear regression model, the variable to be predicted (dependent variable) has a linear relationship with the independent variable. In this study, we want to know how the influence of each variable, including the number of family members (X1), the number of motorbike ownership (X2), the number of car ownership (X3), the average family income (X4), the number of people working (X5) and the number of students attending school (X6) against the number of generation (Y). Therefore, after calculating multiple regressions through the SPSS (Statistical Program for Social Science) tool, the test results are presented as follows:

3.3.1. Model Estimation Results

By using the Statistical Program for Special Science (SPSS) the regression equation model program is obtained as in table 3 and table 4.

From table 3, the equation of the trip generation model in Puri Yuana Permai is as follows:

$$\hat{Y} = 0.202 + 0.570 X_5 + 0.501 X_6$$  \hspace{1cm} (I)

Table 3. Estimation of the Puri Yuhana Permai Housing Regression Model
The regression equation from the estimation results of multiple linear regression analysis is:

\[ \hat{Y} = 0.182 + 0.378 X_5 + 0.249 X_6 \]  \hspace{1cm} (2)
motorbike ownership (X2), number of car ownership (X3), average family income (X4), number of
people working (X5) and number of people attending school (X6) to the number of generation (Y).

Based on table 3, simultaneous hypothesis testing results in an Fcount of 32,046 with a p value of
0.000 and in table 4, simultaneous hypothesis testing results in an Fcount of 20,739 with a p value of
0.000. The test results show p value (0.000) < level of significance (α = 0.05) then reject H0, this means
that there is a signiﬁcant effect simultaneously (together) on the number of family members (X1), the
number of motorbike ownership (X2), number of car ownership (X3), average family income (X4),
number of people working (X5) and number of people attending school (X6) to the number of generation
(Y).

3.5. Partial Hypothesis Test (t test)
Partial hypothesis testing is used to determine whether there is a partial (individual) influence on the
number of family members (X1), the number of motorbike ownership (X2), the number of car ownership
(X3), the average family income (X4), the number of people working (X5) and the number who attend
school (X6) against the number of generation (Y). The test criteria stated that if the tcount> ttable or p
value < level of significance (α = 0.05) then there was a partially signiﬁcant (individual) effect.
Conversely, if the tcount < ttable or p value > level of signiﬁcance (α = 0.05) then there is no partia
lly signiﬁcant (individual) effect.

Conversely, if the tcount < ttable or p value > level of signiﬁcance (α = 0.05) then there is no partia
lly signiﬁcant (individual) effect.

3.5.1. Test of the effect of number of family members (X1) on the number of trip generations
In table 3, testing the hypothesis of the effect of the number of family members (X1) produces a t value
of 1.587 with a p value of 0.119. The test results show p value (0.119) > level of signiﬁcance (α = 0.05)
so that at the 5% real level there is no signiﬁcant effect of the number of family members on the number
of seizures, and in table 4, testing the hypothesis of the effect of the number of family members (X1)
produces t value is 1,456 with p value of 0.150. The test results show p value (0.150) > level of
signiﬁcance (α = 0.05) so that at the 5% real level there is no signiﬁcant effect on the number of family
members on the number of seizures.

3.5.2. Test of the effect of total motorcycle ownership (X2) on the number of trip generations
In table 3, the hypothesis testing of the effect of the number of motorbike ownership (X2) results in a t
count value of 0.594 with a p value of 0.555. The test results show p value (0.555) > level of signiﬁcance (α =
0.05) so that at the 5% real level there is no signiﬁcant effect on the number of motorbike ownership
on the number of generators, and in table 4, the hypothesis testing is the effect of the number of
motorcycle ownership (X2) produces a t value of 0.861 with a p value of 0.392. The test results show
p value (0.392) > level of signiﬁcance (α = 0.05) so that at the 5% real level there is no signiﬁcant effect
on the number of family members on the number of trip generations.

3.5.3. Test of the effect of total car ownership (X3) on the number of trip generations
In table 3, the hypothesis testing of the effect of the number of car ownership (X3) results in a t count
value of 0.461 with a p value of 0.647. The test results show p value (0.810) > level of signiﬁcance (α =
0.05) so that at the 5% real level there is no signiﬁcant effect of the number of car ownership on the
number of generation, and in table 4 testing the hypothesis of the effect of the number of car ownership
(X3) results the t value is 0.444 with a p value of 0.659. The test results show p value (0.659) > level of
signiﬁcance (α = 0.05) so that at the 5% real level there is no signiﬁcant effect of the number of car
ownership on the number of trip generations.

3.5.4. Test of the effect of family income (X4) on the Number of Trip Generation
In table 3, testing the hypothesis of the effect of family income (X4) produces a t value of 1.857 with a
p value of 0.070. The test results show p value (0.070) > level of signiﬁcance (α = 0.05) so that at the
5% real level there is no signiﬁcant effect of family income on the number of generation, and in table 4,
testing the hypothesis of the effect of family income (X4) results in a t value. count of 0.938 with a p value of 0.351. The test results show p value (0.070) > level of significance (α = 0.05) so that at the 5% real level there is no significant effect of family income on the number of trip generation.

3.5.5. Test the effect of the number of people working (X5) on the number of trip generation
In table 3, the hypothesis testing of the effect of the number of workers (X5) produces a t value of 6.371 with a p value of 0.000. The test results show p value (0.000) < level of significance (α = 0.05) so that at the 5% real level there is a significant effect on the number of people working on the number of trip generation. The regression coefficient B5 is positive at 0.570 indicating that the number of workers has a positive effect on the number of generation. This means that the higher the number of people who work in a family, it can significantly increase the number of generations and in table 4 the hypothesis testing of the effect of the number of workers (X5) produces a t-count value of 4.834 with a p value of 0.000. The test results show p value (0.000) < level of significance (α = 0.05) so that at the 5% real level there is a significant effect on the number of people working on the number of generation. The regression coefficient B5 is positive at 0.378 indicating that the number of workers has a positive effect on the number of generation. This means that the higher the number of people working in a family, it can significantly increase the number of trip generation.

3.5.6. Test the effect of the number of people attending school / college (X6) on the number of trip generation
In table 3, the hypothesis testing of the effect of the number of students attending school (X6) produces a t value of 7.052 with a p value of 0.000. The test results show p value (0.000) < level of significance (α = 0.05) so that at the 5% real level, there was a significant effect on the number of people attending school on the number of generation. The regression coefficient B6 is positive at 0.501 indicating that the number of people attending school has a positive effect on the number of generation. This means that the higher the number of people who attend school in a family, it can significantly increase the number of generation and in table 4 the hypothesis testing of the effect of the number of people attending school (X6) results in a t-calculated value of 2.764 with a p value of 0.000.

The test results show p value (0.000) < level of significance (α = 0.05) so that at the 5% real level there is a significant effect on the number of people attending school on the number of generation. The regression coefficient B6 is positive at 0.249 indicating that the number of people attending school has a positive effect on the number of generation. This means that the higher the number of people attending school in a family, it can significantly increase the number of trip generation.

From the results of the hypothesis testing above, it can be concluded that there is a positive and significant influence on the number of workers (X5) and the number of people who attend school (X6) on the number of generation (Y). While the rest, namely the variable number of family members (X1), the number of motorcycle ownership (X2), the number of car ownership (X3), and the average family income (X4) have no significant effect on the number of trip generations (Y).

3.6. Dominant Influence
The dominant effect can be seen through the largest absolute (absolute) value of Beta. In table 26 the estimation results listed in the table above can be seen that the variable that has the largest Beta is the number of workers (X5) of 0.570. Thus the variable number of people working (X5) has the most dominant influence on the number of generation and in table 4 the estimation results listed in the table above can be seen that the variable that has the largest Beta is the number of employees (X5) of 0.378. Thus the variable number of people working (X5) has the most dominant influence on the number of trip generation.

4. Conclusion
Based on the results of the analysis, the population characteristics of Puri Yuhana Permai and Bukit Khatulistiwa housing are still dominated by people who work and attend school / college. This explains that the variable number of workers (X5) and the number of people who attend school (X6) has a significant effect on the number of generations that occur.
Based on the results of the analysis, two-wheeled vehicles are still the main choice for carrying out activities to work and school/college.

The results of the analysis that the trip generation model have obtained are strongly influenced by the number of working family members (X5) and the number of family members who attend school/college (X6) have a positive effect on the number of trip generation, which will affect a road section or access to the housing. While the rest, namely the variable number of family members (X1), the number of motorcycle ownership (X2), the number of car ownership (X3), and the average family opinion (X4) did not have a significant effect on the number of trip generations (Y).

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