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Vehicle Trip Generation Modeling Based on Building Characteristics and Commercial Activities in Commercial and Service Areas

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Abstract

This study aims to develop a vehicle trip attraction model based on building characteristics and commercial activities at Mie Gacoan Pandaan. A quantitative approach with a field survey method was employed. Data were collected through observation, traffic counting, documentation, and secondary sources, then analyzed using multiple linear regression with IBM SPSS Statistics. The resulting model is $Y = -11.361 + 0.359X_1 + 0.455X_2 + 0.268X_3 + 0.266X_4 + 0.276X_5 + 0.448X_6$*. The results indicate that building area, parking capacity, seating capacity, number of visitors, operating hours, and number of employees have positive and significant effects on vehicle trip attraction. The coefficient of determination* (R^2) *of 0.891 indicates that the model explains 89.1% of the variation in vehicle trip attraction. Parking capacity is the most dominant factor affecting vehicle trip attraction. The proposed model can be used as a reference for Traffic Impact Analysis and transportation planning in commercial and service areas.*

Introduction

The development of deferred payment (*pay later*) systems has shown a significant increase. Transportation is one of the fundamental components supporting social, economic, and community mobility activities. Along with population growth and urban development, the demand for an efficient transportation system continues to increase. An effective transportation system ensures the smooth movement of people, goods, and services, enabling activities such as work, shopping, access to public services, and other social interactions to be carried out efficiently (Basuki et al., 2020a; Haque et al., 2013; Jelti et al., 2023; Meyer, 2016). The relationship between transportation systems and land use is reciprocal: the development of an area increases travel demand, while improved transportation accessibility stimulates further growth and activity within that area (He et al., 2025; Li et al., 2025; Calderón et al., 2025; Zhang et al., 2025; Cao, 2022; Xia et al., 2023).

One of the fastest-growing forms of land use is commercial and service areas. These areas function as centers of economic activity and attract large numbers of people by providing a variety of goods and services (Apriyanti, 2024; Xia et al., 2024; Kalfas et al., 2024). According to Government Regulation of the Republic of Indonesia No. 16 of 2004 on Land Use Planning, land use refers to the structure and pattern of land utilization, including land allocation, use, designation, and maintenance. In urban contexts, commercial and service land uses are among the primary factors influencing travel patterns because they generate substantial trip production and trip attraction (Model et al., 2023; Göransson & Andersson, 2023; Talpur et al., 2023; Mwale et al., 2022).

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Trip attraction refers to the number of trips destined for a particular area as a result of specific land-use activities (Marwal & Silva, 2022). The greater the intensity of commercial and service activities, the higher the number of vehicles attracted to the location. Factors such as building size, service capacity, number of employees, number of visitors, parking availability, and the type of commercial activity significantly influence the magnitude of trip attraction (Anggraeini & Basuki, 2016). Therefore, understanding the relationship between building characteristics, commercial activities, and generated trips is essential for transportation planning (Ma et al., 2023; Kesarovski et al, 2023; Yan & Chen, 2024).

Trip attraction modeling is one of the key stages in the transportation planning process. According to Basuki et al. (2020a), transportation models are used to estimate travel demand based on land-use characteristics, thereby supporting the effective provision of transportation infrastructure. Currans (2017) explains that trip attraction models can be used to forecast future traffic impacts, providing a foundation for sustainable transportation policy development. By developing mathematical models using variables related to building characteristics and commercial activities, vehicle trips can be predicted more accurately, providing governments and developers with a scientific basis for planning road networks, parking facilities, and Traffic Impact Analyses (TIA) (Abdullah, 2024; Çolak & Bayrak, 2025; Geremew, 2026; Wang et al., 2025; Mystakidis et al., 2025).

The development of trip attraction modeling originated from the gravity model, which explains that the probability of choosing a destination is influenced by both the distance to and the attractiveness of that destination (Chen et al., 2024; Rossello Nadal & Santana Gallego, 2022; Liu et al. 2026). Subsequent studies have demonstrated that, in addition to distance, physical building characteristics such as floor area, parking capacity, number of employees, and type of commercial activity have a significant influence on trip attraction (George & Kattor, 2018). Research by Andrika and Basuki (2021) also found that small-scale commercial centers can generate relatively high levels of trip attraction due to the high frequency of customer visits. Therefore, trip attraction models should be developed based on the specific characteristics of each type of commercial area to produce more accurate predictions (Huang et al., 2023; Wu et al., 2024; Wagh et al., 2024).

This phenomenon can be observed in the commercial and service district of Pandaan Subdistrict, Pasuruan Regency, which has experienced rapid development in recent years. The growth of modern culinary centers, fast-food restaurants, shopping facilities, and service businesses has increased both community activity and traffic volume along major road corridors. One of the busiest destinations is Mie Gacoan Pandaan, which has become a popular culinary destination because of its affordable prices, diverse menu offerings, and extended operating hours (Park & Widyanta, 2022; Yıkmış et al., 2024)). The high number of visitors particularly during lunch hours, evenings, weekends, and public holidays has resulted in a substantial increase in vehicle movements entering and exiting the site, potentially affecting traffic performance on surrounding roads (Xiang et al., 2024).

The building characteristics of Mie Gacoan Pandaan, including building floor area, seating capacity, parking area, number of employees, and service intensity, are presumed to influence the magnitude of motor vehicle trip attraction. In addition, commercial activity characteristics such as the number of transactions, visitor volume, operating hours, and customer turnover also contribute significantly to the number of vehicles traveling to the site. If the increase in trip attraction is not matched by adequate road capacity and supporting facilities, it may lead to vehicle queues, roadside friction, reduced travel speeds, and traffic congestion along the surrounding commercial corridor.

Previous studies have consistently demonstrated a strong relationship between land-use characteristics and trip generation and attraction. Andrika and Basuki (2021) identified

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building floor area, parking capacity, number of employees, and activity volume as the dominant variables affecting trip attraction. George and Kattor (2018) likewise concluded that commercial and service land uses, together with building density, contribute to the emergence of new activity centers that increase traffic flows. Another study by Basuki et al. (2020b) emphasized that trip attraction models can serve as a basis for traffic impact evaluation and sustainable transportation planning. However, most of these studies have focused on shopping centers, large-scale commercial districts, or urban areas in general, rather than specifically examining modern restaurants as research objects.

Furthermore, most previous studies have relied primarily on physical building characteristics such as floor area or land area as the main predictor variables, while commercial activity characteristics, including visitor numbers, transaction volume, service capacity, and operational patterns, have rarely been integrated into trip attraction models. In modern culinary businesses such as Mie Gacoan Pandaan, however, operational activities have a substantial influence on fluctuations in arriving vehicle volumes. Consequently, there remains a research gap regarding the development of trip attraction models that simultaneously incorporate both building characteristics and commercial activity variables for restaurant establishments within commercial and service areas.

Based on this research gap, the present study offers a novel contribution by developing a motor vehicle trip attraction model that integrates both building characteristics and commercial activity variables as predictors. The proposed model is expected to provide more accurate estimates of vehicle trips than models based solely on physical building characteristics. Moreover, by using Mie Gacoan Pandaan as a case study, this research aims to produce a context-specific model that reflects the characteristics of rapidly developing commercial and service areas in Pasuruan Regency.

Methods

Research Design and Study Setting

This study employed a quantitative explanatory research design with a field survey approach to develop a motor vehicle trip attraction model based on building characteristics and commercial activities. The study was conducted at Mie Gacoan Pandaan, Pasuruan Regency, Indonesia, which represents a commercial and service activity center with relatively high visitor and vehicle movement intensity.

The explanatory approach was applied to examine the relationship between building and operational characteristics and motor vehicle trip attraction. The dependent variable was motor vehicle trip attraction (Y), while the independent variables consisted of building area (X1), parking capacity (X2), seating capacity (X3), number of visitors (X4), operating hours (X5), and number of employees (X6). These variables were selected to represent the physical characteristics of the establishment and the intensity of its commercial activities.

Data Sources and Data Collection

The study used both primary and secondary data. Primary data were obtained through direct field observation, traffic counting, and documentation at the study location. Field observations were conducted to obtain information regarding the physical and operational characteristics of the commercial establishment, while traffic counting was used to record motor vehicle movements associated with the study site. Documentation was used to complement the field data and verify information related to the research variables.

Secondary data were obtained from Statistics Indonesia (BPS), Google Maps, company documents, and relevant scientific literature. These data were used to support the

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characterization of the study area, identify relevant variables, and provide contextual information for the development of the trip attraction model.

The statistical analysis was based on 68 cases, consistent with the number reported in the instrument assessment. The measurement instrument comprised 21 indicators, with three indicators representing each of the six independent variables and three indicators representing the dependent variable.

Research Variables and Measurement

The study examined six independent variables and one dependent variable. Building area (X1) represented the physical size of the commercial establishment; parking capacity (X2) represented the capacity of the available parking facilities; seating capacity (X3) represented the customer accommodation capacity; number of visitors (X4) represented the intensity of customer activity; operating hours (X5) represented the duration of commercial operations; and number of employees (X6) represented the operational workforce. The dependent variable, motor vehicle trip attraction (Y), represented vehicle movements entering the study location.

Prior to regression analysis, the research instrument was evaluated for validity and reliability. Item validity was assessed by comparing the calculated correlation coefficient (r-count) with the critical r-table value. With 68 cases and degrees of freedom of 66 at a significance level of 5%, the critical r-value was 0.239. An item was considered valid when its r-count exceeded 0.239. Instrument reliability was evaluated using Cronbach's Alpha, with a coefficient of ≥ 0.60 considered to indicate acceptable internal consistency. These procedures were applied to ensure that the measurement indicators were sufficiently valid and reliable for subsequent statistical analysis.

Data Analysis

Data were processed and analyzed using IBM SPSS Statistics 27. The analytical procedure included instrument testing, descriptive analysis, classical assumption testing, multiple linear regression analysis, partial significance testing using the t-test, simultaneous significance testing using the F-test, and assessment of the coefficient of determination (R^2).

Multiple linear regression was used to estimate the relationship between building characteristics, commercial activities, and motor vehicle trip attraction. The general regression model was expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

where Yrepresents motor vehicle trip attraction; X_1represents building area; X_2represents parking capacity; X_3represents seating capacity; X_4represents the number of visitors; X_5represents operating hours; X_6represents the number of employees; $\beta_0$represents the regression constant; $\beta_1 - \beta_6$represent the regression coefficients; and εrepresents the error term.

The t-test was used to examine the partial effect of each independent variable on motor vehicle trip attraction. A relationship was considered statistically significant when the significance value was below 0.05. The F-test was used to determine whether the six independent variables simultaneously contributed significantly to the regression model. The coefficient of determination (R^2) was used to determine the proportion of variation in motor vehicle trip attraction explained collectively by the independent variables. In addition, standardized regression coefficients (Beta) were compared to identify the variable with the relatively strongest contribution to vehicle trip attraction. This analytical framework corresponds to the reported Results, which present regression coefficients, individual t-tests, an F-test, R^2, and standardized Beta values.

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Results and Discussion

Validity and Reliability Testing

The primary objective of validity testing is to ensure that the information obtained from the research instrument accurately reflects the object being analyzed. Data derived from a high-quality instrument will be precise and reliable. Reliability testing is used to assess the consistency of the measurement instrument employed by the researcher, ensuring that the data obtained are trustworthy and reliable for subsequent analysis.

Validity Test

Table 1. Validity Test

No	Variable	Indicator	r Count	r Table (N=68)	Description
1	X1	X1.1	0.546	0.239	Valid
2	X1	X1.2	0.531	0.239	Valid
3	X1	X1.3	0.816	0.239	Valid
4	X2	X2.1	0.755	0.239	Valid
5	X2	X2.2	0.428	0.239	Valid
6	X2	X2.3	0.399	0.239	Valid
7	X3	X3.1	0.636	0.239	Valid
8	X3	X3.2	0.615	0.239	Valid
9	X3	X3.3	0.603	0.239	Valid
10	X4	X4.1	0.637	0.239	Valid
11	X4	X4.2	0.428	0.239	Valid
12	X4	X4.3	0.444	0.239	Valid
13	X5	X5.1	0.488	0.239	Valid
14	X5	X5.2	0.408	0.239	Valid
15	X5	X5.3	0.623	0.239	Valid
16	X6	X6.1	0.771	0.239	Valid
17	X6	X6.2	0.488	0.239	Valid
18	X6	X6.3	0.594	0.239	Valid
19	Y	Y.1	0.547	0.239	Valid
20	Y	Y.2	0.706	0.239	Valid
21	Y	Y.3	0.676	0.239	Valid

Source: Data processing using SPSS 27.

This study involved 68 respondents; therefore, the r-table value at a 5% significance level ($\alpha = 0.05$) with $df = 66$ is 0.239. Based on the validity test results, all statement items for variables X1, X2, X3, X4, X5, X6, and Y yielded r-calculated values greater than the r-table value (r-calculated > 0.239) with a significance level of < 0.05. This indicates that all statement items for each variable are valid; thus, the entire research instrument is suitable for use in data collection and the study may proceed to the reliability testing stage.

Reliability Test

Table 2. Reliability Test

No.	Variable	Cronbach's Alpha	Number of Item	Criteria	Description
1	Variable X1	0,688	3	≥ 0,60	Reliable
2	Variable X2	0,688	3	≥ 0,60	Reliable
3	Variable X3	0,644	3	≥ 0,60	Reliable
4	Variable X4	0,732	3	≥ 0,60	Reliable

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5	Variable X5	0,611	3	≥ 0,60	Reliable
6	Variable X6	0,665	3	≥ 0,60	Reliable
7	Variable Y	0,617	3	≥ 0,60	Reliable

Source: SPSS Data Processing Results, 2026

Based on the reliability test results in Table 2, it is evident that all research variables have Cronbach's Alpha values above 0.60. Variables X1 and X2 each obtained a Cronbach's Alpha value of 0.688; variable X3, 0.644; variable X4, 0.732; variable X5, 0.611; variable X6, 0.665; and variable Y, 0.617. Referring to the reliability criteria proposed by Ghozali (2021), a research instrument is considered reliable if it has a Cronbach's Alpha value of ≥ 0.60. Thus, all variables in this study are deemed reliable, meaning that each statement item yields consistent and trustworthy measurement results. Consequently, the research instrument is suitable for use as a data collection tool in this study.

Multiple Linear Regression Analysis

The hypothesis in this study predicts the strength of the relationship between the independent and dependent variables using multiple linear regression, which will be empirically evaluated.

Table 3. Multiple Linear Regression Analysis.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-11.361	1.673		-6.791	.000
	X1	.359	.036	.441	3.993	.042
	X2	.455	.039	.509	4.790	.008
	X3	.268	.046	.255	2.897	.001
	X4	.266	.041	.288	3.549	.034
	X5	.276	.045	.268	4.080	.000
	X6	.448	.064	.309	4.956	.021
a. Dependent Variable: Y						

Table 4. Explanation of Beta Results

Variable	Beta	Description
Parking Capacity (X2)	0,509	Most dominant
Building area (X1)	0,441	Very strong
Number of Employees (X6)	0,309	Strong
Number of Visitors (X4)	0,288	Strong enough
Operating Hours (X5)	0,268	Moderate
Kapasitas Tempat Duduk (X3)	0,255	Relatively the smallest

Multiple linear regression analysis was employed to determine the extent to which building characteristics and commercial activities influence vehicle trip attraction at the study site. The independent variables in this study comprised building area (X1), parking capacity (X2), seating capacity (X3), number of visitors (X4), operating hours (X5), and number of employees (X6), while the dependent variable was vehicle trip attraction (Y), measured by the number of vehicles entering the study site.

The regression analysis yielded the following equation:

$$Y = -11.361 + 0.359X1 + 0.455X2 + 0.268X3 + 0.266X4 + 0.276X5 + 0.448X6$$

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This regression equation illustrates the mathematical relationship between the independent and dependent variables. The constant value of -11.361 indicates that if all independent variables were assumed to be zero, the estimated trip attraction value would be -11.361 vehicles. This negative constant is a statistical calculation result serving as the starting point for the regression model. In practice, a scenario where all independent variables equal zero is virtually impossible in a commercial area; therefore, the study's interpretation focuses primarily on the magnitude of the regression coefficients for each variable.

All regression coefficients in this study are positive, indicating a direct relationship between building characteristics or commercial activities and trip attraction. This means that any increase in building area, parking capacity, seating capacity, number of visitors, operating hours, or number of employees is accompanied by an increase in the number of vehicles entering the commercial area, assuming other variables remain constant.

The regression coefficient of 0.359 for the building area variable indicates that the larger the building area of a commercial activity center, the greater its potential to accommodate various economic activities. Buildings with larger areas generally provide more service space, transaction areas, and supporting facilities, thereby attracting more visitors. This increase in visitor numbers ultimately leads to a rise in the number of vehicles arriving at the site. The parking capacity variable has the highest regression coefficient, at 0.455. This indicates that parking capacity is a crucial factor influencing vehicle trip attraction. Adequate parking availability provides a sense of security and convenience for private vehicle users, thereby increasing the public's inclination to visit the location. Conversely, if parking capacity is limited, some potential visitors may decide against visiting or opt for a location with better parking facilities. Therefore, providing adequate parking space is a key aspect of commercial area planning.

The regression coefficient of 0.268 for the seating capacity variable indicates that the greater the available seating capacity, the higher the location's ability to serve visitors simultaneously. Increasing seating capacity reflects an expansion of the building's capacity, allowing for more activities to take place at the same time. This condition indirectly leads to an increase in the number of vehicle trips to the location.

For the visitor count variable, a regression coefficient of 0.266 indicates that an increase in the number of visitors leads to an increase in the number of vehicles entering the study site. Visitor volume is a primary indicator of a commercial area's activity. Higher public visitation intensity correlates with greater vehicle movement. Although not all visitors use private vehicles, an increase in visitor numbers still contributes to higher traffic volume in the vicinity of the site.

The operating hours variable has a regression coefficient of 0.276. This indicates that the longer a business operates, the greater the opportunity for the public to visit. Extended service hours increase the likelihood of trips being made to the location. Consequently, the number of vehicles entering the area during a single day of operation is higher compared to locations with shorter operating hours.

Furthermore, the employee count variable has a regression coefficient of 0.448, indicating that an increase in the number of employees also increases vehicle trip attraction. A higher number of employees in a commercial area corresponds to increased operational activity. Beyond the trips employees make to work, a larger workforce is generally associated with increased service capacity for consumers. This condition drives up visitor numbers, thereby increasing the volume of vehicles arriving at the site.

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T-Test

The t-test is used to determine the partial effect of each independent variable—building area (X1), parking capacity (X2), seating capacity (X3), visitor count (X4), operating hours (X5), and employee count (X6)—on the dependent variable, vehicle trip attraction (Y). The test is conducted at a significance level (α) of 0.05. The alternative hypothesis (H_a) is accepted if the significance value (Sig.) is less than 0.05. Conversely, if the significance value is greater than or equal to 0.05, H_a is rejected, meaning the variable does not have a significant effect on trip attraction.

Based on the t-test results in Table 4.xx, the following conclusions can be drawn.

The Building Area variable (X1) yielded a calculated t-value of 3.993 with a significance value of 0.042. Since the significance value is less than 0.05, it can be concluded that building area has a positive and significant effect on vehicle trip attraction (Y). This indicates that the larger the building area of a commercial zone, the greater its capacity to accommodate activities, thereby increasing the number of vehicles entering the location. Thus, the first hypothesis (H_1) is accepted.

The Parking Capacity variable (X2) yielded a calculated t-value of 4.790 with a significance value of 0.008. This value is below the 0.05 significance level; therefore, it can be concluded that parking capacity has a positive and significant effect on vehicle trip attraction (Y). Greater available parking capacity makes it easier for visitors to secure a parking space, thereby encouraging an increase in the number of vehicles arriving at the location. Consequently, the second hypothesis (H_2) is accepted.

The Seating Capacity variable (X3) yielded a calculated t-value of 2.897 with a significance value of 0.001. This significance value is less than 0.05, indicating that seating capacity has a positive and significant effect on vehicle trip attraction (Y). Increased seating capacity enhances the building's ability to serve visitors, thereby intensifying activity within the area and resulting in a higher number of vehicles entering the site. Thus, the third hypothesis (H_3) is accepted.

The Number of Visitors variable (X4) yielded a calculated t-value of 3.549 with a significance value of 0.034. A significance value of less than 0.05 indicates that the number of visitors has a positive and significant effect on vehicle trip attraction (Y). A higher number of visitors to the commercial area leads to increased vehicle movement toward the research site. Therefore, the fourth hypothesis (H_4) is accepted.

The Operating Hours variable (X5) yielded a calculated t-value of 4.080 with a significance value of 0.000. Since the significance value is less than 0.05, it can be concluded that operating hours have a positive and significant effect on vehicle trip attraction (Y). The longer a commercial area operates, the greater the likelihood of people traveling to the location, thereby increasing the number of vehicles entering the area. Thus, the fifth hypothesis (H_5) is accepted.

The Number of Employees variable (X6) yielded a calculated t-value of 4.956 with a significance value of 0.021. This value is less than 0.05, indicating that the number of employees has a positive and significant effect on vehicle trip attraction (Y). An increase in the number of employees reflects heightened operational activity within the commercial area, which ultimately increases vehicle mobility toward the site. Therefore, the sixth hypothesis (H_6) is accepted.

F-Test (Simultaneous Test)

The F-test, or simultaneous test, is used to determine whether all independent variables—namely building area (X1), parking capacity (X2), seating capacity (X3), number of visitors

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(X4), operating hours (X5), and number of employees (X6)—collectively influence the dependent variable, namely vehicle trip attraction (Y).

Table 5. F-Test

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	966.475	6	161.079	82.912	.000[b]
	Residual	118.510	61	1.943		
	Total	1084.985	67			
a. Dependent Variable: Y						
b. Predictors: (Constant), X6, X4, X2, X3, X5, X1						

b. Predictors: (Constant), X6, X4, X2, X3, X5, X1

Source: Data processing results using SPSS.

Based on the ANOVA test results, the calculated F-value is 82.912 with a significance value of 0.000. Since the significance value is less than 0.05, the regression model is deemed significant. This indicates that the variables building area, parking capacity, seating capacity, number of visitors, operating hours, and number of employees simultaneously exert a significant influence on vehicle trip attraction (Y).

These results demonstrate that changes in building characteristics and commercial activities collectively affect the volume of vehicles entering the study area. Consequently, all independent variables are suitable for inclusion in the trip attraction model.

Coefficient of Determination (R^2)

The coefficient of determination is used to assess the extent to which the independent variables explain the variation in the dependent variable. The value of the coefficient of determination is represented by the R-Square (R^2) value.

Table 6. Coefficient of Determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.944	0.891	0.880	1.394

Source: Data processed using SPSS.

Based on the analysis results, an R-square value of 0.891 was obtained. This value indicates that 89.1% of the variation in vehicle trip attraction (Y) can be explained by the variables of building area (X1), parking capacity (X2), seating capacity (X3), number of visitors (X4), operating hours (X5), and number of employees (X6).

Meanwhile, the remaining 10.9% is influenced by factors not included in the research model, such as road accessibility, transportation network conditions, vehicle types used, road user characteristics, surrounding traffic conditions, and other external factors. An R-value of 0.944 indicates a very strong relationship between all independent variables and the dependent variable. This suggests that building characteristics and commercial activities are closely linked to the volume of vehicle trip attraction at the study site.

Vehicle Trip Attraction Analysis Model

Based on the multiple linear regression analysis, the vehicle trip attraction model is derived as follows:

$$Y = -11.361 + 0.359X1 + 0.455X2 + 0.268X3 + 0.266X4 + 0.276X5 + 0.448X6$$

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The model indicates that, assuming all independent variables remain constant, any change in a single variable will result in a change in the number of vehicles entering the study site. The constant value of -11.361 represents the baseline value of the regression model when all independent variables are zero. In practice, such a condition does not occur in commercial areas; therefore, the model's interpretation focuses primarily on the coefficient values of the individual variables. These findings support the research by Izzah and Khofifah (2025), which states that land-use characteristics significantly influence trip attraction. That study yielded a simple regression model, Y = 9.093 + 0.478X, with a coefficient of determination (R^2) of 0.200, indicating that land use accounts for 20% of the variation in trip attraction to Hermina Rejoso Hospital. In contrast, the present study developed a more comprehensive model using multiple linear regression based on six variables: building area, parking capacity, seating capacity, number of visitors, operating hours, and number of employees. The resulting model achieved an R^2 value of 0.891, thereby explaining 89.1% of the variation in vehicle trip attraction. This demonstrates that incorporating multiple building and commercial activity characteristics provides superior predictive capability compared to relying on a single land-use variable.

The regression coefficient for the building area variable (X1) of 0.359 indicates that for every 1 m² increase in building area, the number of vehicles entering the site is estimated to increase by 0.359 vehicles.

The regression coefficient for the parking capacity variable (X2) of 0.455 indicates that every addition of 1 Parking Space Unit (SRP) will increase the number of vehicles by 0.455 vehicles.

The regression coefficient for the seating capacity variable (X3) of 0.268 indicates that every addition of 1 seat will increase the number of vehicles by 0.268 vehicles.

The regression coefficient for the number of visitors variable (X4) of 0.266 indicates that every addition of 1 visitor will increase the number of vehicles by 0.266 vehicles.

The regression coefficient for the operating hours variable (X5) of 0.276 indicates that every additional hour of operation is estimated to increase the number of vehicles by 0.276 vehicles.

The regression coefficient for the number of employees variable (X6) of 0.448 indicates that every addition of 1 employee will increase the number of vehicles by 0.448 vehicles.

Factors Influencing Trip Attraction

Based on the multiple linear regression analysis results and the Standardized Coefficients (Beta) values, the factors influencing motor vehicle trip attraction at Mie Gacoan Pandaan can be identified. The factors influencing vehicle trip attraction, according to the analysis results, are as follows:

The building area variable (X1) shows a positive and significant influence on vehicle trip attraction (Y). This variable has a Standardized Coefficient (Beta) value of 0.441 with a significance value of 0.042 (< 0.05). This indicates that the larger the building area of Mie Gacoan Pandaan, the greater the number of vehicles entering the site. Thus, building area is one of the factors influencing vehicle trip attraction.

The Parking Capacity variable (X2) has a positive and significant influence on vehicle trip attraction (Y). A Standardized Coefficient (Beta) value of 0.509, with a significance value of 0.008 (< 0.05), indicates a very strong relationship between parking capacity and trip attraction. The greater the available parking capacity, the higher the number of vehicles that can be accommodated, thereby increasing vehicle trip attraction.

The Seating Capacity variable (X3) demonstrates a positive and significant influence on vehicle trip attraction (Y). A Standardized Coefficient (Beta) value of 0.255, with a

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significance value of 0.001 (< 0.05), confirms that greater seating capacity enhances the building's ability to serve visitors, leading to an increase in the number of vehicles arriving at the location.

The Visitor Count variable (X4) has a positive and significant influence on vehicle trip attraction (Y). This variable yielded a Standardized Coefficient (Beta) value of 0.288, with a significance value of 0.034 (< 0.05). This indicates that an increase in the number of visitors is accompanied by an increase in the number of vehicles entering the Mie Gacoan Pandaan area.

The Operating Hours variable (X5) demonstrates a positive and significant influence on vehicle trip attraction (Y). This variable has a Standardized Coefficient (Beta) of 0.268 with a significance value of 0.000 (< 0.05). This implies that the longer the operating hours of Mie Gacoan Pandaan, the greater the likelihood of customer visits, thereby increasing the number of vehicles entering the site.

The Number of Employees variable (X6) exerts a positive and significant influence on vehicle trip attraction (Y). A Standardized Coefficient (Beta) of 0.309, with a significance value of 0.021 (< 0.05), indicates that an increase in the number of employees boosts operational and customer service activities, subsequently leading to a rise in the number of vehicles arriving at the location.

Based on these results, it can be concluded that all variables related to building characteristics and commercial activities influence vehicle trip attraction at Mie Gacoan Pandaan. Among the variables studied, parking capacity (X2) is the most dominant factor influencing trip attraction, as it possesses the highest Standardized Coefficient (Beta) of 0.509, followed by building area (X1) with a Beta value of 0.441, and the number of employees (X6) with a Beta value of 0.309. This indicates that providing adequate parking capacity is a primary factor to consider during the planning and development of commercial areas, given its significant impact on the volume of vehicles entering the study site.

Conclusion

Based on the research findings regarding the modeling of motorized vehicle trip attraction based on building characteristics and commercial activities in a trade and service area (Case Study: Mie Gacoan Pandaan), the following conclusions can be drawn:

The model for motorized vehicle trip attraction based on the building characteristics and commercial activities of Mie Gacoan Pandaan was derived through multiple linear regression analysis, resulting in the following equation:

$$Y = -11.361 + 0.359X1 + 0.455X2 + 0.268X3 + 0.266X4 + 0.276X5 + 0.448X6$$

Based on this model, all independent variables—comprising building area (X1), parking capacity (X2), seating capacity (X3), number of visitors (X4), operating hours (X5), and number of employees (X6)—exert a positive influence on motorized vehicle trip attraction. This implies that the greater the magnitude of the building characteristics and commercial activities at Mie Gacoan Pandaan, the higher the number of vehicles attracted to the location. The resulting model explains 89.1% of the variation in trip attraction, as indicated by the coefficient of determination (R^2), while the remaining 10.9% is influenced by factors outside the scope of this study.

The characteristics of motorized vehicle trip attraction to Mie Gacoan Pandaan indicate that trip activity is influenced by the physical condition of the building and the restaurant's service operations. Vehicle attraction increases in tandem with increases in building area, parking capacity, seating capacity, number of visitors, operating hours, and number of employees. Analysis results show that the variable exerting the most dominant influence on trip attraction

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is parking capacity (X2), with a Standardized Coefficient (Beta) of 0.509; this is because the availability of parking space is a primary factor facilitating vehicle access to the location. The subsequent influential variables, in order, are building area (X1) at 0.441, number of employees (X6) at 0.309, number of visitors (X4) at 0.288, operating hours (X5) at 0.268, and seating capacity (X3) at 0.255.

The factors regarding building characteristics and commercial activities that influence motorized vehicle trip attraction at Mie Gacoan Pandaan are building area (X1), parking capacity (X2), seating capacity (X3), number of visitors (X4), operating hours (X5), and number of employees (X6). Partial test results (t-test) indicate that all these variables have a significant effect on vehicle trip attraction, as they all possess significance values of less than 0.05. Furthermore, simultaneous test results (F-test) show that all independent variables collectively exert a significant influence on the vehicle trip attraction variable, with a calculated F-value of 82.912 and a significance value of 0.000. Thus, these six factors can serve as variables for constructing a model to predict vehicle trip attraction at the Mie Gacoan Pandaan commercial and service site.

Recommendations

Based on the research findings, the author offers the following recommendations:

The management of Mie Gacoan Pandaan is advised to pay close attention to parking capacity, as it is the most dominant factor influencing vehicle trip attraction. Providing adequate parking areas, organizing vehicle circulation, and managing vehicle entry and exit are expected to mitigate potential traffic congestion in the vicinity of the site.

When planning building expansions or increasing service capacity, management needs to consider the impact on the volume of arriving vehicles. Therefore, any increase in building area, seating capacity, or operating hours should be balanced with the provision of adequate transportation and parking facilities to avoid degrading the performance of road segments surrounding the site.

For local governments and relevant agencies, the findings of this study can serve as a basis for consideration when preparing Traffic Impact Analyses (Andalalin) and formulating policies regarding traffic management in high-traffic commercial and service areas.

Future research is advised to incorporate additional variables likely to influence vehicle trip attraction—such as road accessibility, road width, Level of Service (LOS), vehicle types, public transport usage, peak visitation times, and the condition of the surrounding road network. Including these variables is expected to yield a more comprehensive trip attraction model with a higher level of accuracy.

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