TRIP ATTRACTION MODEL ON THE SHOPPING CENTERS USING LINEAR REGRESSION ANALYSIS IN CHATTOGRAM CITY AS A CASE STUDY

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ABSTRACT

In developing nations, one of the most essential aspects of travel demand management (TDM) is the analysis of trip attraction in shopping malls. Shopping malls are a key source of travel in any country because a large number of people are drawn to shopping centers on a daily basis. As a result of its essential aspect, trip attraction plays a critical role in resolving and improving traffic problems through the development of road networks. In this study, an effort has been made to determine the trip attraction rates of shopping malls in Chattogram city.The trip attraction rate was determined by physical features such as floor area (ft^2), parking space, number of stores, and number of staff (per shop) and the number of vehicles and people entering the shopping centers was counted every 15 minutes during peak hours on weekend and weekday. Questionnaire survey techniques were used to collect primary data and estimate the attractions of shopping centers. Four regression models were developed with respect to physical features and socio-demographic variables. The population size at weekend and weekday was calculated at a 95% confidence level depending on the quantity of visits throughout the week for each population number. Then relevant tests (validity and reliability test, normality test, R-squared, and correlation matrix) were run for each model produced to examine the accuracy and consistency of the research. From the study, the highest trip attraction rate at weekend and weekday was found at Sanmer Ocean City with 286.8 PCU/hr. and 211.1 PCU/hr respectively. Due to the location's suitability as well as its popularity and branding of clothing and other elements, people tend to go to Sanmar Occan City and Finlay Square rather than other shopping centers. Consequently, the lowest peak hour trip attraction rate was found at Chittagong Shopping Complex, with 124.5 PCU/hr (12%). In every case, the weekend trip rate is significantly higher than the weekday travel rate in Chattogram city area. In addition, floor area, number of shops, and number of employees based on physical characteristics have a strong correlation with the number of trips. Because of the availability of leisure time, people spend more time shopping on weekend than on weekday. The study's computed trip attraction rates might be helpful for the regional transportation system or for channeling traffic control around a mall. Furthermore, trip attraction rates can be used to improve traffic facilities on congested roadways and play a vital part in our daily lives in support of Chattogram city's future growth.

Keywords: *Trip Attraction, Gross Floor Area, Multiple Linear Regression Analysis, Passenger Car Unit, Traffic Impact Assessment*

1. INTRODUCTION

Rapid urban growth has become one of the most critical matters facing developing nations. Since the world's population is expanding quickly, new development activities has grown to a big issue in recent years. These changes are degrading the road network's performance (lower free flow speed, increased delay) due to an unplanned existing road network (Mamun et al., 2014). The increase in urbanization, combined with an increased in need for transportation services, has resulted in a gap between travel supply and demand. Forecasting travel demand is significant for road system and service design, as well as planning, investing, and policy creation (Razib & Rahman, 2017). When evaluating the effectiveness of new development, such as activity centers and residential development, transport engineers and designers must include trip generation. The basic goal of trip generation is to link property use and travel patterns in order to predict future travel patterns (George et al., 2013). Therefore, At the tactical and operational levels, linear regression model and rate approaches with linear regression equation are utilized to estimate transport-generated trips (Al-Tae & Taher, 2006; Javed et al., 2020). In many empirical investigations, linear regression and cross-classification approaches are primarily utilized to estimate total number of trips (Ahmed, 2014).

Besides, Industrialization and urbanization are worldwide phenomenon occurring at a quicker rate in the world's least developed countries, such as Bangladesh (Shamsher et al., 2013). Chattogram, Bangladesh's principal commercial hub, is the center of employment possibilities and other necessary services, including health, education, etc. People move from different regions of Bangladesh to Chittagong in pursuit of a better living, education, employment, etc. (Umme et al., 2022). The trip attraction is undoubtedly the most suitable in terms of traffic at particular land use activity. Additionally, it is involved in numerous stages of activities connected to traffic engineering and transportation planning (Rahayu et al., 2020). Recently, shopping tours make up an increasingly big share of urban travel, especially during peak travel times. According to Bhat & Steed, (2002), shopping trips offer greater personal flexibility in terms of timing than do work trips. Therefore, knowing trip attraction rates of shopping centers plays critical role in overall city planning and traffic management activities.

The study aims at to develop trip attraction models using multiple linear regression analysis of shopping centers in Chattogram city. Shopping is such a vital part of our daily lives, significant steps are being done to improve traffic facilities on congested roadways. The trip attraction rates of different shopping centers in Chattogram city were determined in weekends and week days. Finally, this trip attraction rate will be used in the planning and construction of retail complexes, as well as traffic management strategies on the roads surrounding the shopping centres which can provide us an excellent opportunity to support of Chittagong's future economic growth.

2. LITERATIRE REVIEW

Transportation planning approaches have been extensively employed to forecast future demand for journeys. Trip attraction and trip production are the two major branches that performs ordinary essential function on trip generation. In order to determine the attractiveness prices of shopping, it is also necessary to learn about trip producing and trip attraction (Boriboonsomsin et al., 2010). Trip production refers to the journeys that residential zones generate, whether they are trip origins or trip destinations. Trips that end at home are referred to as home-based trips or trip production, whereas trips generated by activities at non-home ends are referred to as trip attraction (Choo et al., 2016).

2.1 Trip attraction

A trip is frequently described as a single journey performed by a person between two sites using one or more means of transportation and with a specific objective in mind. A trip is a one-way movement of people using a mechanized method of transportation (Yulianto et al., 2020). Moussa (2013) conducted research in Gaza City, Palestine, to construct a trip generation model and estimate the home travel characteristics pattern in the study area. In Gaza City, the study aimed to compare trip rates estimated using the Conventional cross classification (CCA) approach with those predicted using the multiple cross classification (MCA) method. In addition, the researcher wanted to use the Multiple linear regression (MLR) approach to create a trip attraction model (Ismail et al., 2023). In the Al-Karkh neighborhood of Baghdad City, Iraq, Saad and Al-Hassani (2011) created statistical models to forecast trip volumes for a specific target year. The study used the usual way of forecasting trip generation volume based on total trips per home, work trip per household, education trip per household, shopping trip per household, and social trip per household. In common usage, trip rate refers to the number of people who enter and exit a development for a specific trip rate parameter factor. Consequently, Shamim & Al Razib, (2017) uses the following equations for computing different trip attraction rates:

1. Peak hour person trip attraction rate (Trips per 1000 sq. ft. per hour) = (Peak hour person trip /Gross Floor Area (GFA)) *1000
2. Peak hour person trip attraction rate (Trips per shop per hour) = (Peak hour person trip/total number of shop)
3. Peak hour person trip attraction rate (Trips per entry gate per hour) = (Peak hour person trip/number of entry gate)
4. Peak hour person trip attraction rate (Trips per 100 employees per hour) = (Peak hour person trip/total no of employee of shopping center) *100. (Uddin et al., 2012).

2.2 Factors affecting trip attraction rate

Several parameters were employed as independent variables in previous studies shown in Table1. Since those studies were based on different commercial centers in various geographical locations of the world, some of the factors may not be suitable for this study.

Table 1: Factors affecting trip attraction rate

<table>
<tr><th>Factor</th><th>Remarks</th><th>Reference</th></tr>
<tr><td>Gross floor Area (GFA)</td><td rowspan="3">As this factor increases the trip attraction rate also increases.</td><td>(Mamun et al., 2014)
(Kikuchi et al., 2004)</td></tr>
<tr><td>No. of Years in operation</td><td>(George et al., 2013)</td></tr>
<tr><td>Parking availability</td><td rowspan="2">(Mamun et al., 2014),(Uddin et al., 2012),(Kikuchi et al., 2004), (George et al., 2013)</td></tr>
<tr><td>No. of stores</td><td>Supermarket is a single store.</td></tr>
<tr><td>No. of floors</td><td>This factor can be accommodated into GFA</td><td rowspan="2">(Sivagnanasuntharam et al., 2017), (George et al., 2013)</td></tr>
<tr><td>Commercial floor area</td><td rowspan="2">Used to analyze shopping characteristics of an area</td></tr>
<tr><td>Residential floor area</td><td>(Sivagnanasuntharam et al., 2017)</td></tr>
<tr><td>Restaurant availability</td><td>Supermarkets do not have restaurants. (They may be seen at shopping malls.)</td><td>(Mamun et al., 2014)</td></tr>
<tr><td>No. of employees</td><td>The shopping centers requires staff to operate</td><td>(Uddin et al., 2012)</td></tr>
<tr><td>Type of the building</td><td>It may have an impact on the trip attraction rate, but it's tough to quantify.</td><td rowspan="3">(George et al., 2013)</td></tr>
<tr><td>Type of goods sold</td><td>All of the shopping centers in this research sell a variety of items.</td></tr>
<tr><td>Width of major corridor</td><td>This rule does not apply to shopping malls.</td></tr>
<tr><td>No. of entrance</td><td>The number of entrances to each retail mall in this study varies.</td><td>(Uddin et al., 2012)</td></tr>
</table>

2.3 Multiple Linear Regressions analysis

Regression analysis is a technique used for the modeling and analysis of numerical data consisting of values of a dependent variable (response variable) and of one or more independent variables (explanatory variables) (Amavi et al., 2014). Multiple linear regression is a statistical technique for predicting a variable's outcome based on the values of two or more variables. The equations are normally constructed based on data aggregated to the zone level as observations and are usually produced by trip purpose (Sonoli et al., 2018). It also assumes that the model's interactions are linear and will stay so in the future, and that if land-use and socioeconomic characteristics can be anticipated, future journeys for any suggested transportation system may be projected. Multiple regression models were chosen from among the several trip generating models available because of their obvious and straightforward structure and ease of implementation (Basuki et al., 2021). The general form of the equation technique for multiple linear regressions analysis is:

$$Y = A + B_1X_1 + B_2X_2 + ... + B_zX_z \quad (1)$$

Where:

Y = Dependent variable, X1…Xz = Independent variables, A = Regression constant B1...Bz = Regression coefficients

3. METHODOLOGY

3.1 Study area profile

Chattogram is the second biggest city, located on the bank of Karnaphuli River. Besides, The city is Bangladesh's fastest-growing and densely populated serves as the economic and industrial center of the country (BBS, 2017). The selected shopping centers such as Chittagong shopping complex, Finlay Square, Ameen center, Yunusco City center, Central Plaza and Sanmar Occan city are located in the road section from Lalkhan Bazar to Muradpur road. However, all the major commercial activities are performed on the both side of the selected road.

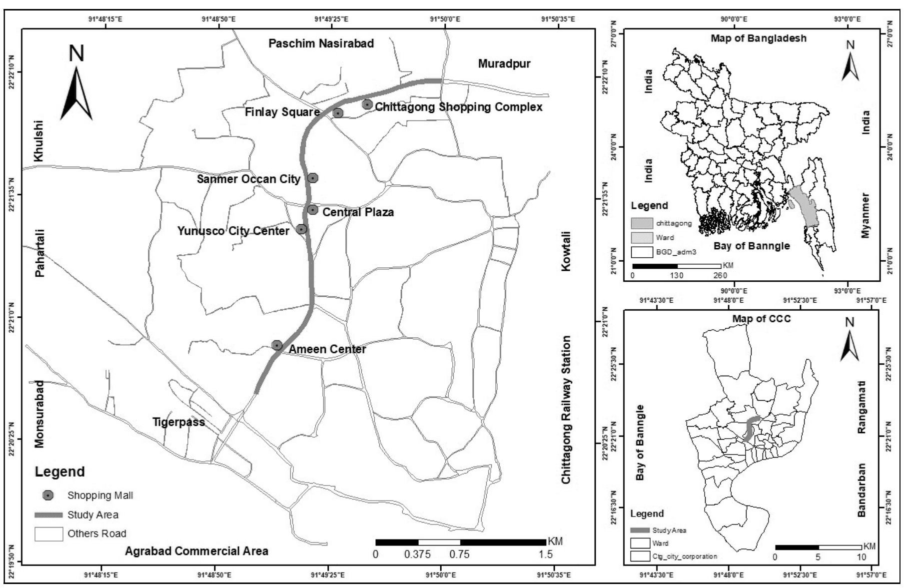

Figure 1: Location Map (Lalkhan Bazar to Muradpur road)

3.2 Sample size determination

Statistical formulas can be used to compute the sample size. The sample size for this study was derived (equation 2) using the Slovin's formula (Abulebu et al., 2018), which is as follows:

$$n = \frac{N}{(1 + Nd^2)} \quad (2)$$

Where: n = number of samples, d = error tolerance, N = total population

The population size was calculated based on the number of visits throughout the weekdays (364) and on weekends (383). For each population number, the sample size error tolerance was considered as 0.05 or 95%.

3.3 Data acquisition

A study requires some data or information, which must be gathered through several methods. There were two types of data used in this study: primary data and secondary data. Primary data was collected through reconnaissance survey, shopping centre survey and field survey. The entire research area was examined to determine the exact point and areas where specific trip attraction preferences exist. After completing a reconnaissance study of the neighbouring land uses, six shopping malls were selected as a sample set. People visit shopping malls for a variety of reasons, including shopping, fitness facilities, eating in restaurants, and other services. To calculate the trip attraction rate, surveyors recorded persons and vehicles entering the shopping mall at 15-minute intervals while standing near the entrance during peak hours, 4.30 p.m. to 5.30 p.m. on weekend and weekdays. The 15-minute period was chosen since it is used as the fundamental unit for capacity calculations in the Highway capacity manual (Kikuchi et al., 2004). Visual observation was used to estimate shopping visits on the weekend and weekday for one hours (4 consecutive 15-minute intervals). The collected data on various physical characteristics and socio-demographic features were used to create regression models in SPSS software to assess the trip attractiveness rate to produce a macroscopic model (Majeed & Qasim, 2021). Finally, relevant tests were run for each model to examine the model's goodness of fit using logic and statistics testing. Validity and reliability test, Normality test, R-Squared and Correlation matrix were used to evaluate the accuracy and consistency of research (Figure 2).

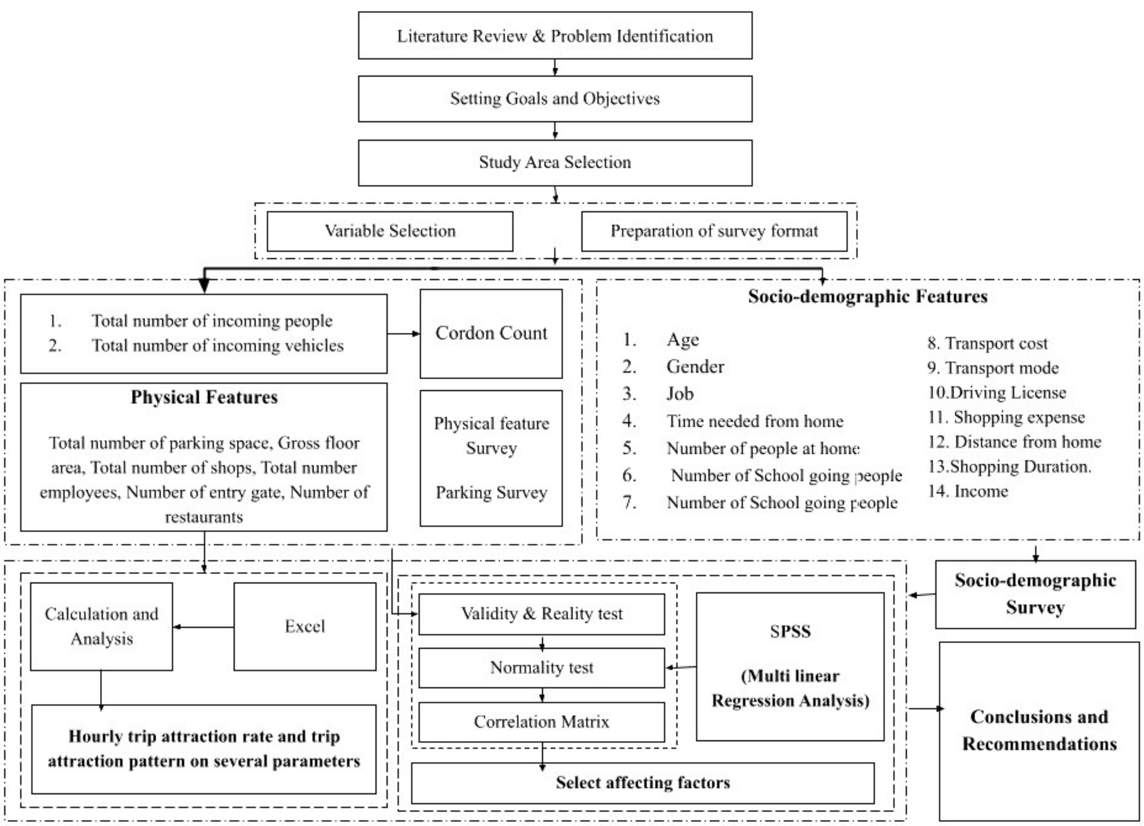

Figure 2: Flow chart of methodology

4. DATA ANALYSIS AND RESULT

4.1 Trip attraction variation at Weekend and weekday

The trip rates were calculated during evening peak hours of six different Shopping mall. The number of individuals and vehicles drawn to shopping malls for a variety of reasons such as shopping, fitness facilities, restaurant dining, and other offerings were recorded during the field survey period shown in Table 2. The weekend and weekday variations in travel rate were observed on Friday and Sunday. The total of each incoming trip over four consecutive times is then used to get the peak hour incoming trip rate. In this study, trip attraction rate was determined with respect to different physical features such as person trips/1000 ft^2/hour, person trips/shop/hour, person trips/100 employees/hour, person trips/entry/hour, and person trips/10 parking spaces/hour (Asmael & Kadhim, 2020).

Table 2: Physical features of shopping center

Shopping center	Floor area	Shop	Employee	Parking space	Entry gate	Availability of restaurants
Chittagong Shopping Complex	116947	505	1540	110	9	13
Finlay	8184	111	670	95	1	20
Ameen Center	6378	217	885	115	1	
Central Plaza	4780	184	570	60	6	6
Sanmar Occan City	11250	260	1280	140	1	14
Yunusco City Center	6184	224	675	124	1	

Source: Field Survey, 2022

The highest trip attraction rate were recorded 286.8 PCU/hr and 211.1PCU/hr at weekend and weekday in Sanmar ocean city respectively (Figure 3). However, Lowest peak hour trip attraction were recorded at Chittagong shopping complex both weekend and weekday 124.5 PCU/hr and 92.6 PCU/hr. In addition, Chittagong shopping complex, Finlay square, Ammen center, Sanmer Ocean city and Yunusco city center's trip attraction rate were found to be higher in weekend rather than at weekdays. On the contrary, Central plaza's trip attraction rate was observed higher in weekday due to higher number of traffic activity.

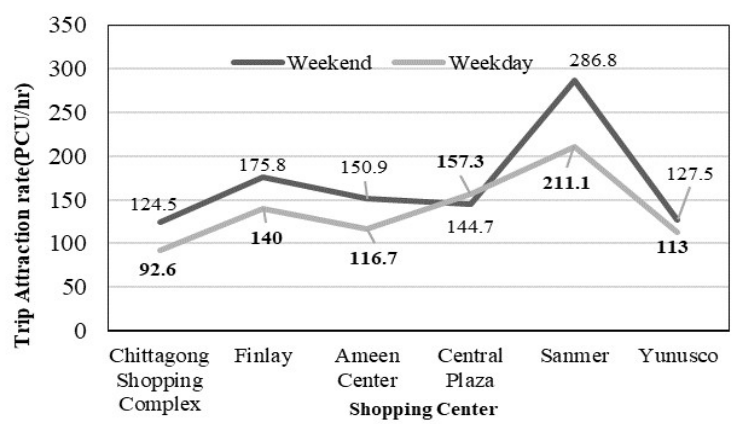

Figure 3: Trip attraction variation at weekend and weekday *(Source: Field Survey, 2022)*

4.2 Trip attraction based on physical features at Weekend and weekday

The trip attraction is generally connected to physical features such as floor space, parking area, number of shops, and number of staffs of the selected shopping centers (Sivagnanasuntharam et al., 2017). The Sanmer ocean city, a well-known shopping center offering name-brand clothes, received the highest people per floor area at peak hour and received 146.67~147 trips per hour at the weekend shown in Figure 4(a). Therefore, the peak hour person trip attraction rate for gross floor space was found 150.21 person trips/1000 ft^2/hr and comprises 31% of total trip attraction on weekday. On the contrary, the lowest peak hour trip attraction rate was observed as 6.65 person trips/1000 ft^2/hour at Chittagong shopping complex due to less amount of floor space in that commercial center.

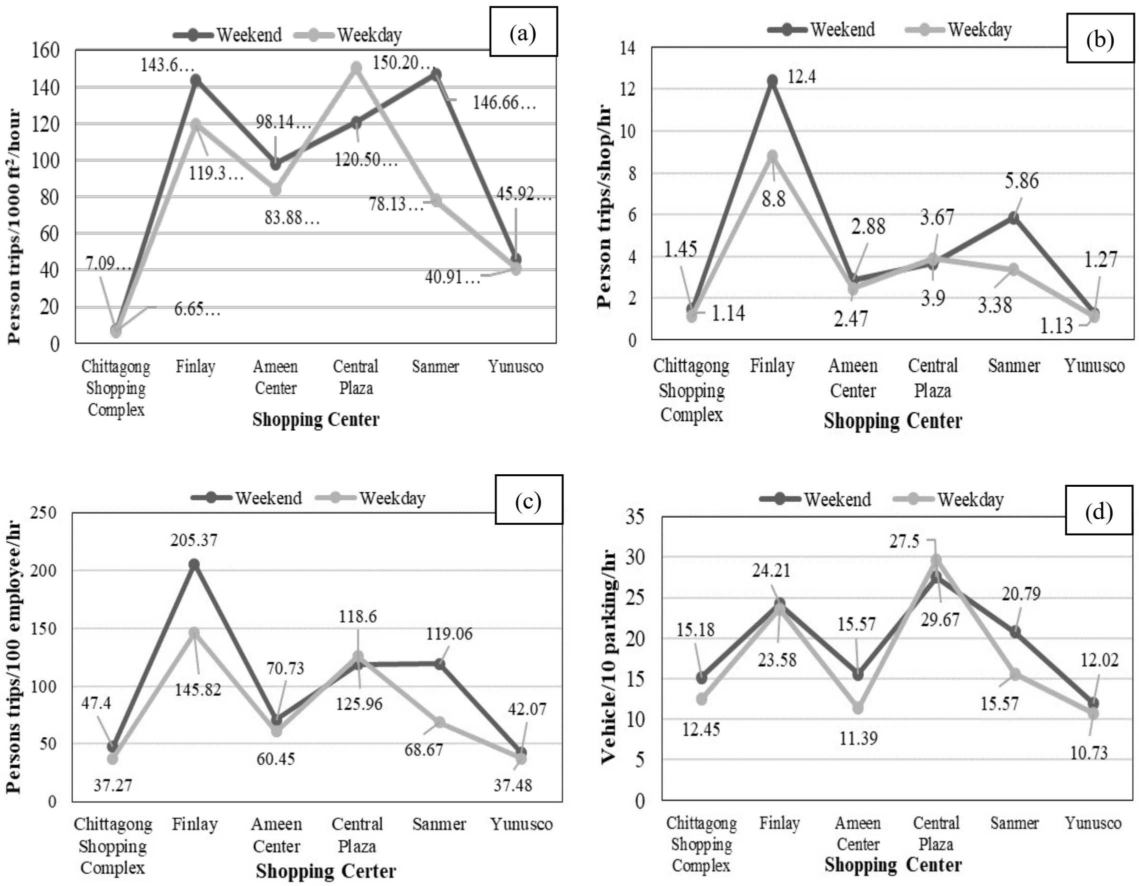

Figure 4: Trip Attraction Rate Variation with respect to (a) floor area, (b) shop (c) no of employees & (d) Parking Spaces at weekend and weekday *(Source: Field survey, 2022)*

The trip attraction rate for each shop during peak hours is 10.59 person trips/shop/hr on weekends and Finlay Square represents the highest person trip per shop shown in Figure 4(b). In contrast, Yunusco City Center has the lowest peak-hour trip attraction rate, at 1.13 per-son trips per shop per hour at weekday. In addition, the highest peak hour person trip attraction rate is in Finlay square which means for every 100 employee on a 145.82~205.37 trip attracted per hour at weekend. Yunusco City Center has the lowest peak-hour trip attraction rate of 37.27 people per 100 employees per hour. In every scenario, the shopping complexes' weekend trip attraction rate is higher than their weekday which represents people tend to shop essential products on weekends rather than weekdays (Figure 4(c)). However, the peak hour vehicle trip attraction rate for 10 parking spaces is 25.43 Vehicles/10 parking/hr, which represents each parking attracts 25.43~26 trips each hour over the weekday. During peak hour, Central Plaza received the most number of vehicles per parking spots. Chittagong Shopping Complex has the lowest peak-hour visitation rate of 12.45 vehicles per 10 parking per hour shown in Figure 4(d) as the shopping centre didn't have any parking facilities of its own premises.

4.3 Multiple Linear Regression Model with Respect to Physical Features at Weekend and Weekday

4.3.1 Physical feature at weekend

Trip attraction rate and trip pattern varies significantly at weekend and weekday. Validity and reliability test, which are used to evaluate the accuracy and consistency of research tools (particularly questionnaires), have been demonstrated in various studies (Abulebu et al., 2018). On a weekend day, the sample size is 6. df = number of samples-2, thus in this case df =6-2=4 and the table value of R = 0.8328 at a 5% significance level. The results obtained from the validity and reliability test for weekend (Physical feature) represents total floor area of shopping center (X1), total number of shops (X3), employee work in the shopping centers (X4) r-count value exceed R table value (shown in Table 3) , which are considered reliable and valid.

Table 3: Validity and reliability test for weekend (Physical feature)

No	Variables	r-count	Conclusion
X1	Total Floor Area of the shopping center	0.975	Valid
X2	Parking Spaces	0.6	Not valid
X3	Total Number of shops	0.85	Valid
X4	Employee work in the Shopping center	0.886	Valid
X5	Number of Entry gate	0.338	Not valid
X6	Number of Restaurant	0.2	Not valid

After that, normality test were performed among the valid variables which displays an approximately bell shaped curve so that the data can be assumed as normally distributed. On the other hand, the normal p-p plot represents the existing points that are dispersed along the diagonal line and their distribution follows the diagonal line's direction. As a result, the R-Squared/Goodness of fit test demonstrates R-Square value is .978, which is close to 1 indicates that the data is well fitted for the multiple linear regression analysis (Table 4). The F-statistics for the general trip generation model are 3061.408, with a significance lower than 0.05, as shown in the Table 5. Therefore, the hypothesis can be formulated that all of the independent factors in the general trip generation model influence the dependent variable (Sulistyono et al., 2012).

Table 4: R-Squared test for weekend (Physical feature)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
	.989[a]	.978	.889	159.38770	1.250

a. Predictors: (Constant), Employee work in the Shopping center, Parking Spaces, Total Number of shops, Total Floor Area of the shopping center.

b. Dependent Variable: Total Number Persons trip

Table 5: ANOVA test for weekend (Physical feature)

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	589335.874	4	147333.968	3061.408	.014[b]
	Residual	48.126	1	48.126		

Total	589384.000	5

a. Dependent Variable: Total Number Persons trip

b. Predictors: (Constant), Total Number of shops, Parking Spaces, Total Floor Area of the shopping center, Employee work in the Shopping center

The correlation between dependent variable and independent variables represents that the coefficient of determination is between 0.7 and 1.0 shown in Table 6. Independent variables like Total floor area (X1), total number of shops (X3), and employees work in the shopping center (X4) are highly correlated with the dependent variable. The correlation coefficient between total floor area (X1) and Total number of shops (X3) are moderately correlated with a value of 0.486 (Table 6). Multi-linear Regression models are used to correlate trip attractions with shopping complex physical characteristics (gross floor space, number of shops employee work in the shopping centre) (Rahayu et al., 2020; Sulistyono et al., 2012). If significance value is found less than 0.05 for any factors, then it should be considered as independent variables and statistically significant. Regression Model for Weekend:

$$Y = 424.528 + 1.262X_1 + .392X_3 + .1.429X_4 \tag{3}$$

Here, X_1=Total Floor Area of the shopping center, X_3 = Total Number of shops, X_4 = Employee work in the Shopping center,

Table 6: Correlation matrix between dependent and Independent variables for weekend

Correlations				
	Total Number Persons trip	**Total Floor Area of the shopping center**	**Total Number of shops**	**Employee work in the Shopping center**
Total Number Persons trip	1.000	0.829	.429	0.886
Total Floor Area of the shopping center (X1)	0.829	1.000	.486	0.886
Total Number of shops (X3)	0.429	.486	1.000	.543
Employee work in the Shopping center (X4)	0.886	0.886	.543	1.000

Table 7: Result for modeling for weekend

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	424.52	19.43		21.840	.029
Total Floor Area of the shopping center (X1)	.111	.004	1.262	31.520	.020
Employee work in the Shopping center (X4)	.353	.038	.392	9.414	.047
Total Number of shops (X3)	-3.64	.069	1.429	-52.473	.012

The following is the interpretation of the regression equation (Equation 3):

a) Constants of 424.52 indicates the magnitude of trip attraction of the the variable type, total floor area (X1), total number of shops (X3) and employees work in the shopping center (X4) equals zero. So in this case the value of the independent variable is the amount of trip attraction of 424.52.

b) Value of B_1= 1.262 indicating that the varying total floor size (X1) will have an impact on trip productivity. Assuming that the total number of shops (X3), and employee work in the shopping center (X4) are constant, then any increase in total floor area variable (X1) of 1 would increase trip production by 1.262 trip/hr.

c) Value of B_2= .392 indicating that the varying employee work in the shopping center (X4) will effect trip productivity. Assuming that the shopping center's total floor area (X1), total number of stores (X3) remain constant, any increase in total Employee work in the Shopping center variable (X4) of 1 increase productivity by .392 trip/hr.

d) Value of B_3= 1.429 indicating that the varying total number of shop (X3) will have an impact on trip productivity. Assuming that the shopping center's total floor area (X1) and employee work (X4) are constant, each increase in total number of shops (X3) of 1 increase trip production by 1.429 trip/hr.

4.3.2 Physical feature at Weekday

Questionnaire validity and reliability test were used to ensure that questionnaires used in this research can really measure research variables (Table 6.6). On a weekend day, the sample size is 6. df = number of samples-2, thus in this example df= (6-2)=4, and R table value = 0.8328 at a 5% level significance. The findings of this weekday analysis represents total floor area of shopping center (X1), total number of shops (X3), employee work in the shopping center's (X4) r-count value exceed R table value which were both reliable and valid (Table 7). The Normal P-P plot graph model for the normality test were done with SPSS in the below mentioned figure 5, where the existing points were scattered around the diagonal line despite the extreme point, and their distribution follows the diagonal line's direction (Rahayu et al., 2020). This regression model were used to forecast the number of people visited the shopping mall on a weekday based on the independent variables.

Table 8: Validity and reliability test for weekday (Physical feature)

No	Variables	r-count	Conclusion
X1	Total Floor Area of the shopping center	0.975	Valid
X2	Parking Spaces	0.6	Not valid
X3	Total Number of shops	0.85	Valid
X4	Employee work in the Shopping center	0.886	Valid
X5	Number of Entry gate	0.338	Not valid
X6	Number of Restaurant	0.2	Not valid

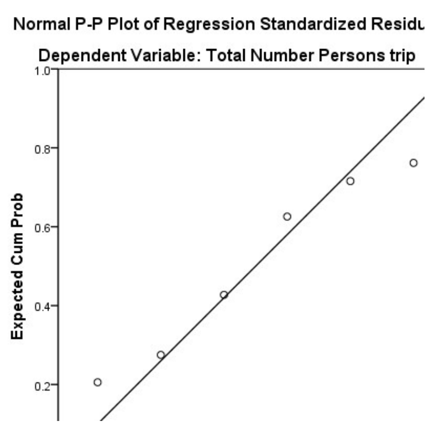

Figure 5: Normal P-P plot for weekday (Physical features)

The R-Square value .996 was calculated using SPSS software and the value was found close to 1, indicate the model would be well fitted for the regression analysis (Table 9). On the other hand, the value from F-statistics (ANOVA test) for the trip generation model were found to be 1660.408, significantly lower than 0.05. The coefficient of determination between 0.7 and 1.0 demonstrates higher correlation between dependent variables (Sulistyono et al., 2012) shown in Table 10. Furthermore, the correlation coefficient between total floor area of shopping center (X1) and total number persons' trip 0.714 were found to be highly correlated. Similarly, the Employee's work in the shopping center (X4) and total number of shops (X3) were moderately correlated (Table 11).

Table 9: R-Squared test for weekday (Physical feature)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.998[a]	.996	.990	26.12

a. Predictors: (Constant), Employee work in the Shopping center, Total Number of shops, Total Floor Area of the shopping center

b. Dependent Variable: Total Number Persons trip

Table 10: ANOVA test for weekday (Physical feature)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	340247.43	3	113415.81	166.23	.006[b]
	Residual	1364.563	2	682.281		
	Total	341612.00	5			

a. Dependent Variable: Total Number Persons trip

b. Predictors: (Constant), Employee work in the Shopping center, Total Number of shops, Total Floor Area of the shopping center

Table 11: Correlation matrix between dependent and independent variables for weekday

Correlations

	Total Number Persons trip	Total Floor Area of the shopping center	Total Number of shops	Employee work in the Shopping center
Total Number Persons trip	1.000	0.714	.486	0.657
Total floor Area of the shopping center (X1)	0.714	1.000	.486	0.886
Total number of shops (X3)	.486	.486	1.000	.543
Employee work in the Shopping center (X4)	0.657	0.886	.543	1.000

According to the findings, the model of trip attraction for visitor movement to shopping centers on a weekday is derived from the regression equation.

$$Y = 786.965 + 2.773X_1 + 2.196X_3 + .452X_4 \tag{4}$$

Here, X_1=Total Floor Area of the shopping center, X_3 = Total Number of shops, X_4 = Employee work in the Shopping center,

The following is the interpretation of the regression equation (Equation 4):

a) Constants of 786.96 indicates the magnitude of trip attraction of the the variable type, total floor area (X1), total number of shops (X3) and employees work in the shopping center (X4) equals zero. So in this case the value of the independent variable is the amount of trip attraction of 786.96.

b) Value of B_1= 2.733 indicating that the varying total floor size (X1) will have an impact on trip productivity. Assuming that the total number of shops (X3), and employee work in the shopping center (X4) are constant, then any increase in total floor area variable (X1) of 1 would increase trip production by 2.733 trip/hr.

c) Value of B_2= 2.196 indicating that the total number of shop (X3) will effect trip productivity. Assuming that the shopping center's total floor area (X1), employee work in the shopping center (X4) remain constant, any increase in total number of shop (X3) of 1 increase productivity by 2.196 trip/hr.

d) Value of B_3= .452 indicating that the varying employee work in the shopping center (X4) will have an impact on trip attraction to the shopping centers. Assuming that the shopping center's total floor area (X1) and total number of shop (X3) are constant, each increase in Employee work in the Shopping center (X4) of 1 increase trip production by 0.452 trip/hr.

Table 12: Result for modelling for weekday

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	786.96	36.27		21.695	.002
Total Floor Area of the shopping center (X1)	.182	.010	2.733	17.815	.003
Total Number of shops (X3)	-4.26	.224	2.196	-19.020	.003
Employee work in the Shopping center (X4)	-.310	.057	.452	-5.463	.032

5. FINDINGS

5.1 Findings from peak hour trip rate calculation

Highest trip attraction rate at weekend is Sanmar occan City with 286.8 PCU/hr which comprises 28% of all trip attraction of commercial facilities. Secondly, Due to the location suitability as well as popularity and branding cloths and others elements, people tend to go to Sanmar occan city and Finlay square rather than other shopping centers as consistent with the findings from (Asmael & Kadhim, 2020). Consequently, the lowest peak hour trip attraction rate were found at Chittagong shopping complex with 124.5 PCU/hr (12%). Finally, the trip attraction rate at weekends are higher than the weekdays and in both of the cases Sanmar ocean city comprises the highest number of trip rate due to its geographic location and different modes of transport availability.

5.2 Findings from trip attraction rate based on physical features

The rate of trip attraction was calculated based on many physical characteristics. The trip attraction rate differ significantly with relation to physical features such as Total floor area, number of shops, no of employees, parking space etc. Because of the availability of leisure time, people spent more time in shopping in weekend than weekdays.

5.3 Finding from Multi-linear regression analysis based on physical features

To estimate the trip attraction rate, two independent models were created using SPSS software for weekends and weekdays in which apart from the number of entries, parking spaces, number of restaurants all of the independent variables show a strong correlation (Majeed & Qasim, 2021). From the results of the regression test, obtained the coefficient of determination (R^2) of weekend and weekdays were 0.978 and 0.996 respectively. This means that the independent variables (Total floor area, total number of shops and employee of the Shopping center) were influential in the model by 97% (Weekend) and 99% (weekdays) to the dependent variable while the remaining 3% (Weekend) and 1% (weekdays) were found due to other factors not included in the regression model.

6. CONCLUSIONS

Chattogram have experienced a surge in the number of shopping centers with each passing day. Because of this, the size and activity of shopping malls have had a significant impact on the region's travel patterns. Planning for transportation facilities must take trip attraction rate into consideration. This trip attraction rate can be used to estimate traffic flow and assess traffic impacts in the surroundings of a new shopping mall. The study's computed trip attraction rates might be helpful for the regional transportation system or for channelizing traffic control around a mall. Therefore, the model assists in the understanding of trip chaining in the Shopping Center and as a result the traffic congestion problems can be rectified by enhancing traffic facilities and expanding Chattogram's current road network facilities.

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