



Trip Attraction Rates of Banking Services in Developing Countries' Cities

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Abstract

There is a lack of studies on trip generation rates related to land use activities in developing countries. The absence of trip rates makes transportation planners use rates listed in the Institute of Transportation Engineers (ITE) Trip Generation Manual, which may lead to unrealistic results. The study aims to determine trip attraction rates for banking services in Zagazig city, Egypt, and evaluate the factors affecting the attracted trips to the banks. The study has designed and implemented a comprehensive data collection and analysis program. The study sample contained nine banks. The study has conducted field surveys that counted the total number of persons entering/exiting the bank under investigation and the generated traffic volume of the adjacent street. The trip rates have been established in terms of independent variables, i.e., gross floor area, the total number of employees, and the number of tellers for different types of banks. Findings showed that average trip attraction rates for public banks were higher than for private banks. There was a strong relationship between trip attractions and the total number of employees at public banks. The most representative factor of private banks' trip attractions was the number of tellers.

Keywords: Trip Generation Rates; Trip Attraction Rate; Public Banks; Private Banks; Developing Countries.

1. Introduction

The main objective of transportation planning is to accommodate the need for human mobility to provide safe, comfortable, and effective access to various land use activities that meet human needs [1]. Understanding human mobility patterns is critical to forecasting the travel demand of individuals and planning for adequate transport infrastructure [2]. Travel demand modeling (TDM) estimates the traffic demand associated with any study area. TDM is implemented in four sequential steps: trip generation, trip distribution, mode selection, and network traffic assignment. The success of travel demand modeling depends on the trip generation stage. The objective of the trip generation stage is to predict the total expected number of trips produced or attracted to each study area zone [3]. Many studies used demographic and socioeconomic variables such as employment, level of education, age, average household income, average car ownership, household size, and population density to develop trip generation models [4–6]. These models are based on household trip questionnaires, which are expensive and time-consuming to create [7, 8]. It is practically impossible to apply the trip-generation model, which includes demographic and socioeconomic variables, to assess the traffic impact of any new development [9]. Therefore, a model with fewer data requirements is more practical [10]. Motivated by this reason, the current study focuses on developing trip rates relevant to land use characteristics.

The weighted average method, regression analysis, and category analysis are three methods used to determine trip generation rates. Several studies used regression analysis to develop trip generation [11–13]. Hirun [14] stated that trip

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generation rates calculated using the weighted average method are simple, whereas the developed trip generation rates calculated by simple regression models are more accurate. Modi et al. [15] discussed using the category analysis method and the regression method in determining trip generation rates.

Recently, cities in developing countries have experienced rapid population growth, necessitating the expansion of public and private banks to meet the increased economic activity. Zagazig is one of the developing countries' regional cities. The banking density in Zagazig city is equal to 20332 capita per bank, which is about twice the international average (11500 capita per bank) [16]. New banks should be constructed in the city to enhance the banking density. So, these banks will generate additional traffic, which needs to be based on traffic impact studies that depend on trip attraction rates. As a result, there is extra traffic congestion and parking issues surrounding the area of the banks. These problems have negative impacts on all types of street users. In addition, traffic delays have long-term effects on the national economy due to the increase in fuel consumption and vehicle maintenance requirements, as well as the adverse environmental impacts of traffic congestion on society, such as stress, noise, and accidents.

The ITE publishes and regularly updates the Trip Generation Manual for various land use activities in the USA [17]. The ITE Trip Generation Manual is the source for transportation planners worldwide in the absence of local trip generation rates. The lack of trip rates for different land uses makes transportation planners use the corresponding rates listed in the ITE Trip Generation Manual in their transportation studies. These rates may not be appropriate for all countries, especially developing countries. Moreover, land use conditions in these countries change tremendously over time because of rapid development activities [1]. As a result, the purpose of this paper is to determine the trip attraction rates of public and private banks, as well as to evaluate the factors influencing the attracted trips to the banks.

2. Trip Rates for Banks: A Review

The ITE Trip Generation Manual defines a person's trip as the movement in a single direction that begins from or ends inside the study area. Therefore, the characteristics of the trips greatly depend on land use. For urban areas, the adjacent traffic condition is affected by various land use phenomena that determine the impact of land use on transportation efficiency [18]. Earlier researchers agreed that the solution to traffic problems is related to land use regulation, but this idea is still not included in most developing countries' planning policies [19]. Local authorities in developing countries lag in applying the relationships between land uses and transportation systems, which are good tools for regulating new developments [20, 21]. According to Ahmed et al. [22], the transportation system, local land use characteristics, and socio-demographic characteristics such as population density all influence trip generation rates. According to Mukherjee & Raghuram [1], several recent studies have focused on developing trip-generation models relevant to land use, but these studies are still limited to cities in developed countries. They also found that the United States and China produced nearly 65% of these studies.

A trip generation model related to land use is built based on the relationships between trip generation and independent variables [23]. When creating the trip generation model, selecting appropriate independent variables is essential. These variables must be easy to measure and have a logical relationship to trip generation. In the ITE manual, Trip Generation Manual [24], the independent variables for the bank land use category are gross floor area and the number of employees. In many studies, the total number of employees and gross floor area were independent variables in developing a bank trip generation model carried out in San Diego [25], Saudi Arabia [26], Abu Dhabi [27], and Greece [28]. The Development Research and Technological Planning Center [29] conducted a study in 1994 to determine trip attraction rates for some land uses in Greater Cairo. The study recommended that the number of tellers as an independent variable for predicting the trip attraction rates of private banks was the best predictor. Narasimha & Upchurch [30] created trip generation for banks using automatic teller machines (ATMs) as an independent factor.

The San Diego Trip Generation Manual included three cases of bank rates: excluding drive-through, with drive-through, and drive-through only [24]. Trip generation rates were developed in Abu Dhabi's Trip Generation Manual according to the central business district [26]. Konstantopoulos [28] studied the effect of bank location on trip generation rates for banks in the Thessaloniki Metropolitan Area, Greece. The study indicated that bank trip rates in the city center were higher than those outside the city center.

Many studies have been conducted to determine bank trip attraction rates regardless of bank type. In the context of cities in developing countries, limited works discuss the effect of bank type on trip attraction rates. Two types of banks exist in Egypt: public and private, which differ from bank types in the United States. Limited work was conducted in Egypt in the past 30 years to develop trip attraction rates for private banks (the last update was in 1994 [29]). In the city center, many new banks will be established in response to the high increase in population, the number of services provided by banks, and the change in land use. Therefore, this study investigates and develops models to forecast trip attraction rates for each type of bank separately, i.e., for public and private banks.

3. General View of Study Area

Situated at $30^{\circ} 34' 00''$ N and $31^{\circ} 30' 00''$ E, with an average elevation of 16 meters, Zagazig city. It is about 86 kilometers northeast of Egypt's capital, Cairo. The Muies Canal runs through the middle of Zagazig. It is a gateway for travellers coming to Egypt's Delta and represents the center of the road network in the eastern Delta. Zagazig city has different land uses, such as residential, commercial, administrative, industrial, educational, agricultural, and other. There are twenty-four land uses in Zagazig city, and the banking land use activity is one of the most land-uses, which affects the quality of traffic. The city area is continuously increasing. It increased by about 30% per decade from 1976 to 2007. Transportation studies are required to face these challenges. All studied banks locate in two streets, Talaat Harb Street and Saad Zaghloul Street. Figure 1 shows a satellite image of Zagazig city and some land use activities.

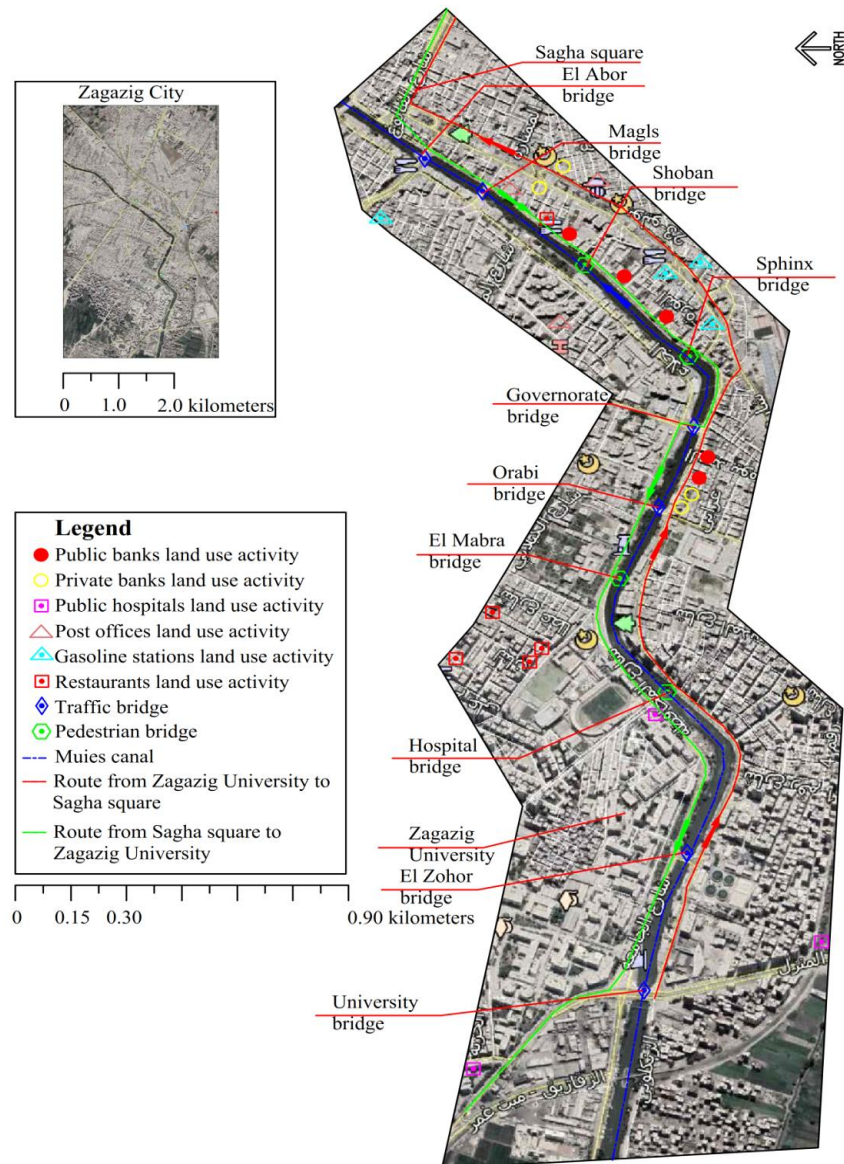


Figure 1. Study area profile of Zagazig city in Egypt (Google Earth 27/12/2022)

4. Study Objective

This study has two main objectives: the first is to determine trip attraction rates for banking services for local study areas. The second objective is to evaluate the factors affecting the attracted trips to the banks.

5. Study Methodology

To achieve the study objectives, a comprehensive methodology was designed and implemented as shown on the flow chart in Figure 2. The study methodology consists of three stages: office work, data collection, and analysis of data.

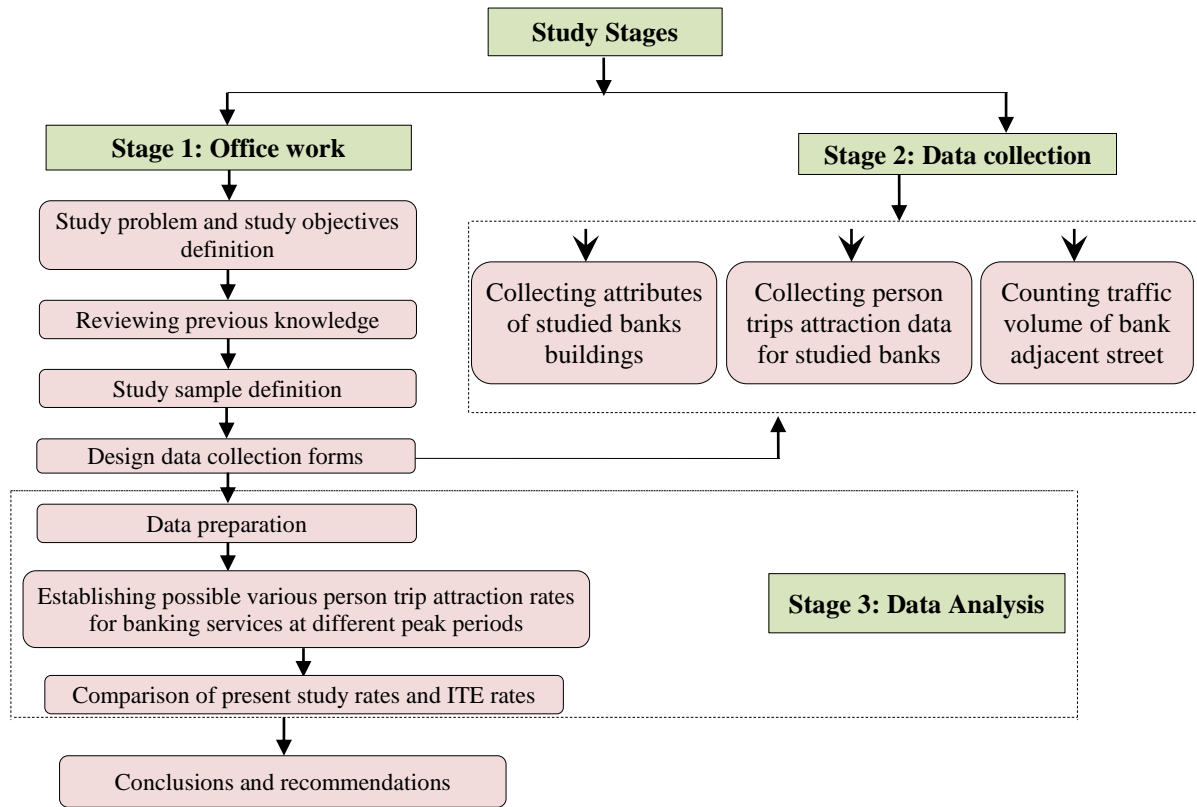


Figure 2. Flow chart of study methodology

5.1. Stage 1: Office Work

The office work included defining the problem statement and study objectives and reviewing past studies relevant to bank trip attraction rates for different developing countries' cities. It also included defining the sample size, involving each public and private bank. According to the Trip Generation Handbook [24], the minimum sample size is three sites. Attributes of surveying bank buildings, a person-trip attraction form for banking services, and a traffic volume form for the bank's adjacent street are three data collection forms. All these forms were designed. Figure 3 shows the attributes of the surveying bank building form.

Zagazig University		Faculty of Engineering	
Construction Engineering and Utilities Department			
Project of Developing Trip Generation Models in Zagazig City			
General Information of the bank			
Land use type	:	Day	:
Name	:	Date	:
Addressee	:	Branch	:
Entrance No.	:		:
Survey time	: From To		:
Number of entrances	:		
Gross floor area, m	:		
Number of floors	:		
Number of tellers	:		
Total number of employees	:		

Figure 3. Attributes of surveying bank building form

Figure 3 shows the main independent variables of the study: the gross floor area, the total number of employees, and the number of tellers. Figure 4 shows the person-trip attraction form. To conduct field surveys of the person entering and leaving the investigated banks every fifteen minutes. The traffic volume form, shown in Figure 5, was used in counting traffic volumes for the adjacent streets of the investigated bank.

Zagazig University		Construction Engineering and Utilities Department		Faculty of Engineering	
Person-trip surveying form designed for trip attraction					
Land use type	:	Day	:
Name	:	Date	:
Addressee	:	Branch	:

Time period	Person count		Time period	Person count	
	Entering	Exiting		Entering	Exiting
8.30-8.45			11.45-12.00		
8.45-9.00			12.00-12.15		
9.00-9.15			12.15-12.30		
9.15-9.30			12.30-12.45		
9.30-9.45			12.45-1.00		
9.45-10.00			1.00-1.15		
10.00-10.15			1.15-1.30		

Figure 4. Person trips surveying form

Zagazig University		Construction Engineering and Utilities Department		Faculty of Engineering	
Vehicle traffic surveying form of Bank adjacent street					

Time period	Vehicle count		Time period	Vehicle count	
	Going	Coming		Going	Coming
8.30-8.45			11.45-12.00		
8.45-9.00			12.00-12.15		
9.00-9.15			12.15-12.30		
9.15-9.30			12.30-12.45		
9.30-9.45			12.45-1.00		
9.45-10.00			1.00-1.15		
10.00-10.15			1.15-1.30		
10.15-10.30			1.30-1.45		
10.30-10.45			1.45-2.00		

Figure 5. Traffic volume count form for bank adjacent street

5.2. Stage 2: Data Collection

The second stage of the study is data collection. The necessary data was collected through the designed forms. The study obtained the independent variables through a direct interview with the bank manager. Person-trip attraction data from the investigated banks were counted from 8:30 AM to 3:00 PM using the person-trip attraction form. During two weekdays, traffic volumes of the bank's adjacent streets were manually collected using the traffic volume form in parallel with the person's trip attraction data collection. Direct investigation of a person's trip attraction data and traffic volume counts of the bank's adjacent streets were counted to define the morning peak period, evening peak period, peak hour of the generator (PHG), and peak hour of the adjacent bank's street traffic (PHAST).

5.3. Stage 3: Data Analysis

This task uses the results of stages 1 and 2 to determine trip attraction for each bank type at the previously mentioned peak periods for each public and private bank. The trip rates have been established in terms of independent variables, i.e., gross floor area, the total number of employees, and the number of tellers. Furthermore, through statistical analysis to obtain the weighted average trip rate were (see Equation 1) and the coefficient of variance. Finally, the study compared the obtained rates with the ITE rates.

$$\text{Weighted average trip rate} = \frac{\sum(\text{person trip rate} * \text{independent variable})}{\sum(\text{independent variable})} \quad (1)$$

6. Data Preparation

This section presents the study's independent variables, steps for calculating peak person-trip attractions, determining peak person-trip attraction rates, and identifying the timing of PHAST. Table 1 shows details of each investigated bank collected. The gross floor area was between 120 and 3750 m². The national bank of Egypt (Main Branch) had the highest gross floor area, 37.50 100 m². Qatar National Bank Alahli-QNB had the lowest floor area, 1.20 m². The total numbers of employees were between 30 and 80 for public banks and between 13 and 28 for private banks. Banque Misr (Islamic Branch) had the lowest number of tellers, 5, whereas the National bank of Egypt (Main Branch) had the highest number of tellers, 32.

Table 1. Independent variables for all investigated banks

		Independent Variables		
		Gross Floor Area, (100 m ²)	Total Number of Employees	Number of Tellers
Public Banks	Banque Misr (Islamic Branch)	5.76	30	5
	Banque Misr (Main Branch)	8.00	80	10
	Banque Du Cairo	9.00	40	7
	National Bank of Egypt (Main Branch)	37.50	80	32
	National Bank of Egypt (Ahmed Orabi Branch)	3.84	40	6
Private Banks	Qatar National Bank Alahli - QNB	1.20	25	5
	Commercial International Bank - CIB	3.00	13	6
	Abu Dhabi Islamic Bank	9.60	28	5
	Bank of Alexandria	8.00	22	6

Table 2 depicts a sample of raw data used to determine the bank's peak person trip attractions during different peak hours. The maximum person trips were 182 and 140 person-trips during the morning peak interval for Monday and Wednesday, respectively. Based on these values, calculating the average maximum of the two previously mentioned values was 161-person trip attractions and represented the AM peak trip attraction. In addition, during the PM peak hour, 184-person trip attractions were determined using the same method. Hence, trip attraction rates were determined by dividing peak person trips by the studied independent variable.

Table 2. Sample of raw data of person trip attractions count (Islamic Branch of Bank Misr)

		Hourly Person Trip Attractions	
		Count Time/ Count Day	Monday Wednesday
Morning period	08.30AM - 09.30AM	177	115
	08.45AM - 09.45AM	169	81
	09.00AM - 10.00AM	161	80
	09.15AM - 10.15AM	146	79
	09.30AM - 10.30AM	142	79
	09.45AM - 10.45AM	146	81
	10.00AM - 11.00AM	165	106
	10.15AM - 11.15AM	180	124
	10.30AM - 11.30AM	176	132
	10.45AM - 11.45AM	172	135
	11.00AM - 12.00 NOON	182	140
Evening period	11.15 AM - 12.15PM	163	141
	11.30AM - 12.30PM	172	153
	11.45AM - 12.45PM	173	176
	12.00 NOON - 10.00PM	149	166
	12.15PM - 1.15PM	167	157
	12.30PM - 1.30PM	191	131
	12.45PM - 1.45PM	165	113
	1.00PM - 2.00PM	151	99
	1.15PM - 2.15PM	121	91
	1.30PM - 02.30PM	73	91
	1.45PM - 2.45PM	72	72
	2.00PM - 3.00PM	59	52

Traffic characteristics of the adjacent street for each investigated bank were manually counted, shown in Table 3. This count is used to identify the timing of PHAST. The PHAST periods were from 11:15 a.m. to 12:15 p.m. on Talaat Harb Street and from 12:15 p.m. to 1:15 p.m. on Saad Zaghloul Street. Therefore, the trip attraction rates were developed during the defined timing of PHAST.

Table 3. Traffic characteristics of the adjacent street of the studied banks

Count Time/Street Name	Traffic Volumes Counts of Adjacent Streets for the Surveyed Banks	
	Talaat Harb Street	Saad Zaghloul Street
08.30AM - 08.30AM	1632	1284
08.45AM - 09.45AM	1772	1299
09.00AM - 10.00AM	1834	1318
09.15AM - 10.15AM	1977	1402
09.30AM - 10.30AM	1976	1441
09.45AM - 10.45AM	2034	1459
10.00AM - 11.00AM	2128	1506
10.15AM - 11.15AM	2207	1519
10.30AM - 11.30AM	2302	1535
10.45AM - 11.45AM	2326	1576
11.00AM - 12.00 NOON	2432	1558
11.15 AM - 12.15PM	2433	1546
11.30AM - 12.30PM	2372	1573
11.45AM - 12.45 PM	2405	1607
12.00 NOON - 10.00PM	2363	1612
12.15PM - 1.15PM	2321	1652
12.30PM - 1.30PM	2373	1625
12.45PM - 1.45PM	2323	1571
1.00PM - 2.00PM	2323	1563
1.15PM - 2.15PM	2305	1511
1.30PM - 02.30PM	2208	1489
1.45PM - 2.45PM	2194	1421
2.00PM - 3.00PM	2048	1350
Peak Hour Time	11:15 AM To 12:15 PM	12:15 AM To 1:15 PM
Peak Hour Volume	2433	1652
Peak Hour Factor	0.936	0.946
Located Banks	<ul style="list-style-type: none"> • Qatar National Bank ALAHLI - QNB • National Bank of Egypt (Main Branch) • Banque Misr (Islamic Branch) • Commercial International Bank - CIB • Banque Du Caire • Alexandria Bank • National Bank of Egypt (Ahmed Orabi Branch) • Abu Dhabi Islamic Bank • Banque Misr (Main Branch) 	

7. Results and Discussions

This section presents the obtained results of data collection and its analysis. The analysis and discussion of the data shall include three basic directions; the peak person trip attractions, the person trip attraction rates and a comparison between the obtained rates with those of the ITE rates.

7.1. Peak Person Trip Attractions

Table 4 shows person-trip attractions values during AM, PM, PHG, and PHAST peak hours. Table 5 also shows the daily person trip attraction values for the public and private banks and the ratio of entering and exiting trips. The average percentage of public bank entering trips was lower than the percent of the existing trips during all peak hours except the morning peak hours. During the morning peak hour, the average percent of entering/exiting trips of public banks have recorded at 52% and 48 %, respectively.

Table 4. Person trip attractions during different time periods for all investigated banks

Peak Person Trip Attractions						
Period		AM	PM	PHG	PHAST	Daily
Public Banks	Banque Misr (Islamic branch)	161	184	184	152	832
	Banque Misr (Main branch)	439	464	480	439	2548
	Banque Du Cairo	221	227	243	219	1210
	National Bank of Egypt (Main Branch)	411	465	483	411	2247
	National Bank of Egypt (Ahmed Orabi Branch)	211	257	259	248	1202
The Ratio of Average Entering/Exiting Trips		52:48	47:53	47:53	48:52	50:50
Private Banks	Qatar National Bank ALAHLI - QNB	55	34	55	47	217
	Commercial International Bank - CIB	74	60	74	53	319
	Abu Dhabi Islamic Bank	62	46	62	44	199
	Bank of Alexandria	106	75	106	40	406
The Ratio of Average Entering/Exiting Trips		57:43	46:54	57:43	42:58	50:50

Table 5. General statistical data of trip attractions rates based on gross floor area

Period	Weighted Average Rate (Person Trips Per 100 m ²)		Ratio of Hourly to Daily Rates		Range of Rates		Coefficient of Variance	
	Public Banks	Private Banks	Public Banks	Private Banks	Public Banks	Private Banks	Public Banks	Private Banks
AM Peak Hour	22.51	13.62	0.18	0.26	10.96-54.95	6.46-45.83	0.56	0.76
PM Peak Hour	24.91	9.86	0.20	0.19	12.44-66.93	4.79-28.33	0.59	0.68
PHG Period	25.73	13.62	0.21	0.26	12.88-67.45	6.46-45.83	0.58	0.76
PHAST Period	22.91	8.44	0.18	0.16	10.95-64.58	4.53-39.17	0.62	0.98
Daily Period	125.41	52.34	N/A	N/A	59.92-313.02	20.73-180.42	0.60	0.78

The maximum number of daily person trips recorded by Banque Misr was 2548 person trips. Its location next to attractive land uses such as hypermarkets, moles, and restaurants may be the cause. The daily person trip attraction values of public banks ranged between 832 and 2548 person trips per day, with an average of 1608 person trips per day, while the daily person trip attraction values of private banks ranged between 199 and 406 person trips per day, with an average of 285 person trips per day. Thus, this indicates that the person-trip attraction values of public banks represent about six times those of private banks. All peak hourly person trip attraction values for public banks were between 152 and 483 persons per hour and are much higher than those of private banks, which were between 34 and 106 person trips per hour. Because of the multiple banking services provided by public banks only rather than private banks.

7.2. Person Trip Attraction Rates

7.2.1. Person Trip Attraction Rates Based on Gross Floor Area

Figure 6 shows the trip attraction rates of the studied banks based on gross floor area. It shows that the minimum AM/PM person trip rates of public banks were 10.96 and 12.40 persons per hour per 100 m², respectively, for the National Bank of Egypt (Main Branch). Therefore, this may be because this is the city's main branch, and 40% of its area is devoted to administrative tasks rather than public services. The AM/ PM person trip rates of the National Bank of Egypt (Ahmed Orabi Branch) were 54.9 and 66.9 person trips per hour per 100 m², respectively.

Table 5 presents the average trip attraction rates, the ratio of hourly to daily rates, the range of average rates, and the coefficients of variance (Coefficient of Variance = standard deviation/mean) of the public and private banks. Each 100 m² of the public bank attracted an average of 125 person trips per day, with a daily maximum of 313 person trips. While the average trip attraction was 52 person trips per day, and the maximum was about 180 person trips per day for the private banks. Based daily, average daily attraction trip rates of public banks were roughly 2.5 times those of private banks. Public banks are more attractive to customers than private banks. Accordingly, this might be because private banks are relatively new in this city, whereas public banks have historically been the most established.

The average trip rates of public banks are 22.51, 24.91, 25.73, and 22.91 person trips per 100 m² during AM, PM, PHG, and PHAST peak hours intervals, respectively. While private banks' average hourly trip rates ranged from 8.44 to 13.62 person trips per 100 m².

Also, Table 5 shows that the trip attraction rates during the PHG period are 0.21 and 0.26 times the average person's daily rates for public and private banks, respectively. The maximum percentage of the hourly rate of person-trip attractions of a private bank was 0.26 of the daily rate and occurred during the morning period. Accordingly, this may be due to the high demand for foreign currencies during this period, which this type of bank supplies.

Regardless of the period, the coefficients of variance for private banks were lower than the variations in person trip attraction rates around the mean for public banks using gross floor area as an independent variable. Therefore, the gross floor area was a poor predictor of person-trip attractions in each public and private bank. Due to its higher coefficient of variance values (0.56-0.98).

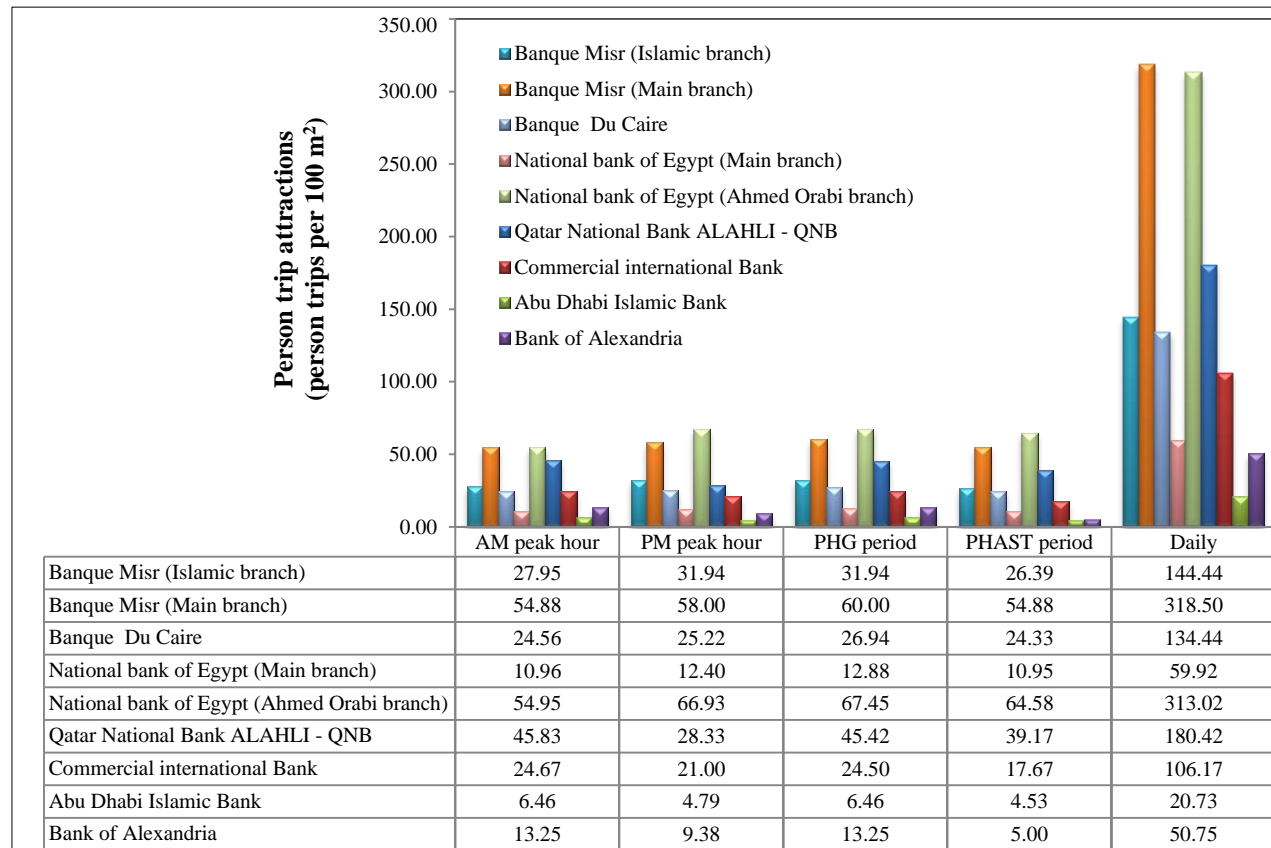


Figure 6. Trip attraction rates of banks based on gross floor area

7.2.2. Person Trip Attraction Rates Based on Total Number of Employees

Table 6 shows the statistical data on person-trip attraction rates based on the total number of employees. The average hourly person trip attraction rates at AM, PM, PHG, and PHAST peak hours were 5.34, 5.91, 6.11, and 5.44 person trips per employee of public banks, respectively. On average, each employee attracted about 30 persons per day for public banks and 13-person trips per day for private banks.

Table 6. General statistical data of trip attraction rates based on total number of employees

Period	Weighted Average Rate (Person Trips Per 100 m ²)		Ratio of Hourly to Daily Rates		Range of Rates		Coefficient of Variance	
	Public Banks	Private Banks	Public Banks	Private Banks	Public Banks	Private Banks	Public Banks	Private Banks
AM Peak Hour	5.34	3.38	0.18	0.26	5.14-5.53	2.20-5.69	0.03	0.48
PM Peak Hour	5.91	2.44	0.20	0.19	5.68-6.43	1.36-4.85	0.05	0.58
PHG Period	6.11	3.38	0.21	0.26	6.00-6.48	2.20-5.69	0.03	0.48
PHAST Period	5.44	2.09	0.18	0.16	5.07-6.20	1.55-4.08	0.08	0.50
Daily Period	29.77	12.97	N/A	N/A	27.73-31.85	7.11-24.50	0.06	0.56

The minimum hourly rate of private banks was 2.09 person trips per employee and occurred during the PHAST period. Thus, this demonstrates that the peak period for traffic on the adjacent streets and the peak trips attraction at the private banks were not the same. The maximum average hourly rate per employee for public banks was 6.11 person trips, and this rate occurred during the noon period.

Considering the total number of employees as the independent variable, public banks had the lowest variations, from 0.03 to 0.08, with person trip attraction rates around the mean. As a result, there was a significant relationship between the total number of employees and the person-trip attractions in public banks

7.2.3. Person Trip Attraction Rates Based on Number of Tellers

Figure 7 shows the trip attraction rates for the public and private banks based on the number of tellers for each bank. Banque Misr recorded the maximum rates related to the number of tellers, which were 43.90, 46.40, 48.00, and 43.90 person trips per hour per teller during the AM, PM, PHG, and PHAST peak hour periods, respectively, as shown in Figure 7. It may be the high level of customer confidence in this bank, and many parking spaces exist in the area's neighborhood around the bank. According to data gathered by the Bank of Alexandria between AM and PM peak times, the maximum hourly rates were 17.67 and 12.50 person trips per hour per teller. During the PM peak hour, Qatar National Bank ALAHLI- QNB achieved the minimum hourly rate of 6.80 person trips per hour per teller, while Abu Dhabi Islamic Bank recorded the minimum daily rate.

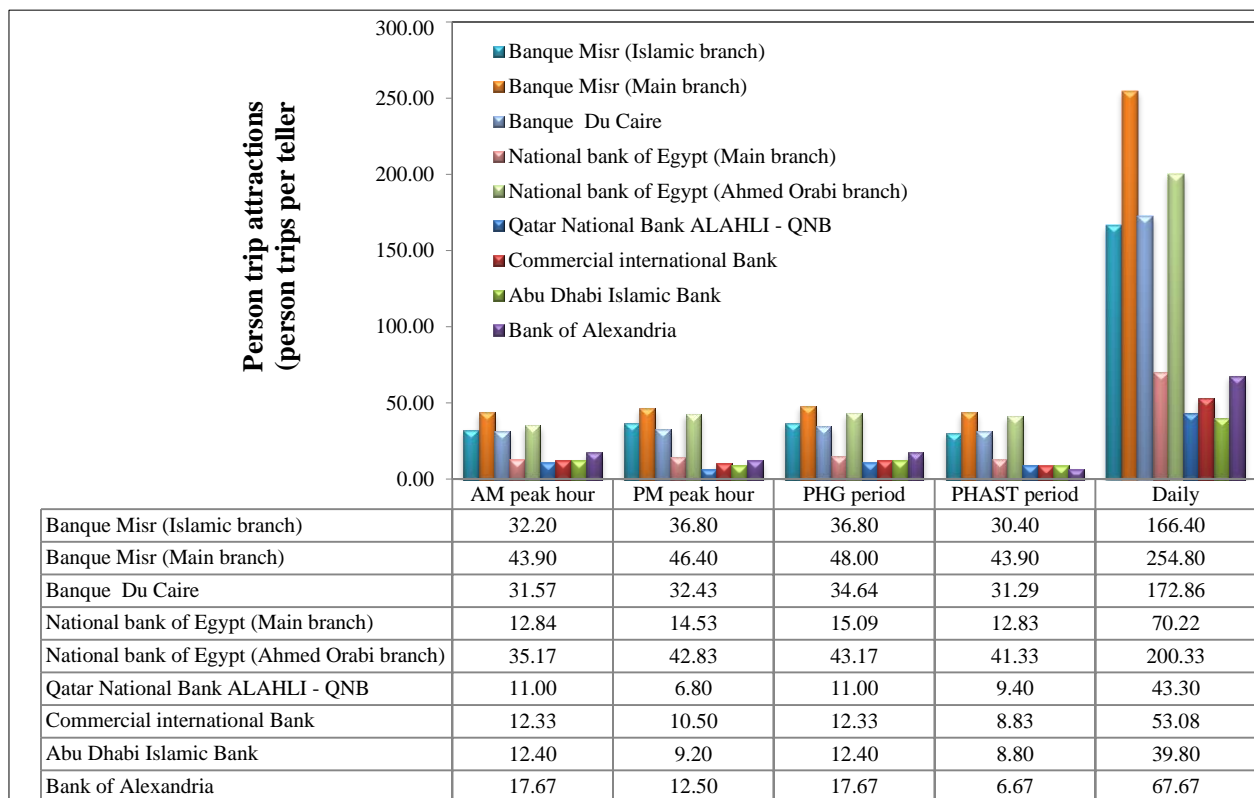


Figure 7. Trip attraction rates of public and private banks based on number of tellers

Table 7 presents general statistical data on person-trip attraction rates based on the number of tellers. During the peak hour of the generator period, the average rate was 27.48 person trips per teller for public banks and 13.50 person trips per teller for private banks. Thus, this means that the ratio between the average rate of public banks and the average rate of private banks was two times, whereas it was three times during the peak hour of traffic on the adjacent street. During the morning peak hour, the minimum ratio was 1.8. Therefore, this could be due to the increase in person's trips during the morning period during all working hours in private banks.

Table 7. General statistical data of person trip attractions rates based on number of tellers

Period	Weighted Average Rate (Person Trips Per 100 m ²)		Ratio of Hourly to Daily Rates		Range of Rates		Coefficient of Variance	
	Public Banks	Private Banks	Public Banks	Private Banks	Public Banks	Private Banks	Public Banks	Private Banks
AM Peak Hour	24.05	13.50	0.18	0.26	12.84-43.90	11.00-12.40	0.36	0.24
PM Peak Hour	26.61	9.77	0.20	0.19	14.53-46.40	6.80-12.50	0.36	0.25
PHG Period	27.48	13.50	0.21	0.26	15.09-48.00	11.00-12.40	0.35	0.24
PHAST Period	24.48	8.36	0.18	0.16	12.83-43.90	6.67-9.40	0.38	0.61
Daily Period	133.98	51.86	N/A	N/A	70.22-254.80	39.80-67.67	0.39	0.24

Among all three studied independent variables, the number of tellers at private banks had the lowest coefficients of variance, 0.24 to 0.25, in all periods except the peak hour of adjacent street traffic, as shown in Table 7. Accordingly, the number of tellers should use as an independent variable in predicting trip attraction rates for private banks.

7.3. Comparison of Obtained Rates with ITE Rates

Table 8 compares the ITE rates of walk-in banks in the United States to the obtained rates from the investigated public banks in Zagazig City during the AM and PM peak hours. As for the total number of employees as an independent variable, the ITE trip rates for walk-in banks at the AM and PM peak hours are 7.43 and 7.81 person trips per employee, respectively [23]. On the same peak hours, the corresponding ITE's trip rates for walk-in banks were 5.36 and 5.97 person trips per employee. It means that the hourly trip rates of the public bank were roughly 0.75 of ITE rates, while the hourly trip rates of the private bank were about 0.40 of ITE rates.

Table 8. Comparison of obtained rates of banks with corresponding ITE Rates

Independent Variable	Peak Hour Period	ITE Rates [24], Person Trips Per Hour	Study Area Rates, Person Trips Per Hour	
			Public Bank	Private Bank
Number of Employees	AM Peak Hour	7.43	5.36	3.38
	PM Peak Hour	7.81	5.97	2.44
Gross Floor Area (100 m ²)	AM Peak Hour	34.17	22.51	13.62
	PM Peak Hour	35.39	24.91	9.86

In the case of gross floor area as an independent variable, the obtained AM peak hour rates of the public bank type were 22.51 person trips per 100 m² and 13.62 person trips per 100 m² for the private bank, which corresponds to 34.17 in the ITE rates, as depicted in Table 11. As a result, during the morning peak hour, the ITE rate was 2.5 times higher than the private bank rate and 1.5 times higher than the public bank rate. It concluded that the trip attraction rates at ITE Trip Generation Manual were higher than those of the investigated public banks in the current study during morning peak hours.

In general, the differences between the obtained rates and the ITE rates are logical due to the differences between the societies of the developing countries and the ITE considerations in terms of investment, industrialization, and commercial activities that require intensive dealings with banks, which differ among the developed and developing countries.

8. Conclusions

Analyzing the collected data and applying the study methodology to achieve the study objectives, which include the prediction and estimation of the bank trip attraction rates for the cities of the developing countries, leads to the following summarized conclusions:

- A strong relationship was between the trip attraction and the total number of employees at public banks;
- For private banks, the number of tellers was the most representative variable of the trip attraction;
- Public banks had approximately six times the daily person trip attraction values of private banks;
- For private banks, AM peak trip attraction values were higher than that recorded during the morning period;
- For public banks, AM peak trip attraction values were lower than recorded during the morning period;
- Each 100 m² of public and private banks attracted approximately 125 and 52-person trips per day on average, respectively;
- Each 100 m² of the public and private banks attracted maximum values of 313 person trips per day and 180 person trips per day, respectively;
- Each employee attracted approximately 30-person trips per day, while private banks received about 13 persons per day for public banks;
- In the case of public banks, each teller received approximately 134 person trips per day, while private banks received 52 person trips per day;
- For public banks, average person trip attraction rates at AM, PM, PHG, and PHAST peak hours were 22.51, 24.91, 25.73, and 22.91 person trips per 100 m², respectively, while the corresponding values for the private banks are 13.62, 9.86, 13.62, and 8.44 person trips per 100 m², respectively;
- For public banks, average person trip attraction rates at AM, PM, PHG, and PHAST peak hours were 5.34, 5.91, 6.11, and 5.44 person trips per employee, respectively, while the corresponding values for the private banks were 3.38, 2.44, 3.38, and 2.09 person trips per employee;

- For public banks, average person trip attraction rates at AM, PM, PHG, and PHAST peak hours are 24.05, 26.61, 27.48, and 24.48 person trips per teller, respectively, while the corresponding values for the number of employees were 13.50, 9.77, 13.50, and 8.36 person trips per teller employee;
- For private banks, average person trip attraction rates at AM, PM, PHG, and PHAST peak hours were 12.33, 9.75, 12.33, and 5.54 person trips per teller, respectively;
- The peak hour of the generator for all independent variables was 0.21 and 0.26 for the daily trips for public and private banks, respectively;
- The maximum person trip attraction rate of private banks occurred in the morning period and did not coincide with the peak hour of traffic volume of the adjacent street;
- The average daily trip attraction rates of public banks relative to either gross floor area or the total number of employees were about 2.5 of those of the private banks;
- The maximum person-trip attraction rate of private banks occurred in the morning period and did not coincide with the peak hour of traffic volume on adjacent streets;
- The average daily trip attraction rates were roughly 2.5 times those of private banks when measured related to gross floor area or the total number of employees in the public banks;
- The obtained rates for public banks based on gross floor area were roughly 0.75 of ITE rates, while hourly trip rates of the private bank were about 0.40 of ITE rates;
- The ITE rate based on the total number of employees was 2.5 times higher than the private bank rate and 1.5 times higher than the public bank rate.

9. Declarations

9.1. Author Contributions

Conceptualization, M.G.M.A. and M.A.E.; methodology, M.G.M.A., M.A.E., and A.R.I.; formal analysis, M.G.M.A., M.A.E., and A.R.I.; investigation, A.R.I. and M.G.M.A.; resources, M.A.E., H.D.H., and A.R.I.; data curation, M.A.E. and A.R.I.; writing—original draft preparation, M.G.M.A. and A.R.I.; writing—review and editing, M.G.M.A., M.A.E., H.D.H., and A.R.I.; visualization, M.G.M.A. and M.A.E.; supervision, M.G.M.A. and M.A.E.; project administration, M.G.M.A. and M.A.E. All authors have read and agreed to the published version of the manuscript.

9.2. Data Availability Statement

The data presented in this study are available in the article.

9.3. Funding

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9.4. Conflicts of Interest

The authors declare no conflict of interest.

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