Trip Production Modeling for Selected Zone in AL-Amarah City

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Abstract— The initiation of this study was made with the objective of building the predicted household trip production models for Al-Amarah city that involve the socioeconomic characteristics and land use trends. For the purpose of this study, Al-Amarah city was divided into 5 sectors with 113 zones. 2923 home questionnaire forms were distributed in the city through arrangements with the secondary, industrial, commercial schools, administrations and some colleges and 1177 forms were distributed for full home interview purpose. In fact a concentrated briefing to the respondents was demonstrated before the distribution of the forms. The questionnaires and home interview response rate was 76.44 %. The collected data was analyzed and classified in order to qualify the social and economical features in each zone.

The relationship between daily household trips and socioeconomic characteristics were developed using stepwise regression technique (Multiple Linear Regression ,MLR) after the collected data being feed to SPSS software version 20, Results showed that trip production model mainly depends on family size, gender, the number of workers and the number of student in the family.. (Abstract)

***Keywords-Trip Generation Model; Household Trip; Linear Regression ; Al-Amarah City. (key words)*.**

I. INTRODUCTION

The number of persons or vehicles per unit time that can be predicted to travel on a specific segment of a transportation system under a variety of land-use, social, economic, and environmental conditions is known as travel demand. Travel demand forecasting predicts the number, type, source of (origin and destination) of "trips" on a transportation network [9].

Al-Amarah city as many other Iraqi cities has no comprehensive published studies in transportation planning, or traffic management plans taking into account the annual growth in population, employment and car ownership, which made the performance of daily activities , represent a burden increases day after day.

These reasons become necessary to prepare the transfer of detailed studies of the areas to identify the causes of these trips. The process is to create a predicated statistical model that describes the behavior and relationship of the phenomenon under observation. In practice, it is not always easy to construct a model from field data, due to the fact that many phenomena are non-linear and/or collinear or they are not easy at all to derive a model valid for prediction.

II. LITRICTURE RIVIEW

Trip generation is the first stage of the classical four-step modeling procedure. The trip generation process aims at estimating the total number of trips generated from and attracted to each traffic analysis zone of the study area for each trip purpose. Trip generation studies are concentrated on residences, that trip production is considered as a function of the socioeconomic characteristics of households. The vocabularies of land use that is utilized at the traffic analysis zone (TAZ) is "producing" or "generating" trips. Zones are additionally destinations of trips, "trip attractors". The study of attractors is concentrated on non residential land uses [14].

The trip generation models are generally developed using regression analysis approach and a zonal trips prediction equation is developed. Regression analysis helps to estimate one variable or the dependent variable from the other variable or the independent variable. In other words the value of one variable can be estimated, provided that the value of the other variable is given [13].

Al-Zaidy, studied the influence of socioeconomic factors on trip generation for Al-Hadar district at Al-Dora section at the south of Baghdad city. The study found that, the most effective independent variables on trip generation for families were number of workers, number of students, type of vehicle and age group between 21and 40 years [7].

Al-Khalidy, attempted to find out a model to reveal the source of the transportation network in Al-Mahmoodiya land study, gravity force and the number of trip production. The study concluded that, the power of attraction between these nearby rural areas and the city centre is higher than other remote cities. This reveals the weak connection and link between the province center and its affiliated cities [6].

Safa-Eldeen, developed trip generation model for Kirkuk city. Both multiple linear regression and cross-classification methods were used to predict equation of trip generation. Results displayed that, trip generation model depending on the size of family, area of dwelling unit and the workers number per family have high coefficient of multiple correlation (R=0.952). Another model, representing the relationship between trip attraction between zones and number of employment per zone, was also established and has high value of multiple coefficient of correlation (R^2 =0.914) [15].

Al-Taei and Amal developed trip attraction model for Dohuk city residential area. They found that home base shopping and home base other trips are showing weak correlation with their independent variables like amount of CBD area and number of retail sales located within CBD area [2].

A cross-classification technique was used to predict trip production travel. Two and three level cross-classification matrices had been used to describe disaggregated trip rates/Du, total vehicle trips/Du and total private trips/dwelling unit. Car ownership was considered as the main factor causing trip production related to other household characteristics like family size income level and workers number. Out of this study it was concluded that data can be used directly in the prediction analysis of trip rates. Family size and workers number were the most effective independent variables [3].

Al-Hasani, developed relationships between daily trips and socioeconomic characteristics for Al-Karkh side of Baghdad city. Both multiple linear regression and cross-classification methods were used to predict trip generation. Results showed that, total person's trip per household is related to family size and composition variables like no. of persons greater than 6 year old, no. of male, no. of workers male. Also, it is related to the number of available vehicles, type of dwelling unit. A model was developed with a coefficient of determination (R^2) equal to 0.678 for whole study area [5].

Al-Zubaidy, provided a prediction trip production models for Al-Diwaniyah city that includes the social economical features, using of alternative statistical techniques for trip generation modeling (Multiple Linear Regression and Artificial Neural Network). Models were developed using stepwise regression technique. Results showed that trip generation model is based on the size of family, gender, and the family workers and students number.The coefficient of determination R^2 are 0.92 and 0.88 for MLR and ANN approaches respectively; but the ANN prediction model was more accurate than the MLR prediction model because the average accuracy (AA%) is 52.897 % and 78.622 % for MLR and ANN models respectively [8].

III. LOCATION OF THE STUDY AREA

AL-Amarah is the capital city of Maysan Province. It is located on the Tigris River in a strategic location with respect to Iraq's provinces within the southeastern part of Iraq. It is about 390 kilometers south of Baghdad and 280 kilometers north of the Arabian Gulf and the Iranian border, lies about 50-55 kilometers to the east of the city. The total area of Al-Amarah city is 2862 km² (17.8%) of Maysan Province area. In 2014, the estimated population was 427658 (Directorate of AL-Amarah Statistics).

The area surrounding AL-Amarah city that is well irrigated from Tigris River and its two branches (Al-Musharah and Al-Kahlaa Rivers) is often considered as one of the most agricultural parts of Iraq producing strategic agricultural crops such as wheat, barley, maize, and rice and the province also has a beautiful environment that can become gorgeous tourism sites in the marshlands and natural protectorates in addition to a large and unutilized oil wealth. The geographical position of the city centre is on longitude (31° 50/ 27//), and latitude (47° 9/ 11//). Figure 1 shows the growth in population for last 37 years.

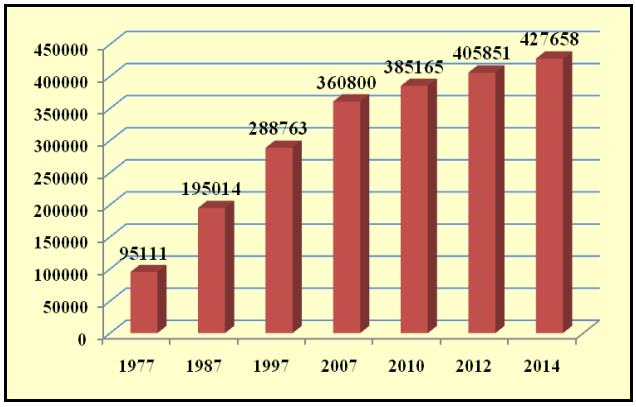

Figure.1 Population Growth of AL-Amarah City

IV. RESEARCH OBJECTIVES

The following objectives were assigned for this study:

- Collecting the social, economic and travel variables that cause the need to make a trip.
- Developing statistical models for household trip generation of Al-Amarah city using the Multiple Linear Regression (MLR) technique.

V. RESEARCH METHODOLOGY

To achieve the research objectives, an outline framework is planned to include the requirements of data collection as represented in Figure 2. The method of data collection used mixed between home interview survey and questionnaire. An adequate questionnaire sheet was designed to cover almost all the variables that might affect the requirements for transport. These questionnaires forms are distributed to secondary schools and colleges to students by hand and used for data editing in the full home interview.

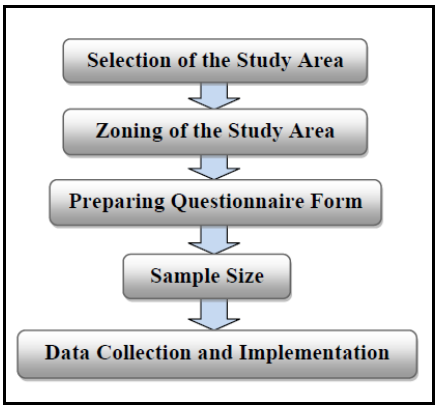

Figure.2 Work Plan Flowchart

A. *Selection of the Study Area*

The area of study, for which transportation facilities are being planned, is first of all defined. The imaginary line that surrounds the area of study and represents its borders may be called the 'external cordon'. The area which is inside the

external cordon line that determines the travel pattern to a large extent is subdivided into zones.

In Al-Amarah city study, the process for determining the line of external cordon should be accurate, taking into account the following characteristics [11]:

- The external cordon line should be surrounded the whole existing zones and the expected zones to be created during the study time.
- The external cordon line should be included whole zones of the people with routine daily life directed to the centre of the city.
- The external cordon line should be non-stop and regular in its path in which the trips pass it just once. The cordon must cross streets wherever it is reliable and suitable to fulfill the surveys of traffic studies.
- The external cordon line should be in agreement with preceding or future transportation planning studies.

Figure 3 represents the external cordon of the study area.

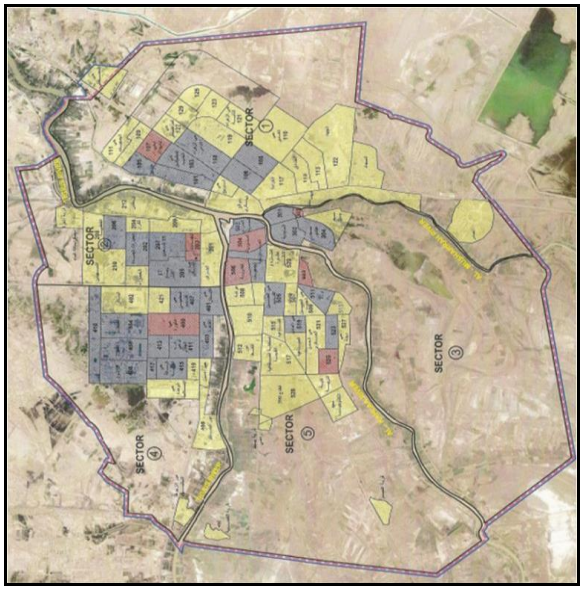

Figure.3 External Cordon and Internal Zone of AL-Amarah City

Study Area Zoning

In urban transportation planning processes in order to collect the data easily the study area is subdivided into a number of zones. Ordinarily, the zoning is established for the following reasons [11]:-

- Well comprehension of the study area composition according to the land use and activity factors.
- Facilitate the processes of collecting and offering the data.
- Decreasing the required time for the calculating and storage of data processing.

The division of these zones was took place according to a number of standards such as homogeneity, social and economical characteristics.

According to the division of the Municipal Council of AL-Amarah city, the area of study is subdivided into 5 sectors as shown in Table I and Figure 4. Figure 5 shows the 113 zones in the 5 sectors.

Table II. Zones of the Study Area

Sector No.	Description	Land Use
1	44 zones, located to the right side of Tigris River.	Residential and industrial
2	15 zones, located to the left side of Tigris River.	CBD of the study area
3	5 zones, located to the right side of Tigris River.	Residential
4	21 zones, located to the left side of Tigris River.	Residential and industrial
5	28 zones, located to the right side of Tigris River.	Residential and educational

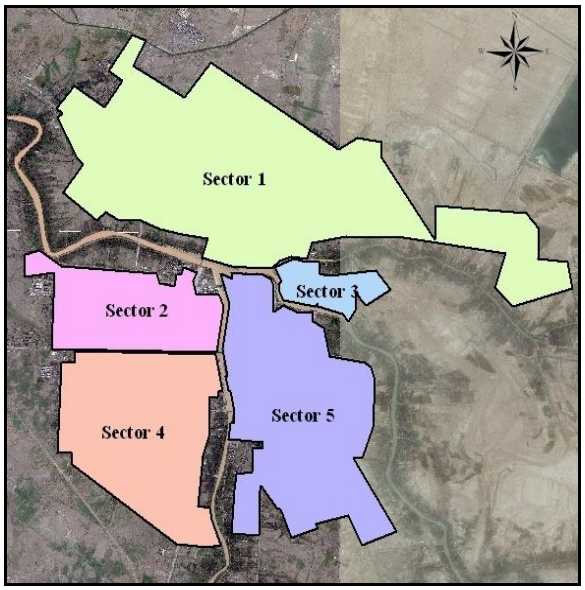

Figure.4 Study Area and Municipality Sector Divisions

B. Sample Size

The required sample size can be calculated based on the population density of the study area. In this study relied to 2014 census of Al-Amarah city that is taken from the Statistics Directorate in the city of Al-Amarah shows that the population of the study area is 427658 inhabitants, while the total number of households is 61094. Since it is not practical interview all the residents of the study area, so it became necessary to calculate the sample size according to the population density of the study area. Table II represents the recommended values for sample size [11].

It can be noticed from Table II that, the recommended sample size for the population of the study area should be 1 in 15.Therefore, the required sample size is:-

The size of study area sample = (1/15)* 427658=4073.33

4100 questionnaire forms will be used for data collection.

Table III presents the survey type methods distribution.

Table II. Data Survey Sample Size

Population of study area	Sample Size	
	Minimum	Recommended
Under 50,000	1 in 10	1 in 5
50 000 – 150 000	1 in 20	1 in 8
150 000 – 300 000	1 in 35	1 in 10
300 000 – 500 000	1 in 50	1 in 15
500 000 – 1, 000,000	1 in 70	1 in 20
Over 1 million	1 in 100	1 in 25

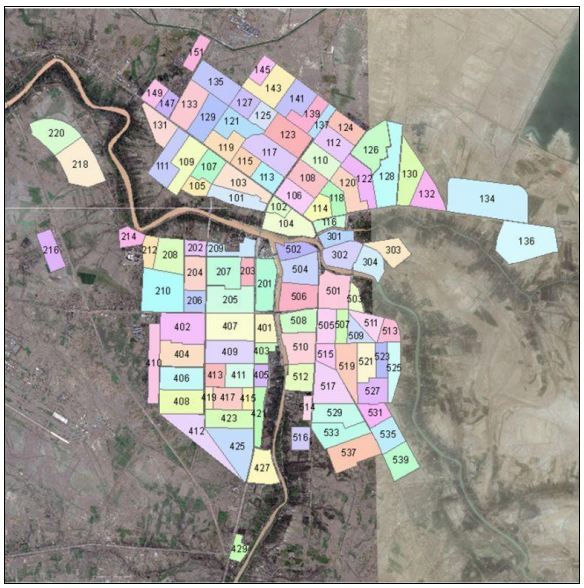

Figure.5 Internal Zone of AL-Amarah City According to the Municipality Divisions

Table III. Survey Type Methods Distribution

No. of Sector	Full Interview		Questionnaire		Total	
	No.	%	No.	%	No.	%
1	288	30.0	672	70.0	960	100
2	233	38.83	367	61.17	600	100
3	128	42.0	177	58.0	305	100
4	254	25.0	761	75.0	1015	100
5	274	22.5	946	77.5	1220	100
Total	1177	28.71	2923	71.29	4100	100

VI. HOUSEHOLD TRIP GENERATION MODELING

Multiple Linear Regression (MLR) is a standard statistical method that is used in the development of trip generation model [8].

In order to derive the relationship between two or more variables to develop a model that forecast one variable from the rest variables and represent the data in the best fit, the regression modeling technique is used for this purpose. The aim of multiple linear regressions is to drive the best model at the chosen level of confidence that satisfies the basic hypothesizes of regression analysis [5].

In order to fulfill an ideal regression models, there are several conditions should be taken into account:

- There is no high inter correlation among the predicted variables,
- There is no effective observations or outliers in the data,
- There is a normal distribution of error,
- There is a zero mean for the error distribution, and
- There is a constant variance σ^2 of error (Homoscedasticity Hypothesis).

Multiple linear regression models of trip generation were developed by using the Statistical Package for Social Sciences (SPSS) software version 20. The variables that have been considered in the analysis were symbolized as follows:-

1. Dependent variables: -

Y : Daily all trips per household
Y_1: Daily educational trips per household
Y_2: Daily work trips per household
Y_3: Daily other trips per household
Y_4: Daily religious trips per household
Y_5: Daily social trips per household
Y_6: Daily shopping trips per household

2. Independent variables:-

X_1: Gender (Male or Female) (0,1)
X_2: Size of family (No.)
X_3: workers' number per family (No.)
X_4: Persons' number per family (less than 6 years old) (No.)
X_5: Persons' number per family (6-18 years old) (No.)
X_6: Persons' number per family (19-24 years old) (No.)
X_7: Persons' number per family (25-60 years old) (No.)
X_8: Persons' number per family (more than 60 years old) (No.)
X_9: Students' number per family (No.)
X_{10}: Income of household per month in I-D (No.)
X_{11}: Dwelling unit area in m^2 (No.)
X_{12}: Dwelling unit proprietorship (own, rented) (1,2)
X_{13}: Type of dwelling unit (house, apartment) (1,2)
X_{14}: Vehicle proprietorship (number) (No.)

The correlation matrix of the independent variables of the data set computed using SPSS software version 20 and the result shown in Table IV.

Table IV. Correlation Matrix of the independent variables

Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	Y
X1	1	.031	-.023	.022	-.018	.043	.070	.031	-.045	.040	-.020	-.015	.102	.017	.823
X2		1	.254	.311	.432	.562	.521	.458	.661	-.321	.187	-.109	.211	.312	.667
X3			1	-.633	-.243	.099	.483	.039	-.381	.599	.132	-.100	.099	.627	.655
X4				1	.018	-.134	.189	-.054	.009	-.201	.199	-.111	.117	.122	.215
X5					1	-.089	.301	-.088	.732	-.453	-.009	.073	-.089	-.033	.832
X6						1	-.142	.163	.467	.214	.088	-.083	.101	.100	.677
X7							1	.224	.299	.433	-.201	.144	.039	.333	.512
X8								1	-.031	.101	.145	-.065	.070	-.255	-.198
X9									1	-.421	-.218	.101	-.201	-.299	.933
X10										1	.211	-.094	199	.641	.415
X11											1	-.355	-.145	.120	-.034
X12												1	.133	.511	.081
X13													1	.098	0.112
X14														1	0.683
Y															1

A. Multiple Linear Regression Models

The SPSS software version 20 is used to develop multiple linear regression models of trip generation. Many methods of linear regression are available, they are:

- Enter
- Stepwise
- Remove
- Backward
- Forward

Stepwise method is the preferable and frequently method that is applied to derive a simple prediction regression models for each independent variable [5].

The independent variable that has the largest F-value is chosen as the first entering variable. If at least one variable exceeds the standard, the procedure continues. The procedure considers whether the model would be improved by adding a second independent variable and so on. It examines all variables to determine which has the F value test and which suits the selected F-value to inter criteria [7]. Either F value test or probability of F value test is used as enter criteria. Probability of F equal to 0.05 is used in the analysis; this corresponds to a value F test of 3.48.The stepwise regression models are given in Tables V to XI.

Table V. Stepwise Regression Models for All Trips Type (Y)

Sec. No.	Models	R^2	Adj R^2	S.E.E
1	$1.249+0.956(X_1)+0.699\ (X_2)$ - $0.147(X_3)+1.291(X_9)+ 0.711\ (X_{10})+0.411(X_{14})$	0.98	0.98	0.95
2	$1.782+1.225(X_1)$- $0.361(X_2)+1.026(X_3)-0.261(X_5)$ + $0.581(X_6)+0.747(X_{14})$	0.97	0.96	0.91
3	$1.866+0.461(X_1)$- $0.244(X_3)+1.455(X_6)+0.537(X_7)$- $0.230(X_9)+0.533(X_{14})$	0.99	0.98	0.86
4	$1.580+0.861(X_1)+0.613(X_3)$- $0.212(X_5)+0.398\ (X_6)+0.801(X_{10})$ $+0.456(X_{14})$	0.99	0.98	0.66
5	$1.295+0.393(X_1)+0.841(X_2)$+ $0.421(X_3)+0.116(X_9)$ $+0.486(X_{10})+0.559(X_{14})$	0.98	0.96	0.92
Total	$1.925+0.879(X_1)+1.194(X_2)$ + $1.429(X_3)+0.358(X_4)$ - $0.597(X_5)+0.481(X_6)+0.393(X_7)$+ $0.275(X_{10})-0.516(X_{11})-0.502(X_{14})$	0.95	0.94	0.89

From Table V, it can be noticed that the gender (X_1), the No. of workers (X_3), the No. of students (X_9) and the car ownership(X_{14}) represent the most effective independent variables, and appear in all sectors. The Family income (X_{10}) also represents effective independent variable in three sectors.

Table VI shows the gender (X_1) represents most efficient independent variable, and appears in all sectors. The number of students in the family (X9) represents effective independent variable, however it does not appear in sectors No.3 and No. 4 as the age groups (X_5) (6-18) and (X_6) (19-24) have high correlation with (X_9).

Table VI. Stepwise Regression Models for Educational Trips (Y_1)

Sec. No.	Models	R^2	Adj R^2	S.E.E
1	$2.424+0.786(X_1)+0.679(X_2)+$ $0.933(X_9)$	0.96	0.94	0.93
2	$0.937+0.413(X_1)-0.832(X_2)$ $+0.710\ (X_5)$ + $0.339(X_6)$ $+0.828(X_9)$	0.97	0.92	0.94
3	$0.982+0.834(X_1)+0.274(X_4)$ - $0.481\ (X_5)+1.217(X_6)$	0.98	0.96	0.98
4	$0.911+0.478(X_1)+0.479(X_2)$- $0.094(X_4)+1.265(X_6)$	0.97	0.94	0.93
5	$1.606+0.310(X_1)+0.667(X_6)+$ $0.989(X_9)+0.620(X_{14})$	0.96	0.92	0.94
Total	$0.953+0.441(X_1)+0.892(X_2)+$ $0.803(X_3)+0.394(X_4)+$ $0.315(X_5)+0.854(X_6)-0.166(X_7)-$ $1.021(X_9)-0.459(X_{10})+0.318(X_{11})+$ $0.238(X_{12})-0.965(X_{14})$	0.98	0.98	0.91

Table VII. Stepwise Regression Models for Works Trips (Y_2)

Sec. No.	Models	R^2	Adj R^2	S.E.E
1	$1.204+0.285(X_2)$ $+0.935(X_3)+$ $0.546(X_{14})$	0.97	0.95	0.94
2	$1.029+0.863(X_3)+0.433(X_7)$- $0.165(X_{10})$ $+0.955(X14)$	0.92	0.84	0.89
3	$1.340-0.913(X_1)$ $+1.197(X_3)$ $+0.538(X_7)$ $+0.635(X_{14})$	0.98	0.97	0.96
4	$1.182+0.\ 853(X_3)+0.491(X_7)$ - $0.233(X_{10})+0.309(X_{14})$	0.96	0.92	0.93
5	$1.303+0.272(X_2)+1.305(X_3)+0.825($ $X_{14})$	0.97	0.95	0.94
Total	$1.737+0.891(X_1)$- $0.379(X_2)+1.129(X_3)-0.173(X_4)$- $0.188(X_5)-0.155(X_6)+0.266(X_7)$- $0.148(X_9)$ $-0.339(X_{10})$ - $0.112(X_{11})+0.103(X_{12})+0.604(X_{14})$	0.99	0.98	0.95

Table VII shows that parameters; No. of workers in the family(X_3), and the car ownership (X_{14}) have the highest effect on the number of work trips in all sectors. It can be seen that, the age group (25-60) (X_7) which represent work age group appears in three sectors.

In Table VIII the models do not show parameters that effect of other trips which may include; healthful trips, recreational trips, and etc. These results may be because the unusual data that is related to such trips.

Table VIII. Stepwise Regression Models for Other Trips (Y_3)

Sec. No.	Models	R^2	Adj R^2	S.E.E
1	0.463+0.775(X1)+0.764(X2)	0.85	0.81	0.88
2	0.505+0.745(X4)+1.22(X6)-0.977(X8)	0.85	0.82	0.89
3	0.571-0.026(X2)-0.197(X5)+1.571(X6)+0.434(X9)	0.96	0.88	0.91
4	0.820-0.242(X5)+1.164(X6)+0.716(X8)+0.230(X14)	0.87	0.83	0.87
5	1.160+0.597(X2)+0.863(X14)	0.96	0.95	0.94
Total	……	…	…	…

The models in Table IX show that, the family size (X_2) is considered as effective independent variable in three sectors while the age group (25-60) (X_7) appears in the other two sectors. The No. of the car ownership(X_{14}) also appears in three sectors which correspond to religious trips.

Table IX. Stepwise Regression Models for Religious Trips (Y_4)

Sec. No.	Models	R^2	Adj R^2	S.E.E
1	$0.230+0.137(X_2)+0.214(X_{14})$	0.89	0.85	0.86
2	$0.621+0.152(X_2)+0.145(X_{14})$	0.82	0.75	0.84
3	$0.628+0.223(X_1)+0.134(X_3)-0.721(X_7)+0.361(X_{14})$	0.88	0.82	0.85
4	$0.973+0.475(X_1)-0.215(X_2)+0.326(X_3)-0.180(X_5)+0.319(X_6)$	0.95	0.86	0.89
5	$1.063+0.707(X_8)-0.075(X_7)$	0.82	0.76	0.84
Total	$1.256+0.534(X_2)+0.096(X_4)-1.296(X_5)+2.559(X_6)-1.044(X_7)+5.766(X_8)+0.631(X_9)+0.476(X_{10})-0.446(X_{12})$	0.85	0.85	0.91

Table X shows that in sectorsNo.1, No.3 and No5, the social trips are correlated to the age group (25-60) (X_7) variable. The social trips of sectors No.4 and No.2 are high correlated to family income (X_{10}).

While Table XI shows that, the No. of workers (X_3) the car ownership (X_{14}) and the family income (X_{10}) appear in the models, as they are important parameters for the shopping trips.

Table X. Stepwise Regression Result for Social Trips (Y_5)

Sec. No.	Models	R^2	Adj R^2	S.E.E
1	$1.051+0.519(X_7)$	0.86	0.78	0.82
2	$1.416-0.152(X_2)-0.204(X_5)+0.546(X_6)+0.549(X_{10})$	0.93	0.87	0.91
3	$1.054+0.598(X_7)+0.419(X_{14})$	0.94	0.92	0.91
4	$1.106-0.140(X_3)+0.594(X_{10})$	0.82	0.72	0.81
5	$0.700+1.022(X_7)$	0.88	0.86	0.88
Total	$1.300+0.58(X_3)-0.185(X_5)+0.155(X_7)+0.054(X_{10})-0.0708(X_{14})$	0.75	0.69	0.81

Table XI. Stepwise Regression Models for Shopping Trips (Y_6)

Sec. No.	Models	R^2	Adj R^2	S.E.E
1	$1.205+0.431(X_1)+0.128(X_2)-0.192(X_3)+0.988(X_{10})+0.306(X_{14})$	0.95	0.86	0.91
2	$1.147-0.175(X_2)+0.575(X_3)+0.195(X_6)$	0.89	0.82	0.89
3	$1.550-0.143(X_3)+0.281(X_7)-0.110(X_{11})+0.327(X_{14})$	0.97	0.93	0.94
4	$1.417-0.143(X_5)+0.278(X_6)+0.541(X_{10})-0.501(X_{14})$	0.88	0.80	0.85
5	$1.829+0.631(X_1)+0.812(X_3)+0.210(X_7)$	0.88	0.81	0.85
Total	$1.498+0.178(X_2)+0.631(X_3)-0.142(X_5)+0.204(X_7)+0.335(X_{10})-0.065(X_{11})$	0.89	0.84	0.88

Generally, it can be deduced that, the variables X_1, X_3, X_7, X_9, and X_{14} are significant in all trip purpose types in comparison with the other factors. The family income (X_{10}) is correlated to some trips purpose types in sectors (1 and 4), because the low income families particularly sector 4.

A prediction model for specific prediction accuracy sector can be exercised to other sector with the lower effective independent variables in the prediction model in each sector which is different from others.

VII. CONCLUSION

1. Gender, number of workers in the household, students' number per household, the ownership of vehicles and the family income represent the most significant independent variables that influence the trip generation rate in Al-Amarah city.
2. The highest percentage of the total trips of Al-Amarah city posed by the education home-based trips because the high ratio of the students' number and the student's age group (6-24) per household.

3. The short walk educational trips that range from 5 to 10minutes was produced as a consequence of considerable number of primary, intermediate and, secondary schools that are within the residential zones and close-by the dwelling units

4. Work trips present a considerable large ratio of the total trips and these trips are related to the number of workers per household and the work's age group (25-60).

5. The main factors that affected the number of the religious trips are the family size, the age group older (25-60) and the car ownership.

6. Trips generated are affected more by the number of males in the household more than female due to social considerations in the city.

7. The most effective independent variables on total trips (Y), the age groups (6-60) that represents the number of persons of (6 – 60) years old. Those persons are able to make more trips and usually they are either workers or students.

8. Increasing monthly household income slightly leads to a slight increase in the average household trips for MLR.

9. There is a significant relationship between mode usage and monthly household income. Families that have high monthly income tend to use private vehicles; whereas, families with low monthly income tend to use public transportation.

10. The coefficient of determination R^2 for (Y) is 0.94 for MLR, and this is considered as a very good prediction model.

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