Trip Attraction Development Statistical Model in Dohuk City Residential Area

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ABSTRACT

In this study, trip attraction phenomenon has been studied for 20 residential out of 28 traffic zones located within Dohuk city urban area composed of more than 300,000 in residents. Home-interview travel data provided for the city are used in addition to special data collected to perform the trip attraction analysis .Attraction trips are classified into seven types and selected as dependent variables while other variables like number of dwelling units, employment,....etc., are selected as independent variables in the SPSS package to obtain the most statistically well accepted predicted attraction trip models. Some models like HBW trips is constant eliminated with good (R^2) value. HBSH and HBOH trips are showing weak correlation with their independent variables like amount of CBD area and number of retail sales located within CBD area.

Key Word: Trip Attraction

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[illegible]

[illegible]

28 [illegible] 20 [illegible] 300.000 [illegible] (SPSS) [illegible] (R2) [illegible] HBW [illegible] (HBOH) [illegible] (HBSH) [illegible]

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Introduction

Transportation problems present a number of the constituent complex factors of urban problems. In fact in many respects ,transportation may be considered as one of the major causes of present urban problems .In this process., Planners develop information about the impacts of implementing alternative courses of action involving transportation services such as, new highways, bus route change, and parking restrictions.

Trip generation provides the linkage between land use, and travel. It is separated into two phases:

Phase1:Understanding and quantification of the amount of travel, and land use linkage is developed, and

Phase2:Quantification results are applied to forecast land use characteristics and to develop future travel estimates.

For trip generation purposes, travel is considered in terms of trip ends and/or number of trips. It does not consider the other characteristics such as direction, length, or duration of trips. Trips considered are usually those generated for an average weekday ,but they may also be for weekend travel, particularly trip purpose, mode of travel, and/or other stratification required for a specific analysis or forecasting purposes(1,2).

Trips ends may be in terms of origins and destinations, or in terms of productions, and attractions depending upon the purpose to be forecasted and the subsequent models to be used for trip distribution and modal choice (2).Land use for trip generation purposes is usually described in terms of land use intensity, character of the land use activities and location within the urban environment. These measures are the main inputs to trip generation., trip rate, regression, and cross-classification analysis are the main techniques linked with land use to measure trip generations. These techniques are then utilized and applied to forecast/and use and to develop future travel (2,3).

Urban transportation process is already based on a comprehensive study of an urbanized area, and includes the following phases:

Phase 1:Formulation of goals, and objectives;
Phase 2:Process organization and data assembly;
Phase 3:Model calibration and
Phase 4:Area wide study.

Trip Generation Models

Trip generation refers to both trip production(i.e, typically emanating from the home or the beginning point of a non-home based trip),and trip attraction(i.e; to the point where an out of home activity will be undertaken),on zonal and regional level through the origin-destination(O-D),survey models to predict both types of trips can be correlated to social, and economic characteristics of each house-hold for existing condition(i.e; base year),and future(i.e; horizon year).

Trip generation analysis phase is interesting to develop equations that allow the trip ends of a particular or trip type generated by traffic analysis zones. This analysis is used most commonly used for the development of these prediction equations by multiple regression and cross-classification analysis. For trip attraction models the multiple regression technique was preferred based on the `variables used (3).

Scope of the Study

This study was mainly implemented to provide the followings:

1-Compilation and analysis of the (O-D) survey data collected by a previous study in addition to a new set of data survey especially related to trip attraction analysis in Dohuk city (5,6).

2-Developing (O-D),survey data for the non-residential zones within Dohuk city; and

3-Developing a suitable trip attraction modeling system to forecast future travel in the city using some computer software packages for the city.

Study Area and Site Location

The study area was divided into 27 analysis units defined as traffic analysis zones(TAZ).These 27 zones were designed to be relatively homogenous in land use that 20 zones out of them are mainly residential and constitute the main trip generation demand of the city. The other remaining zones represented for medical, commercial, educational, and constitutional purpose.

Residential zones were selected only but other special considerations were given to analysis areas or zones containing unique characteristics such as (CBD),office buildings, and the land which contains stadium, or retail sales areas.

Figure (1),contains the main analysis units considered in this study from which different data about trip attractions were collected.

Data Source

Data were taken from other previously implemented (O-D),survey in the urban transportation study conducted for the city of Dohuk in 2001(5).Home interview survey collected data for 2437 families was conducted to characterize demographics of household members and travel pattern of household members for life style trips using special form.. For trip attraction other additional information was needed for the same study area like zonal area amount, school enrollment, distance from CBD to each zone center, retail sales, mainly from maps found in the Municipality Directorate of Dohuk city(7).

Data summary about the zonal additional characteristics are shown in table (1). Trip attraction purposes were considered also in 5 types in this study reflecting the amount of total attraction conducted in a typical day within the study area. All trips are classified either Home Based Trips (HBT),or trips did not end at home called Non-Home Based Trips (NHBT).The 5 types classified in this study are as follows:

1-Home-Based Work (HBW),those trips conducted between personal place of residence and his place of employment;
2-Home-Based Education(HBED),those trips by students performed between place of residence, and school for the purpose of attending classes;
3-Home-Based Shopping(HBSH),these trips between personal place of residence and a commercial establishment for the purpose of shopping;
4-Home-Based Social(HBSO),those trips between personal place of residence, and place of cultural social ;and
5-Home Based Other(HBO);all trips oriented to personal place of residence for miscellaneous trip purpose other than those listed above. Table (2),shows the different types of data according to purpose described before.

Variable Definitions

The dependent variables selected for analysis is regarded as daily personal attracted trips with respect to purpose:

1-HBW trips	Y1
2-HBSO trips	Y2
3-HBSH trips	Y3
4-HBED trips	Y4
5-HBO trips	Y5
6-NHB trips	Y6
7-Total attracted personal trips	Y7

The independent variables collected from the two survey data sources are prepared and described as given below;

1-Number of dwelling units(DU)	X1
2-Number of employment	X2
3-Number of workers	X3
4-Total area	X4
5-Retail sales	X5
6-School enrollment	X6
7-Distance to CBD	X7
8-Number of schools	X8

Stepwise Regression Analysis

Statistical package for social sciences (SPSS),is extremely powerful tool used in this analyses. Stepwise method is by far the most versatile and helpful in the analysis. In this method one variable is added at each step and statistical tests were conducted to determine the improvement in the equation and variables are continuously to be added until the maximum step specified is reached to obtain the most meaningful interpolation results of tests examined at each step. This will include the increase in the multiple correlation coefficient(R),or the multiple determination coefficient(R^2).The increase or decrease in the standard error of estimate(STD),and the t-test value on each regression equation.. F-test can be obtained automatically for variance test in order to reject or accept the null hypotheses.

Prediction Trip Attraction

Using the multiple linear regression analysis technique between all independent and dependent variables table (3),listed all the equations chosen from the analysis with (R^2),and (STD)values.

HBW trips attracted are positively affected by the employment number but decrease with the dwelling units as work trips attracted to certain zone from institutional offices or shopping but not from residential units.

HBSH trips take no variable zonal area is the most effective on HBSO trips and when this area becomes large no increase in dwelling units will happen and this type of trips is going to expand.

NHB trips seem to be affected positively by employment number and school enrollment as they constitute the largest group of trip makers in the society for five days of the week.. The three equations predicted show (R^2),values more than 0.533 which is extremely reliable (4).

HBSH,HBOTH and HBED trips did not accept any variable ,for this reason another method of analysis was used by the elimination of constant or using non-linear analysis.

Elimination of the Regression Constant

Problems occur in forecasting where regression turns out to be either quite large or negative or both and/or when there is no equation like NHB,HBSH,HBOTH and HBTH trips constant elimination can be implemented as shown in table (4).Initial selection is usually an attempt to modify the equation into suitable form. This method is preferable for better evaluation of the basic data and their relationships with other factors to obtain more realistic results from the estimated equation.(R^2),values obtained are preferably accepted except HBSH and HBOTH attracted trips.

Non-Linear Regression Analysis

Final step in the regression analysis is conducted by dividing the equation required into subsets based on those variables selected from stepwise regression results. This was performed by the addition of non-linear regression models with largest (R^2) ,measure. From the examination of the individual analysis, certain relationships of the independent one might appear. Table(5),shows the obtained results. (R^2),values are not reliable with the transform-action equation.

Conclusion and Recommendations

The models shown in Table (6) can be considered as trip attraction prediction equations to forecast future trip generation in the Dohuk city especially if employment numbers ,school enrollments, number of schools and retail sales are going to change. It can be concluded ,that HBW could be better predicted by constant eliminated shape model with good(R^2),value but HBOTH with weak (R^2) value. Retail sales and CBD area values are sufficient to predict HBSH but with small (R^2),value.

Out of the results and data interviewed from this study it can be recommended that further results can be obtained if local study of trip attraction is performed on each trip attraction major center like super markets, commercial, educational, and recreational areas within the city of Dohuk to more effectively reflect its attraction size on the city transport volume.

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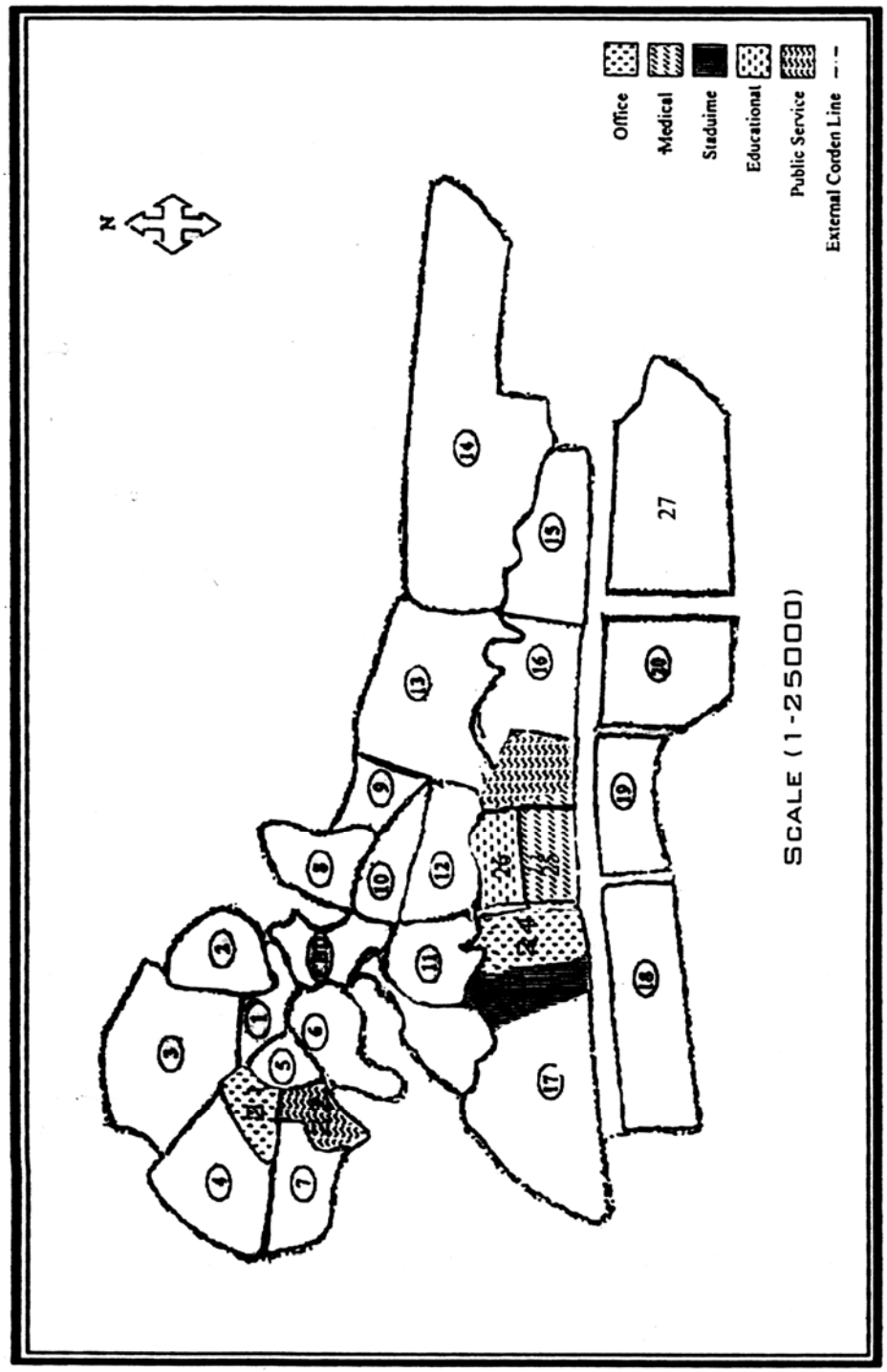

FIGURE (1) DOHUK MUNICIPALITY PALN SHOWING THE STUDY AREA AND ZONES

Table (1)
Zonal Characteristics Related to Trip Attraction Collected

#	No. DU	Total Area km2	Employ	Worker	Retail sales	School enrollment	Distance to CBD	No. of schools
1	995	.155	1031	1021	1221	2020	.4635	5.0000
2	640	.415	700	908	1680	1354	.4697	3.0000
3	1273	1.081	1728	1410	1081	1437	.9159	9.0000
4	1570	.738	2179	961	1560	2123	1.3615	5.0000
5	262	.172	108	355	888	1431	.6414	3.0000
6	408	.412	452	321	1128	1079	.4202	4.0000
7	520	.424	636	40	1104	1851	1.2756	5.0000
8	1200	.384	746	1103	1344	3243	.5015	4.0000
9	1120	.251	960	132	1320	2653	1.0032	3.0000
10	1550	.330	1116	1829	1416	2723	.5272	5.0000
11	700	.411	800	800	1512	2475	.5583	6.0000
12	1160	.496	630	1185	1632	2023	.7889	5.0000
13	583	1.113	331	552	1872	3121	1.5000	10.0000
14	4505	2.553	3604	4441	2136	4523	2.9557	13.0000
15	884	.669	598	741	1896	1821	2.6544	4.0000
16	1744	.637	1662	1997	1704	2330	1.7500	4.0000
17	1350	1.310	1826	1588	1848	2411	1.3402	8.0000
18	1600	1.117	1806	1290	1800	3253	1.6304	12.0000
19	550	.523	523	445	1464	2056	1.7846	5.0000
20	1060	.811	1060	833	1512	1983	2.3779	9.0000

DataTable (2)
Trips Attracted by Zones within Dohuk City by Purpose

#	HBW	HBSH	HBSO	HBOTH	HBED	NHB
1	1298	343	519	69	770	181
2	866	14	298	0	1994	30
3	2954	219	270	0	0	137
4	1864	74	232	232	2432	96
5	293	420	108	46	123	62
6	955	2380	109	0	511	58
7	347	0	165	0	723	0
8	843	0	60	65	4018	195
9	1640	0	160	0	880	240
10	1054	434	124	0	2232	155
11	1100	398	400	0	200	200
12	908	430	150	250	1900	175
13	551	311	537	0	221	79
14	1406	256	1280	384	704	704
15	713	0	114	0	2508	57
16	986	100	350	100	4350	350
17	1985	0	874	0	474	474
18	2754	0	416	0	3060	780
19	1367	0	530	0	1534	130
20	302	152	608	1520	100	0

Table (3)
Summary of the Model Selected by Stepwise Regression with Constant Results for the Study Area

Equations	R^2	STD
HBW= 691.58+1.461X_2-95X_1	0.533	532.04
HBSH= No variables	-	-
HBSO =50.349+449.723X_4	0.664	180.615
HBOTH= No Variables	-	-
HBED= No Variables	-	-
NHB= -206.081+122X_2+199X_6	0.646	136.461
Total person trip = 2437.361+1.057X_2	0.322	1281.63

Table (4)
Summary of the Model Selected by Stepwise Regression without Constant Included Results for the Study Area

Equations	R^2	STD
HBW= 180.344X_8	0.753	716.46
HBSH= 263.186X_7+0.38X_5	0.244	532.107
HBSO= 495.124X_4	0.863	178.57
HBOTH= 131.077X_7	0.279	313.74
HBED= 1.905X_5 – 230.93X_8	0.779	1152.361
NHB= 186X_2	0.751	150.991
Total person trip = 2.389X_5	0.881	1385.245

Table (5)
Transformations of the HBW Variables on the Independent Variables A-Employment (X_2), B-No. of Du(X_1), and C-No. of Schools (X_8)

A-No. of Employment (X_2)		
Equations	R^2	STD
$HBW = 639.6+507X_2$	0.313	$7.07X_{10}^{6}$
$HBW = 603.2\ e^{4.52X10-4X2}$	0.375	$9.82X_{10}^{6}$
$HBW = 21.4\ X_2^{0.568}$	0.378	$6.67X_{10}^{6}$
$HBW = 1.7X_2 - 3.57\ X_{10}^{-4}\ X_2^{2}$	0.517	$4.98X_{10}^{6}$
$HBW = 1/(0.00184-5.328X_{10}^{-7}\ X_2)$	0.486	-
$HBW = \frac{1324.9X_2}{398.2 + X_2}$	0.232	$9.5X_{10}^{6}$
B-No. of Du (X_1)		
Equations	R^2	STD
$HBW = 895.6 + 265X_1$	0.103	$9.23X_{10}^{6}$
$HBW = 720.5\ e^{00028X1}$	0.224	-
$HBW = 18.9\ X_1^{0.577}$	0.283	$9.31X_{10}^{6}$
$HBW = 40.4+1.45X_1 - 2.553X_{10}^{-4}\ X_1^{2}$	0.311	$7.03X_{10}^{6}$
$HBW = 1/(0.00168-3.8X_{10}^{-7}X_1)$	0.49	-
$HBW = \frac{248.2X_1}{1689.5 + X_1}$	0.278	$9.5X_{10}^{6}$
C-No. of schools (X_8)		
Equations	R^2	STD
$HBW = 582.2 +102.8X_8$	0.176	$8.48X_{10}^{6}$
$HBW = 694.5\ e^{0.0627X8}$	0.142	$9.39X_{10}^{6}$
$HBW = 490\ X_8^{0.42}$	0.136	$9.39\ X_{10}^{6}$
$HBW = 415.9 + 156.7X8-3.548\ X_8^{2}$	0.178	$8.46\ X_{10}^{6}$
$HBW = 1/(0.001518-46X_{10}^{-5}X_8)$	0.209	-
$HBW = \frac{1243X_8}{(2.5 + X_8)}$	0.208	$1.23\ X_{10}^{6}$

Table (6)
Summary of the Final Regression Models used for Each Dependent Variable for Study

Equations	R^2	STD
HBW= $180.344X_8$	0.753	716.46
HBSO= $50.349+449.723\times X_4$	0.664	180.615
NHB= $-206.081+0.122\times X_2+0.199\times X_6$	0.646	136.461
HBSH= $-263.186\times X_7+0.38\times X_5$	0.244	532.107
HBOTH= $131.077\times X_7$	0.279	313.740
HBED= $1.905\times X_5-230.93\times X_8$	0.779	1152.361
Total person trip = $2.389\times X_5$	0.881	1385.245