

ANALYSIS OF MODEL FOR TRIP GENERATION AND ATTRACTION OF KABUL CITY

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1. INTRODUCTION

Kabul city, (the capital of Afghanistan) is one of the fastest growing cities in the world and city has been suffering from a highly congested traffic, caused by a dramatic increase of its population and a growing flow of economy during the last decade. As a result of three decades of an enduringly unstable political system, the majority of the inhabitants were displaced. However, upon the establishment of a new government in 2001, a considerable number of inhabitants have returned to Kabul city. Moreover, people from other parts of the country have come to Kabul for personal, official, and business purposes, as Kabul city is offering a higher level of security and a better quality of life. Initially, the present Kabul city was designed to accommodate approximately two millions people at most, while based on JICA's master plan, current population is almost double (4.01 million). On the other hand, lack of proper transportation planning and facilities such as public transportation system, bus stops, traffic signal etc. has caused many traffic congestion within the city.

2. PURPOSE OF THIS RESEARCH

This research focuses on the transportation trip generation/attraction models based on the combination of person trip (PT) survey conducted by Japan International Cooperation Agency (JICA) in 2008 and 2015's demographic - socioeconomic attributes of Kabul city. The study area in this research not only covers the current 22 traffic zone of existing Kabul city, but some new zones were also introduced. These zones are as follow:

Zone 23 (Dehsabz North), zone 24 (Barikab), zone 25 (Dehsabz South) and zone 26 (Paymonar) (Figure-2). It worth to be mentioned that, the newly introduced zones will be develop under the name of Kabul New City in near future. On the other hand, although zone number 18 and 19 are currently part of existing Kabul city (Figure-1), but these zones also will be developed as part of Kabul New City (particularly as Dehsabz South) in the future.

In this research, transport trip generation/attraction models are considered with an aim to compare the year 2015 situation with the previous studies. The results signifies an increment of approximately 10% in the amount of trip generation and attraction within the Kabul city compared to JICA's 2008 study.

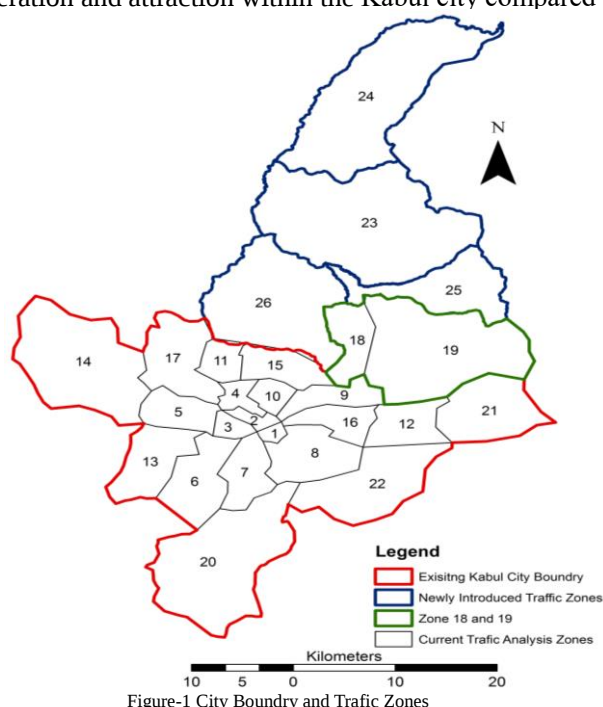


Figure-1 City Boundary and Traffic Zones

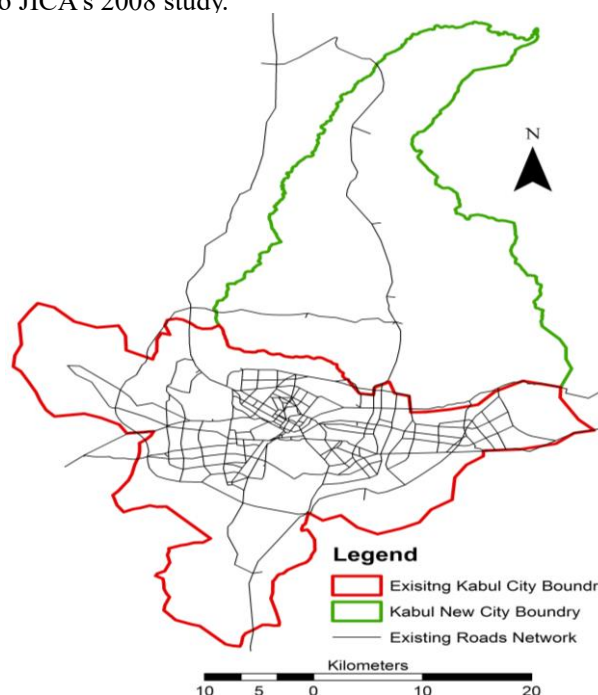


Figure-2 Kabul City Arterial Road Networks

3. TRIP GENERATION AND ATTRACTION

3.1 Methodology and Model Specification

Trip Generation and Attraction is the first step in the conventional four-step transportation forecasting process, followed by trip distribution, mode choice, and route assignment that is widely used for forecasting travel demands. It assume the number of trips created in or destined for a particular traffic analysis zone.

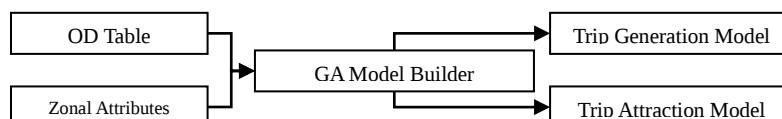


Figure-3 Trip Generation and Attraction Structure

Keywords: Kabul City, Transportation planning, Trip generation, Trip attraction, Public Transportation

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This study drives the projection of trip generation and attraction based on each purpose and mode by constructing a simple linear regression equation (Equation 1 for trip generation and 2 for trip attraction). Several variables were analyzed and compared in order to develop a significant model. Finally four variables “Population,” “Employment,” “Service worker ratio” and “Industrial worker ratio” were considered for achieving trip generation and attraction models. Table-1 and 2 illustrates the parameters for trip generation and attraction. JICA STRADA software was used as a tool to generate model.

$G_i = \beta_0 + \beta_1 pop_i + \beta_2 emp_i + \beta_3 ser_worker\ ratio_i + \beta_4 ind_worker\ ratio_i$ (1)

$A_j = \beta_0 + \beta_1 pop_j + \beta_2 emp_j + \beta_3 ser_worker\ ratio_j + \beta_4 ind_worker\ ratio_j$ (2)

Where
 G_i : Trip generation in zone i;
 A_j : Trip attraction to zone j;
 pop_i : Population in zone i;
 emp_i : Employment in zone i;
 $ser_worker\ ratio_i$: Service worker ration in zone i;
 $ind_worker\ ratio_i$: Industrial worker ration in zone i;
 β : Parameters;

Table-1 Parameters Of Trip Generation

Trip Generation			
Variable Name	Coefficient	Standard Error	T Value
Population	0.46	0.11	4.35
Employment	0.44	0.15	2.92
Ser Worker Ratio	14563.30	6049.77	2.41
Ind Worker Ratio	232755.57	106681.27	2.18
Constant	16420.52		
Corr. Coefficient	0.88		

Table-2 Parameters Of Trip Attraction

Trip Attraction			
Variable Name	Coefficient	Standard Error	T Value
Population	0.46	0.11	4.31
Employment	0.48	0.15	3.18
Ser Worker Ratio	14846.90	6332.45	2.34
Ind Worker Ratio	228945.22	99081.66	2.31
Constant	18187.93		
Corr. Coefficient	0.88		

3.2 Trip Generation And Attraction By Purpose

Considering Figures 5 and 6, in zones 1 and 2, the amount of work trip attraction is greater than generation. This indicates that, these zones are business areas, and trips from other districts are concentrated in these zones. From the generation and attraction by purpose in other zones, there are no large differences between generation and attraction. This reflect the fact that these zones are residential area. On the other hand, both the generation and the attraction are small in Districts 14, 17, 18, 19, 20, 21, 22, 23, 24, 25 and 26, which indicates small population and limited employment opportunities in the area. Trips with the purpose of returning home are the half of the total trips (Figure-4), implying that most inhabitants are returning home after going to respective destinations.

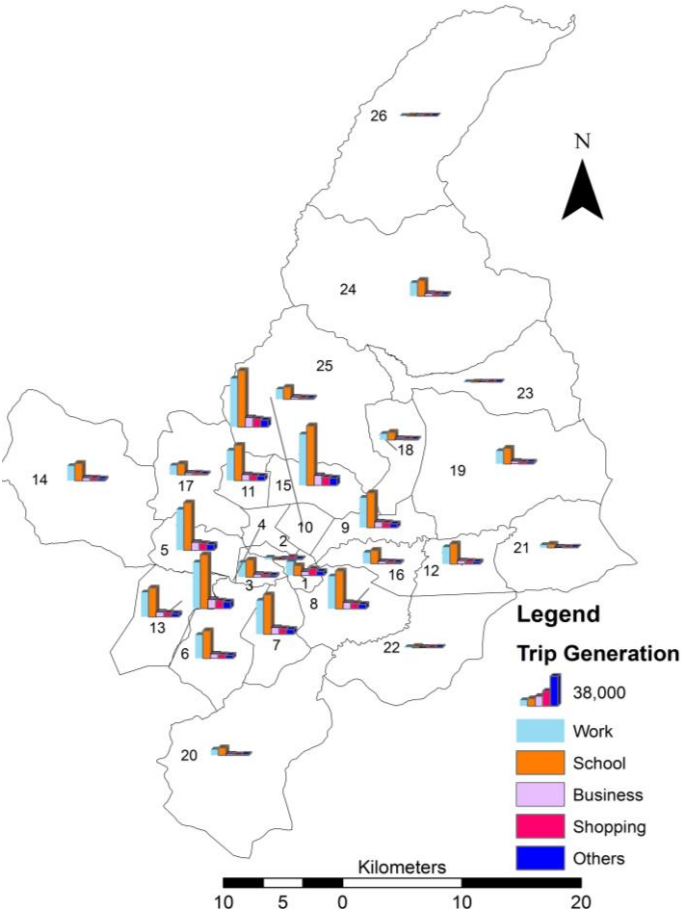
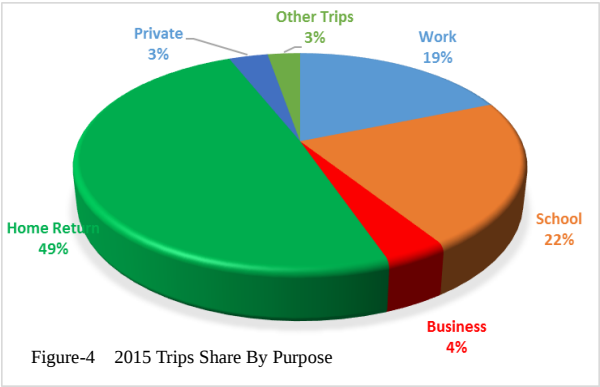


Figure-5 Trip Generation by Purpose

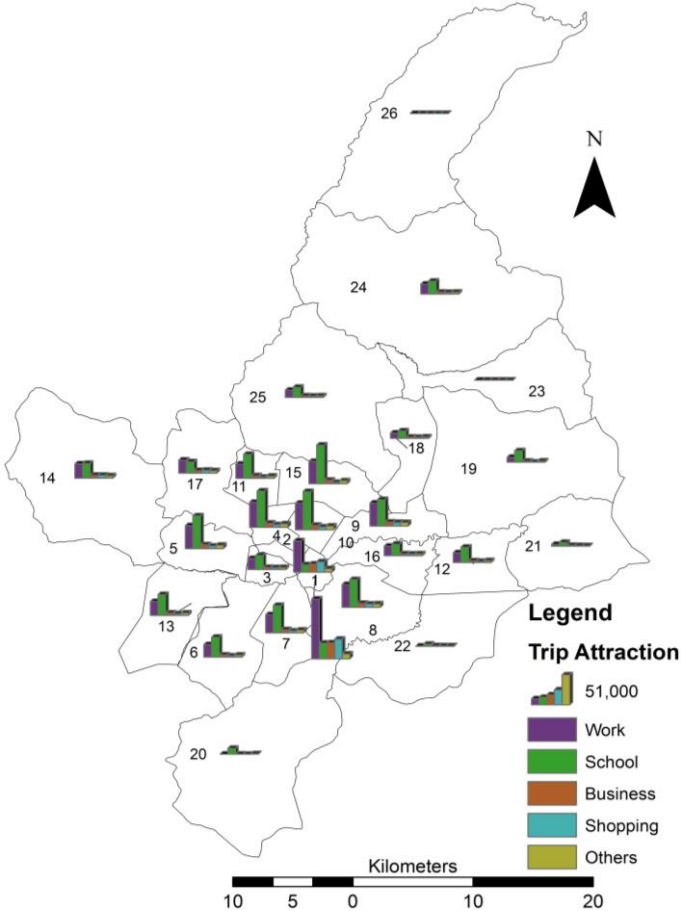


Figure-6 Trip Attraction by Purpose

Table 3 Total Trip Generation and Attraction in Kabul City by Purpose 2015

Zone Nun	Generation (2015)						Total
	Work	School	Business	Private	Home Return	Other	
Total Trips/Day	643864	750608	129872	115870	1661328	94494	3396036
Total Trips/Day	Attraction (2015)						Total
	Work	School	Business	Private	Home Return	Other	
Total Trips/Day	644389	739337	128779	116168	1665513	94641	3388827

3.3 Trip Generation And Attraction By Mode

From the generation and attraction by transport mode in the zones, there are no large differences between generation and concentration (Table 3) and (Figures 8 and 9). This indicates that people are using the same mode of transport for going and returning. Among the 3.9 million transport modes with in Kabul city in 2015, walking has the largest share of (39.2%), followed by microbus (17%), large bus (13.9%), taxi (11.6%), private car (2.8%) and (1.5%) by other types of vehicles (Figure-7). The study result shows that, despite many problems in public transportation sector in Kabul city, yet public transportation including buses and taxis shares 48.9%, indicating that public transport is the important mode for Kabul habitants.

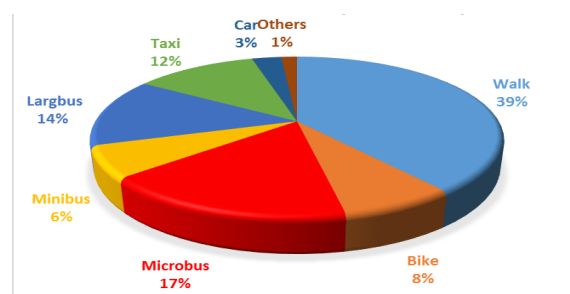


Figure-7 2015 Trips Share by Mode

Table 4 Total Trip Generation and Attraction in Kabul City by Mode 2015

Zone Nun	Generation (2015)				Attraction (2015)			
	Walk	Public Transport	Private Transport	Total	Walk	Public Transport	Private Transport	Total
Total	1324168	1652780	403927	3381226	1332074	1653310	404211	3389595

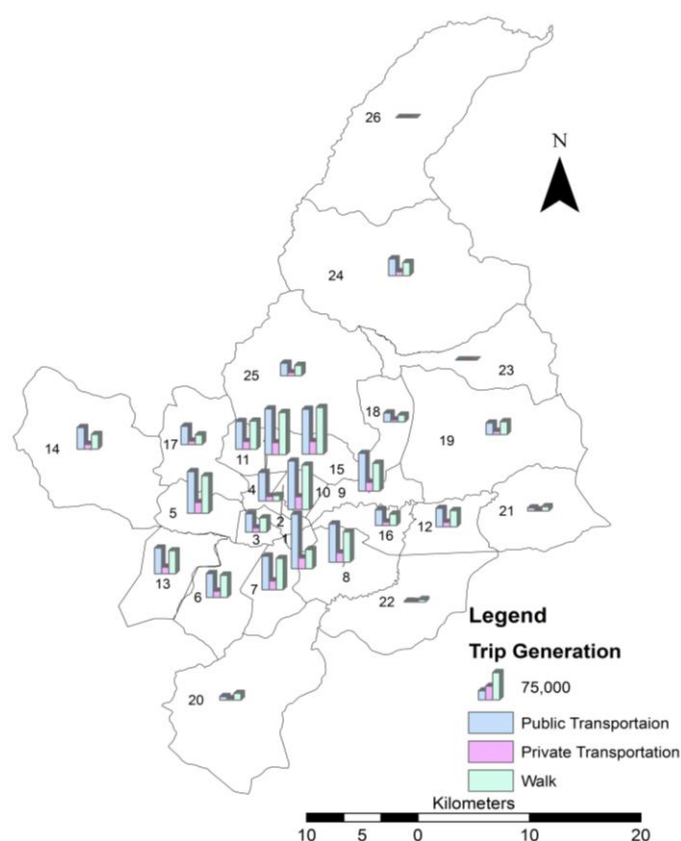


Figure-8 Trip Generation by Mode

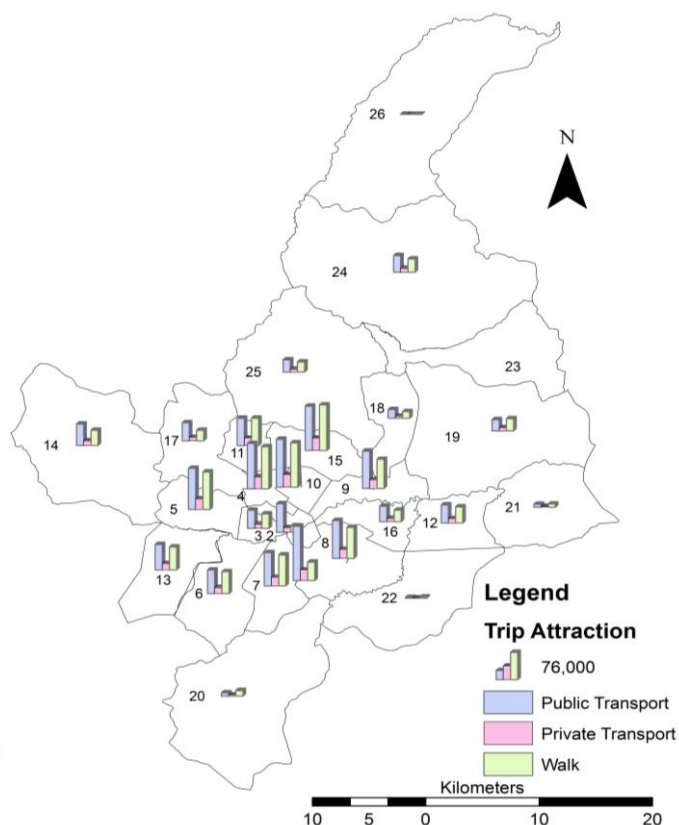


Figure-9 Trip Attraction by Mode

3.4 Comparative Analysis Of Trip Generation And Attraction 2008 And 2015

3.4.1 Comparison of 2008 and 2015 Trip Generation And Attraction By Purpose

Considering table (3), the results signify that in total 3.38 million per day made in 2015 for different purposes. While in 2008, this amount was 3.12 million trips/day.

The share of trips (Figure 10 and 11) indicates almost the same percentage of trips for specific purpose in 2008 and 2015 in which trips with the purpose of returning home still consist the half of the total trips (49% - 2015, 48% - 2008). Comparing the result of JICA's 2008 master plan report and 2015 analysis, although the study shows decreases in number of trips for some specific purposes, but overall result shows an increases of 0.24 million trips/day (approximately 10%) in 2015 in Kabul city.

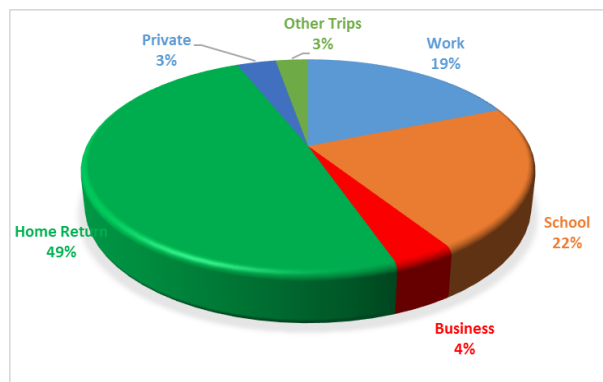


Figure-10 Trip share in 2015 by Purpose

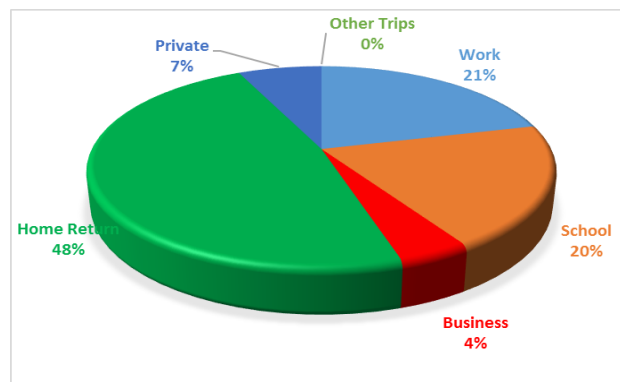


Figure-11 Trip share in 2008 by Purpose

3.4.2 Comparison of 2008 and 2015 Trip Generation And Attraction By Mode

The results signify that in total 3.38 million trips/day were conducted in 2015 by different modes (Table 4). While in 2008, this amount was 3.12 million trips/day. The share of trips by mode (Figures 12 and 13) indicates increases of approximately 6.5% (from 32.7% to 39.2%) in trips by walking in 2015. On the other hand, in comparison with 2015 trips by mode with 2008, the result indicates that, Corresponding to 2008, in 2015 yet public transport is the main traveling mode type for Kabul city habitants in compare to private mode. Furthermore, figure 12 illustrates that, in 2015 Kabul residence used approximately 48% public transport (large bus 13.9%, microbus 17%, minibus 6.4% and taxi 11.6%) while in 2008 approximately 50% of habitants were using public transportation for their daily bases movements. In conclusion, the result of study in 2015 shows an increment of 0.25 million trips by mode (approximately 8%) comparing to 2008.

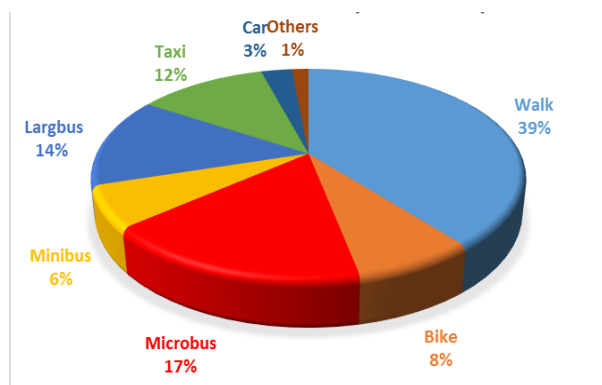


Figure-12 Trip share in 2015 by Mode

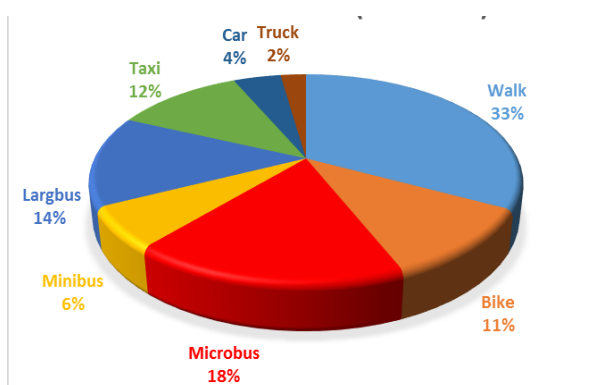


Figure-13 Trip share in 2008 by Mode

4. CONCLUSION

This study has focused on the amount of trip generation and attraction per day within the Kabul city. Analysis revealed that after walking, the greater percentage of trips are made by public transport. Thus in the short-term, Kabul city urgently requires a large amount reliable of public transport while there is lack of high capacity public transportation facilities. The outcome of the study shows that, special considerations shall be kept in mind for improvement of the current public transportation system and facilities (proper bus routes, bus terminals, car parking etc.) for the Kabul city for the short-term. Meanwhile, the BRT and LRT system shall be proposed for the long-term, in order to avoid future problems. Furthermore, the required data for a detailed transportation planning of the Kabul city has to be gathered for more precise results.

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