

An overview of Transportation Situations in Kabul City, Afghanistan

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Much of the transportation infrastructures in Afghanistan have either been damaged or have deteriorated due to lack of regular maintenance over decades. After the repatriation of Afghan refugees from neighboring countries the population raised up rapidly, mostly in unplanned urban areas at Kabul city. This rapid increase in unplanned urban population has resulted in an increase in consumption patterns and a higher demand for transport, energy and other infrastructures, thereby putting a load on the transportation and pollution problems. This study provides an overview of the current transportation situations in Kabul city. Moreover this study explores the basic relationships between traffic volume and travel time on weekdays (the national and international organizations working days) in April and May, 2013.

Key Words: *Kabul's transportation, traffic volume, travel time*

1. Introduction

Kabul city is the most populous and urbanized area of Afghanistan with an estimated population of 3.95 million. The city's population grew from 1.96 million in 2000 to 2.99 million in 2005, reaching the growth rate as high as 8.44, that later slowed to 4.41 from 2005 to 2010, and the estimated growth rate from 2010 to 2015 is 4.26. Because of wars for several decades, Kabul suffered damage and destruction of its transportation facilities including pavements, sidewalks, traffic circles, drainage systems, traffic signs and signals, trolleybuses, and almost all of the public transit buses. From 2001 to present, a rapid increase in population, in planned and unplanned areas caused an increase in number of motor vehicles and spurred the demand for transportation facilities and services. There are sidewalks on both sides of the streets in Kabul but those located in downtown (Districts 1 and 2) have capacities less than the pedestrian demand. Even more some shopkeepers and vendors have decreased the capacities by putting their merchandise along the sidewalks. These situations force people to

walk alongside the street and occupy a significant portion of roadway capacity. Roundabouts are very common and about 35 of them exist. There are no left-turn and right-turn lanes even in the busiest streets. Even the newly-built multilane expressways have none of those lanes having road stripe, sufficient signs, and signals. Though recently, most of intersections are signalized, but due to lack of appropriate data most of the signals are not activated and just a small number of them are activated full day or at a portion of day. The on-street road occupancy, lack of signage and multiple modes sharing within the city decrease road capacity and increases delays and accidents due to the physical occupation of the space.

Fig.1 illustrates one of the challenges of multiple modes and on-street occupancy sharing the right-of-way in Kabul. As shown in Fig.1, motor vehicles, bicycles, motorcycles, pedestrians, and push-cart selling vegetables all share the road. The street vendors are especially problematic because they attract customers, leading to a reduction in road capacity.



Fig.1 Typical Kabul downtown street (Murat Duzvol, 2009).

Kabul's unique challenges due to right-of-way encroachment by vendors, lack of signing and road strip and multiple modes presents interesting opportunities for creative research into innovative traffic management techniques, and comprehensive planning. Thus, the objective of this study is to explore the average travel time, traffic volume and relationship between travel time and traffic volume within the course of a day, contribute to Kabul's transportation studies. Also this study will be beneficial in transportation planning process for Kabul city.

This paper is organized in six sections Section 2 summarizes the characteristics of transportation in Kabul city. Section 3 describes the survey design and data collection process. Section 4 describes the key findings from the survey and this study. And finally Section 5 presents conclusion and suggestions for future studies.

2. Recent researches on Kabul Transportation

Japan International Cooperation Agency (JICA) conducted the study for the development of the Master plan for the Kabul Metropolitan Area in 2008. JICA conducted a person trip (PT) survey in the KMA Kabul city. The survey was conducted on 50,000 households, representing 1% of the total households. This survey outlined that the total number of trips in a day related to Kabul city in 2008 is 3.35 million trips, of which 1.02 million trips are on foot within the Kabul city. Trips by vehicles moving inside the City are 2.12 million.

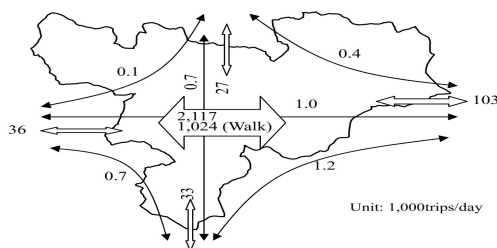


Fig. 2 Trips in, out, and within Kabul city

Fig.2 describes traffic connecting inside and outside the Kabul city.

Fig.3 describes the composition of trips by mode within the Kabul city. And the purposes of the trips by the inhabitants of the Kabul city are outlined as follows from PT survey.

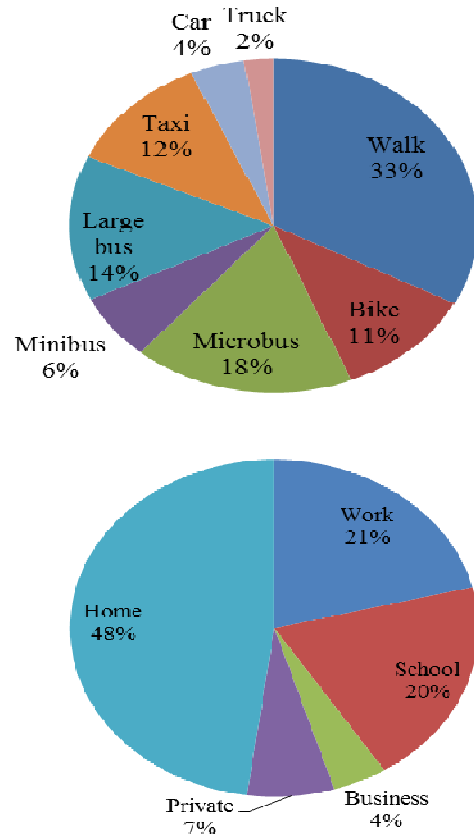


Fig.3 Share of trips by modes and purposes

3. Survey design and data collection technique

The main objective of this research is to explore the basic relationship between travel time and traffic volume for Kabul city. For this study 6 links are selected considering the characteristics of main corridor. These 6 links are located in different parts of Kabul city, and connected to residential, educational, and commercial areas. Moreover the selected links include different types of roads. Several time elements (months of the year, days of the week, and time of day) have been considered in establishing the scope for travel time and volume data collection activities. Thus, April and May, Sunday to Wednesday are commonly considered as average condition of traffic stream. And time periods are considered as follows:

For the study of traffic flow, traffic count survey was implemented six hours per link by using videography mostly at intersections. In terms of travel time survey the test vehicle technique has been used.

Table 1. Survey Periods

Morning peak		
06:00 to 07:00	07:00 to 08:00	08:00 to 09:00
1. 06:00- 06:20	1. 07:20- 07:20	1. 08:00- 08:20
2. 06:20- 06:40	2. 07:20- 07:40	2. 08:20- 08:40
3. 06:40- 07:00	3. 07:40- 08:00	3. 08:40- 09:00

Noon peak		Evening peak	
12:20- 01:20	03:40 to 04:40	04:40 to 05:40	
1. 12:20- 12:40	1. 03:40- 04:00	1. 04:40- 05:00	
2. 12:40- 01:00	2. 04:00- 04:20	2. 05:00- 05:20	
3. 01:00- 01:20	3. 04:20- 04:40	3. 05:20- 05:40	

Since test vehicle technique has three different test vehicle driving styles (Average car, Floating car, and Maximum car), in this study a hybrid of the floating car and average car driving styles have been used. Since the inherent difficulties of keeping track of passed and passing vehicles in high traffic volume conditions are exits, thus a hybrid of the floating car and average car has been selected.

During this survey a set of data (variables) has been collected, and are listed as follows:

- ♦ Directional traffic flow
- ♦ Directional travel time
- ♦ Free flow travel time
- ♦ Link length, width and number of lanes, and
- ♦ Road condition

Furthermore the presence of illegal roadside parking and on-street occupancy through the links were also collected.

Fig.4 shows the location of surveyed links within the Kabul city.

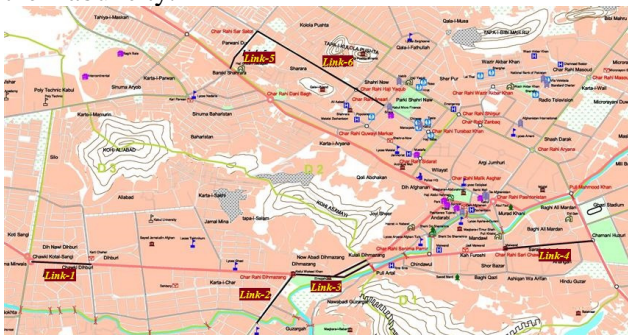
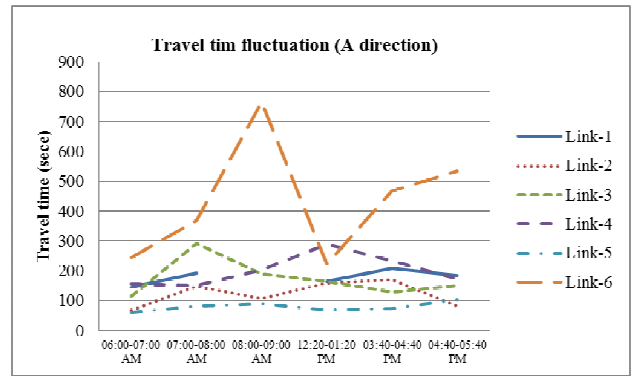


Fig. 4 Survey locations

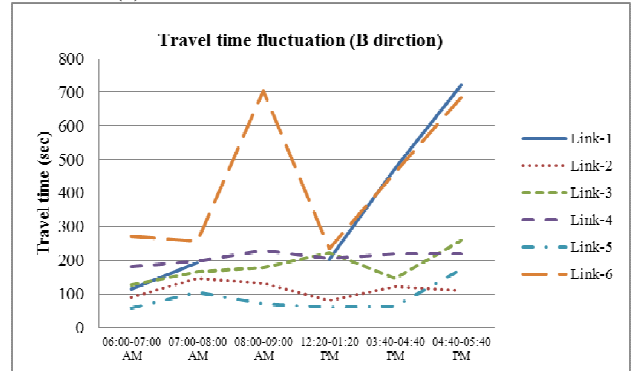
4. Findings

4.1 Travel time

Average travel time data from the beginning point of a link until the end point of the link is collected and Fig.5 describes the fluctuation of travel time within course of a day on different links on both A and B directions.



(a) Travel time fluctuation in A direction



(b) Travel time fluctuation in B direction

Fig.5 Travel time fluctuation

There are significant changes in travel time during different periods of time, but the most significant changes in travel time appear on Link-1 and Link-6. Link-1 locates in a populous area of Kabul city and it connects the eastern part of the city to educational and center of the Kabul city. Link-6 has been partially expanded and it locates along residential, national and international organizations and business district.

4.2 Traffic volume

Traffic volume data is collected from videography and Fig.7 describes the fluctuation of traffic volume during course of a day on different links at the A direction.

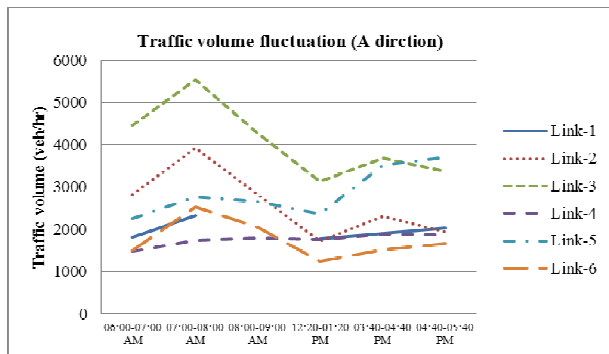
Fig.6 demonstrates the traffic volume peak hour within the course of a day in Kabul city, thus the peak hour at morning starts from 07:00 to 08:00. And the peak hour at evening starts from 03:40 to 04:40 in both A and B directions.

4.3 Relationship between travel time and traffic volume

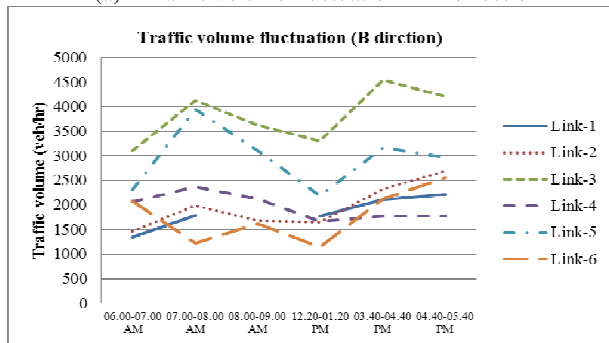
The relationship between travel time and traffic volume at different course of a day and on six links is described in Fig.7 in both A and B directions.

Fig.7 describes that fluctuation of traffic volume causes some fluctuations in travel time, and it is more obvious on Link-1, Link-3 and Link-6. Furthermore

Fig.7 declares the existence of congestion, by significant changes in travel time and fewer changes in traffic volume on Link-1 and Link-6.

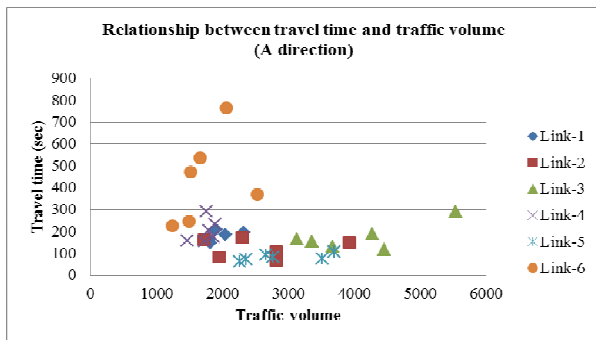


(a) Traffic volume fluctuation in A direction

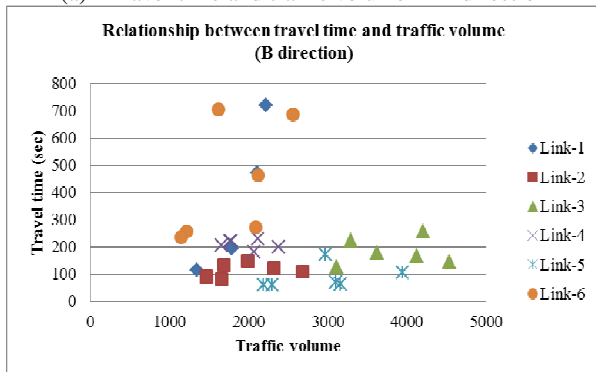


(b) Traffic volume fluctuation in B direction

Fig.6 Traffic volume fluctuation



(a) Travel time and traffic volume in A direction



(b) Travel time and traffic volume in B direction

Fig.7 Travel time and traffic volume

5. Conclusion

This study declares that there are major problems within the Kabul's transportation. The long travel times indicates more clearly the existence of problems through network. Furthermore, within different links the travel time is changed due to change in traffic volume, but in some cases the travel time is increasing dramatically without any significant change in traffic volume which declares the existence of congestion. Lack of an ideal and smooth flow within the transportation network, causes significant problems like; waste of time, waste of fuel, increase carbon emissions, less mobility.

Within different links the travel time is changed due to change in traffic volume, but in some cases the travel time is increasing dramatically without any significant change in traffic volume, which implies the existence of congestion.

The recent studies on Kabul's transportation and the collected data by author on April and May, 2013 pave the road for more precise research on Kabul transportation problem and will contribute for a comprehensive planning to Kabul's transportation.

The data that has been collected by the authors can be used to identify congested roadway segments. Those roadway segments could be studied further to determine the root cause of the congestion, whether it is operational issues, recurring incidents, insufficient capacity, or other causes, and additional studies could be conducted to identify potential roadway improvements. The collected data could also be used to prioritize Transportation Improvements Program (TIP) within the Kabul city.

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References

1. A. J. Habibzai, S. Habibzai and C. Sun, Overview of Transportation in Kabul City, Afghanistan.
2. JICA, Dehsabz City Development Authority, The study for the development of the master plan for the Kabul metropolitan area final report September, 2009.
3. Afghanistan Statistical yearbook 2012-2013 [http://cso.gov.af/Content/files/Population\(2\).pdf](http://cso.gov.af/Content/files/Population(2).pdf)
4. UN-Habitat. State of the World's Cities 2012/2013. Statistical annex.
5. A.H.M. Mehbub ANWAR, Akimasa FUJIWARA and Junyi ZHANG, Newly Developed Link Performance Functions Incorporating the Influence of On-Street Occupancy for Developing Cities: Study on Dhaka City of Bangladesh.