Australian Journal of Basic and Applied Sciences, 5(6): 563-569, 2011
ISSN 1991-8178

Introducing Public Transport System to Improve Travel Time and Road Safety in Tripoli, Libya

Amiruddin Ismail, Adel Ettaieb Elmloshi

Sustainable Urban Transport Research Centre (SUTRA) / Department of Civil and Structural Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia.

Abstract: Increasing dominance of private car as a mode of transport is due to its inherent advantages associated with its usage. In Tripoli, Libya due to rapid increase in car usage associated with poor public transport system, has resulted in increase of traffic congestion, road accidents and street parking spaces. This study aims to identify the factors encourage users of own car to switching to public transport. Introducing the public transport (PT) system and reduce own car users simultaneously has become necessary for solving congestion problems and reduces road accidents and improve travel time for all trips. A questionnaire survey was carried out on users of transport in the city such as car owners, passengers, taxis and micro buses drivers (n = 600). The probability of car drivers switching to public transport was examined based on scenario several options such as reduce and improve in public transport travel time. Logistic regression technique has been used to analyses the factor that impact users to switch their trips to public transportation alternatives. Statistical Package for Social Science (SPSS) and Excel 2007 software were used to analysis the questionnaire in this study.

Key words: Travel time, traffic congestion, public transport, road safety, logistic regression technique

INTRODUCTION

Tripoli is Libya's largest city and port, and is the country's capital. Meeting-place of the People's Congress, it is known in Arabic as Tarabalus Al-Gharb, or Tripoli of the West. Tripoli Population is 1,682,000 people with covered area of 400 square kilometres and population density 2207.32 people / sq km (Libya, 2008). Tripoli is growing very fast for the last ten years, both geographically and administratively. More and more policies and regulations are being developed at Tripoli area level, particularly in the field of traffic and transport. The free movements of people, goods and services are a key priority of the Tripoli city. The continuing growth in vehicle ownership, lack of car parking spaces and stopped public transport service in latest of eighties, many streets of Tripoli road network started to suffer from various traffic problems.

The number of vehicles increased approximately to 705025 own cars, 43740 taxis, and lorry from one to three tons 120599 vehicles, vehicles heavy load 29343 vehicles. Then the total vehicles use the road of Tripoli every day are 898707 vehicle, at peak period from 7 am to 7pm, there is continual congestion, traffic congestion is frequently a problem through weekdays (Traffic office and licensing of Tripoli, 2008). Figure 1 shows the Tripoli network which covered most of city area.

This paper is a part of the study that focused on model shift initiatives. These initiatives focused on shifting own car users to safer modes of public transport in order to increase road safety and enhance the environment with improve travel time. There are many cities have attempted to restrict to use of own cars in favour of public transport, such as policies exist in Egypt Mahmoud El-Shourbagy (2003), Dubai Ghaya Adam Almannaei (2005), Saudi Arabia Abdul Jalil (1401), Lebanon, (2001), England, (Harrison *et al.,* 1998), Romania Marshall and McLellan, (1998), Malaysia (Abdalla *et al.,* 2007), Asian countries (Land transport Authority LTA, 1996), Dublin (Transportation, 2005) and France (Harrison *et al.,* 1998). The attempts have been by changing the public perception to it. This study shows the differences in the characteristics of current transport modes namely micro bus, taxi and car users, travel time present the hypotheses testing as relation between car users and public transport modes to provided safety road service and avoid road accidents risk.

Corresponding Author: Amiruddin Ismail, Sustainable Urban Transport Research Centre (SUTRA) / Department of Civil and Structural Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia.
Tel.: +60389216203/12 Malaysia; E-mail: abim@eng.ukm.my,

Methodology:

There are different methods were followed to obtained numbers of road traffic accidents and their injuries from Libyan statistic offices; fortunately, road traffic accidents database was published since latest 1970s. All information about road traffic accidents in Libya was obtained from General Department of Traffic and Licensing, Tripoli Office of Traffic Statistics sources. The survey was carried in selected roads in Tripoli city area where there were higher car ownership users and micro buses and taxi available. The survey was done used questionnaires to get relevant data. In this study were used two basic approaches in data collection, revealed preference (RP) and stated preference (SP) methods. The respondents for this survey are the private vehicle users in study area who use their cars to go to work, study and shopping. The respondents selected randomly. A total of 900 questionnaires were collected in 5 months from (25 July to 23 December 2009). The questions addressing own car, taxi and micro bus users were addressed contained only in the revealed preference survey and pertained to demographic, socioeconomic characteristics and mode attributes. The respondents were asked to report their current travel situation by answering a set of questions. Statistical Package for Social Science (SPSS) version 16.0 and Microsoft office Excel 2007 software were used to analysis the questionnaire and logistic regression method was used in this study.

Fig. 1: shows the study area Source: Google Earth 2009

Revealed Preference (RP) Data:

The revealed preference approach has been used to model mode choice when data on actual choice of mode by travellers are available. And besides the mode choice attributes, social demographic information of each respondent. Figure 2 shows and summarizes the (RP) variables.

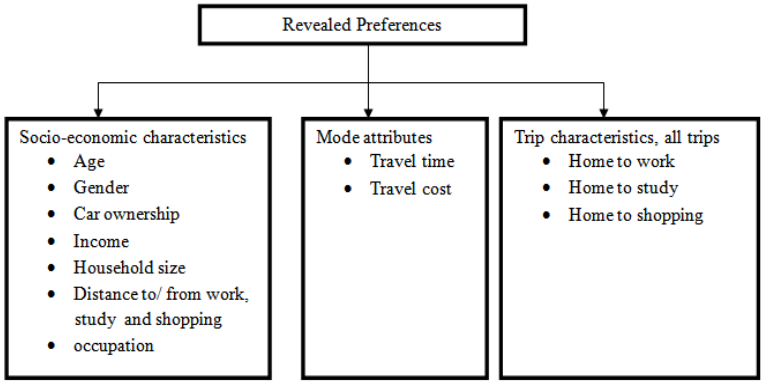

Fig. 2: shows Revealed preference framework for data collection

Stated Preference (SP) Data:

The Stated Preference (SP) technique as shown in Figure 3 consists of expressing preferences on hypothetical scenarios, upon alternatives that are presented to travellers. People's choice of one of the alternatives (or the ranking or rating of them) is utilized to derive the importance of those attributes describing the alternatives. Stated preference method was used to design the data gathering aiming at own car, taxi and

micro buses users. The data required covered data set for transport mode choice and scale of psychological attitude decision model for choosing a mode. Attributes for private vehicle utility (own car, taxi and micro buses) comprise travel time and road safety level. The (SP) survey was designed to collect information on the choice of travelling by own cars, taxi and micro buses using a series of hypothetical route choice questions. In this study, stated preference approach has been adopted for the model development. The data from attitudinal survey will used to estimate the potential impact of the improving travel time and road safety by introducing public transportation system. Figure 3 shows and summarizes the (SP) variables in this study

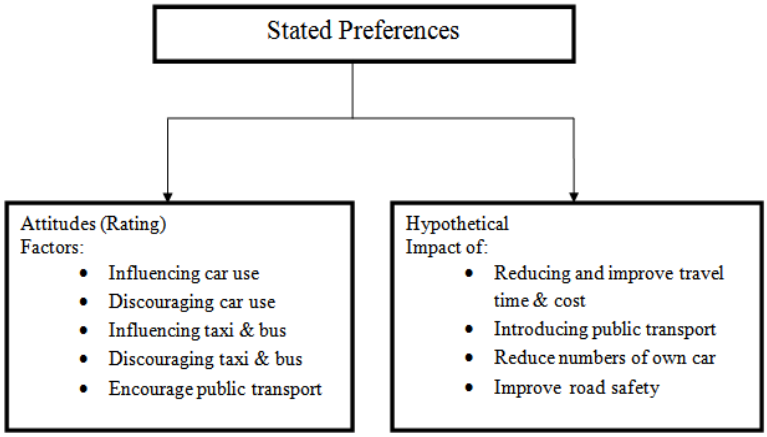

Fig. 3: Shows stated preference framework for data collection

RESULTS AND DISCUSSION

Road Traffic Accidents:

Libya is one of the most affected countries of the traffic accidents that lead to the death of 5 persons per day according to the Secretariat of the Libyan justice and this is a very large number of the population does not exceed seven millions Traffic office and licensing of Tripoli (2008). The social and economic impacts of traffic accidents are very large annual losses of money in addition to the losses and the high proportion of social orphans and the disabled. Figure 5 presented the cost of Road Traffic Accident from 1998 to 2008. Road traffic risk may be defined as the probability of accident, injury, death and damages for a given amount of activity or exposure. Risk estimates are also given for specific age / gender groups for the most common road user groups. Accident There is reason to believe that the risk increase for young car drivers is connected to the increased risk at night or weekend days. Accidents by young drivers are typically single accidents especially at night during weekends. Other sources seem to confirm that the death of young drivers have increased during the late nineties until 2008 in Libya as shown in Figure 4.

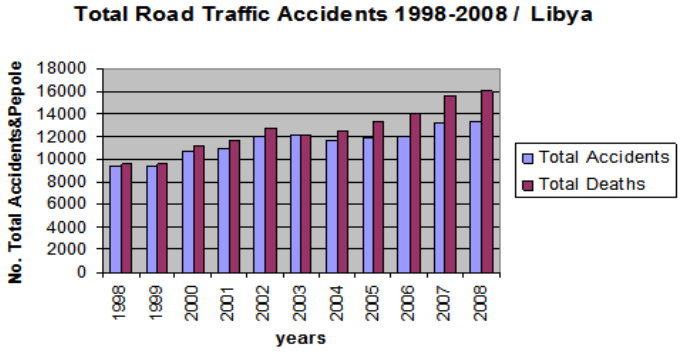

Fig. 4: Total road traffic accidents during 1998 to 2008 Source (Statistic Traffic Office – Tripoli)

Figure 5 shows the accidents cost in last ten years from 1998 to 2008 was dead about 18,946 people, about 52,915 people major injury, 66,707 people in minor injury, reconciliation and damage accidents was 42,592 accident, by total cost was 189,665.666 Libyan Dinar. (1U.S. dollar equivalent of 1.25 LyD) (Traffic office and licensing of Tripoli, 2008).

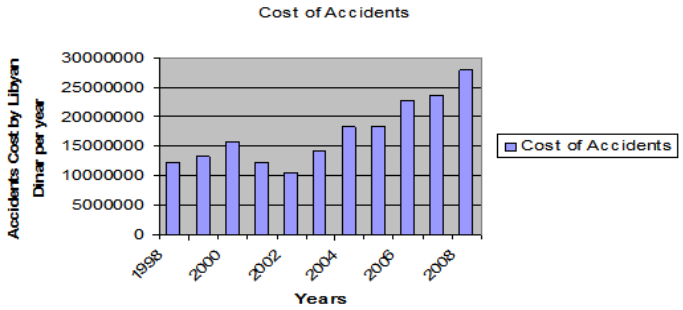

Fig. 5: Cost of accidents Source (Statistic Traffic Office – Tripoli)

Alternative Mode of Transport for Car Users:

The study made an attempt to determine whether car users had access to other modes of transport. Results from the study indicated that about 82% of car users had access to the public transport mode, while 18% had no access to alternative modes. While the own car users prefer switch to public transport by 46% would shift to bus as an alternative mode of transport and 17% would access to LRT as an alternative mode of transport, and 24% would access to train as an alternative mode of transport, and 13% would access to public taxi as an alternative mode of transport.

Reasons Convince to Switch from Using Own Car to Public Transport:

In considering the reasons convince to a mode shift from car travel to public transport, it is necessary to understand the factors, which support the great majority of active car users to using public transport (PT) system as a regular means of transport. Table 1 presented the major reasons identified when survey respondents were asked to name or, select from a given list, the factors which would influence their decision to use Public transport. The factor of most significance encouraging car users to using the public transport was that the "High traffic congestion and delay" (Table 1). This statement received an average rating of 1) 29.8 % if the PT service is available, 2) 6.2% if the PT fare is cheap, 3) 20.2% if the PT service is fast, 4) 17.5% if the PT covered all desirable routes, and 5) 26% if the PT vehicles are clean and comfortable.

Table 1: Reasons can convince to switch from using own car to public transport

No	Statement	Percent
1	If the service is available	29.8
2	If the fare is cheap	6.2
3	If the service is fast	20.2
4	If the desirable routes are covered by public transport	17.5
5	If the vehicles are clean and comfortable	26.3

Improving the Travel Time for the Public Transport:

The main factors affect decision making in choosing travel mode from, in and to Tripoli city are travel time and travel cost. But travel time is considered an important reason for mode choice. Using Public transport services is perceived as a waste of time by almost all private car users. Figure 6 represents travel time reduction of fifty percent to allowed switch to use public transport by (45%) of respondents and a time reduction of seventy percent will be prefer to switch for use public transport by (81.2%) of respondents.

Table 2 below shows improve travel time with respect to survey result and probability of prediction (P) values. P value is derived from Equation 1 which involve constant and alpha (α) values to verify the logistic prediction model used in this study.

$$P = 1 / 1 + De^{\alpha(\text{variable})} \quad (1)$$

Where P = Probability prediction, D = constant, α = coefficient of x_i

Table 2: Survey results and data calibration

Travel Time Reduction	Survey Results (P)	(1-P)/P	Ln(1-P)/P
10 %0.0866667	10.53846	2.355031	
30 %0.078333	11.76601	2.465215	
50 %0.285	2.508772	0.919793	
70 %0.3616667	1.764977	0.568137	
90 %0.188333	4.309744	1.460878	

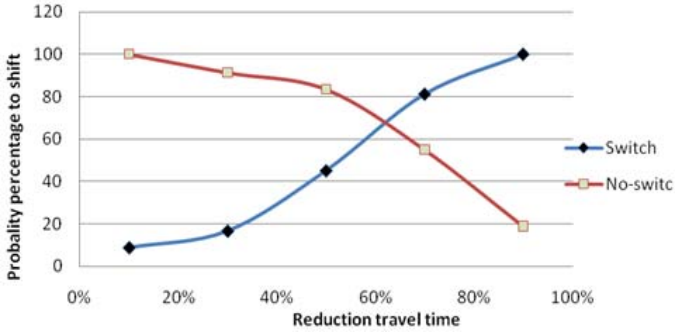

Fig. 6: Switching to PT if the Travel Time Improved

The results of above table reflect the model calibration process which then uses to develop the Analysis of Variance (ANOVA) table, which is described in Appendix 1. By using the alpha (α) and (D) values from ANOVA table, our model achieved the value of P equal to 0.0011 which somehow acceptable to be significant (significant value is <0.05) as shown in Equation 2.

L_n D = 2.90749
α = -6.7684
D = 18.31077849
Thus,

$$P = 1 / 1 + 18.31077849\ e^{-6.7684(\text{variable})} \quad (2)$$

The result of the prediction models can be shown in Table 3 and Figure 7.

Table 3: Survey results and logit model results

Travel time reduction	Survey results(P)	Result from logit model
10%	0.0866667	0.089407
30%	0.1649997	0.17432707
50%	0.4499997	0.44751729
70%	0.8116664	0.834601394
90%	0.9999994	0.998051664

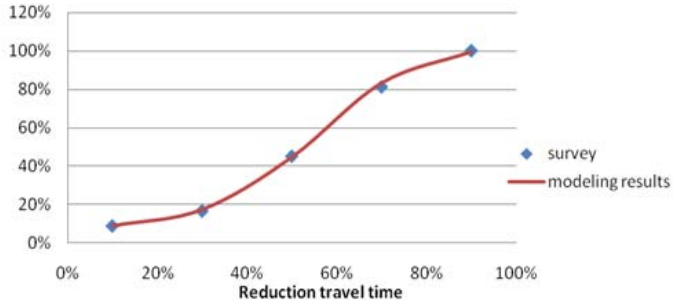

Fig. 7: Improving travel time for public transport

Majority of Tripoli residents are suffering from daily traffic congestion in most city streets especially during peak periods of working days (Saturday through Thursday). Table 4 shows that in 494 Tripoli residents out of 600 respodents or 82.3% (of the respondents) prefer to use public transport to avoid traffic congestion.

Table 4: Use public transports or prefer your own car (n 600)

Statement	Frequency	Percent
Yes, use public transport	494	82.3
No, prefer use own car	106	17.7

Which the Best Public Transport Mode Use in Tripoli:

Table 5 shows the 33.3% of the respondents prefer to use buses in city streets while, 28% like to use light rail transit, 24.5% for train and low percent about 14.2% prefer to use public taxi.

Table 5: The best public transport mode use in Tripoli (n 600)

Statement	Frequency	Percent
Buses	200	33.3
Light Rail Transit	168	28.0
Under Ground Train	147	24.5
Public Taxi	85	14.2

The Model examined the influential attributes for car users, taxi and micro bus users relative to public transport (PT) use. It was found that the estimated coefficient on travel time and travel cost for PT modes were significant.

Conclusion:

Transportation is an important service to Tripoli resident's daily trip. However, due to the increase of private vehicles usage on the road, it has caused many problems such as traffic congestion, accidents, air pollution and lost of unproductive times on the road. Reduction of travel time by introducing public transport mode will encourage users or drivers to switch to this mode. The switching to public transport mode may reduce traffic congestion, improve travel time and increase road safety. The results from the study above shows the users or drivers or travellers prefer to switch to public transport if the travel time for trips on Tripoli road network improved significantly. Improvement or reduction in travel time by 10% will encourage about 8% to switch, reduction of 30% will encourage about 16% to switch, reduction of 50% will encourage 44.9% to switch, reduction of 70% encourage 81% to switch and finally reduction of 90% encourage 99.9% to switch to the public transport. This study indicate the need to introduce an efficient public transport system namely (buses, light rail transit (LRT) and underground train) in Tripoli to reduce the traffic problems such as traffic congestion, road accidents and delay in travel time on Tripoli roads network for all trips.

ACKNOWLEDGEMENT

The research was conducted in collaboration with the Sustainable Urban Transport Research Centre (SUTRA), Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia.

REFERENCES

Abdalla, N., Kamba, O. Riza Atig, K. Rahmat and Amiruddin Ismail, 2007. Why Do People use Their Cars: A Case Study In Malaysia. Journal of Social Sciences, 3(3): 117-122.

Abdul Jalil, 1401. Statistical Analysis of the Number of Traffic Accident in Saudi Arabia. Paper Presented to symposium Studies Traffic in Big Cities. Security Academy of Naif.

Ghaya Adam Almannaei, Dr Arif Mehmood, 2005. Analyzing the impact of Traffic Congestion Solution on Road Safety. A case of Emirates and Sheik Zayed Road in Dubai).

Harrison, S., G. Henderson, E. Humphreys amd A. Smyth, 1998. Quality bus corridors and green routes: can the achieve a public perception of permanence of bus services? In Proceedings of the PTRC 26th European Transport Conference: Public Transport and Operation, 14-18 September 1998, Loughborough University, UK.

Jamilah Mohamad & Amin T., Kiggundu, 2007. The Rise of The Private Car in Kuala Lumpur, Malaysia – Assessing the Policy option. IATSS Research, pp: 1

Land transport Authority LTA., 1996. A world class land transport system' white paper presented to Parliament.

Lebanon, 2001. state of the Environment report, Ministry of Environment / LEDO, Chapter 5: 65-83.

Libya country Profile – Published 13 November 2007, last update 21 September, 2008.

Marshall, S & A. McLellan, 1998. Reducing the need to travel: a European guid to good practice in proceedings of PTRC 26th European transport Conference: policy, planning and sustainability: 14-18 Sept. Loughborough University, UK

Mahmoud El-Shourbagy, 2003. Traffic Analysis on Main Corridors in Mansoura City, Dakahlia Governieate, Egypt. Associate Professor, King Saud Universit, Civil Eng. Department, college of Eng.

Traffic office and licensing of Tripoli, 2007).

Traffic office and licensing of Tripoli, 2008).

Transportation 21: Future for Dublin A policy Paper by the Dublin Chamber of Commerce 10th January 2005.

Appendix 1

SUMMARY OUT PUT: IMPROVE IN TRAVEL TIME

Regression Statistics	
Multiple R	0.990555
R Square	0.981199
Adjusted R Square	0.974932
Standard Error	0.133757
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.801105	2.801105	156.5655	0.0011
Residual	3	0.053673	0.017891		
Total	4	2.854778			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.90749	0.123621	23.51934	0.000168	2.514072	3.300908	2.514072	3.300908
X Variable 1	-6.7684	0.540926	-12.5126	0.0011	-8.48987	-5.04693	-8.48987	-5.04693