Towards more effective urban transport policy: Understanding the travel behavior of Tbilisi residents

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Abstract

In recent decades the public transport network in Tbilisi, Georgia has decayed, while the number of private automobiles has increased dramatically. This study seeks to expand our understanding of the Tbilisi population's urban transport behavior, on the proposition that residents' attitudes could form obstacles, but also suggest solutions to transport problems. It elaborates on the perceived strengths, weaknesses, and potentials of the public transport system, and seeks to understand the reasons for the increased use of private automobiles. A questionnaire survey was conducted among Tbilisi car drivers (n=159) and public transport users (n=163). The survey data were supplemented by cooperative dialogue with Tbilisi municipal transport policymakers. The results show that most of the survey respondents preferred to use a private car and avoid using public transport. Particularly important factors include time issues such as schedules and frequency, and comfort and safety issues. Tbilisi residents value their time and want to use it efficiently. Changing residents' travel behavior will require making the public transport options competitive with the perceived advantages of the car. The study offers recommendations for more effective urban transport policy, including incentives to encourage greater use of public transport in Tbilisi.

1. Introduction

1.1 Background

Until recent years, research in urban transport focused mainly on economic calculations and engineering analyses. This has given a clear picture of certain aspects of transport systems, but has failed to resolve many transport-related problems. There have been few efforts to understand the social basis of such transport behavior, though it is increasingly recognized that considering phenomena such as social norms and habitual behavior is at least as important as issues of economic and engineering optimization (Lyons, 2004). Cutting-edge research now considers transport as a part of everyday life and behavior, and an integrated part of modern culture (Jensen, 1999). Differences in people's attitude and personality traits lead to their attributing varying importance to environmental considerations, safety, comfort, and convenience, and could be a key to improving the urban transport situation. Gärling et al. (1998) found that attitudes towards flexibility, comfort, and environmental issues all influence one's choice of transport. Ibrahim (2003) examined the attitude of car owners and non-car owners towards transport modes in Singapore, and found that car owners and non-car owners portray different attitudes towards various transport modes. This suggests that different strategies may be needed to change transport behavior of various social groups.

The theory of planned behavior (TPB) seeks to understand how the behavior of people can be changed (Ajzen, 2002). The TPB predicts deliberate, planned behavior. According to TPB, human action is guided by three kinds of considerations: behavioral beliefs (beliefs about the likely consequences of the behavior), normative belief (belief about the normative expectations of others), and control belief (belief about the presence of factors that may facilitate or impede performance of the behavior). Past travel choice contributes to the prediction of later behavior only if circumstances remain relatively stable, possibly limiting the applicability of this theory to rapidly changing transition countries. For example, the TPB can help to explain why advertising campaigns merely providing information may not work. Increasing knowledge alone does not help to change behavior very much. Campaigns that aim at attitudes, perceived norms, and control in making the change may have better results.

An expanded version of the TPB was used to predict and explain public transportation use in a Canadian city (Yuko and Gifford, 2002). A pre-post design was used to examine changes in university students' bus ridership after the implementation of a universal bus pass (U-pass) program. Bus ridership significantly increased after the U-pass was implemented, and associated changes in attitudes and beliefs about transportation modes were found. In both phases, students' public transportation use was

well predicted by the original TPB. However, two additional constructs—a descriptive norm, and the interaction between intention and perceived behavioral control—significantly improved prediction in both phases of the study. These constructs might be useful additions to the original TPB, at least in this behavioral domain.

A travel feedback programs (TFP) is a communication program aimed at voluntary travel behavior modification, from, e.g., automobile use to non-auto means of travel such as public-transit and bicycle use (Fujii and Taniguchi, 2006). These constitute soft measures designed to change travel behavior, mainly from automobile to non-automobile travel, in mobility management. Fujii and Taniguchi (2006) classified TFPs according to place, technique, procedure, and communication media, and reviewed the effectiveness of 10 TFPs in Japan. They found that TFPs in Japan reduced CO_2 emissions by about 19% and car use by about 18%, while increasing the use of public transport by about 50%. In addition, they found that TFP effectiveness increased when participants were asked to make behavioral plans to change their travel behavior.

Beirão and Cabral (2007) conducted a qualitative study of public-transport users and car users in order to obtain a deeper understanding of travelers' attitudes towards transport and to explore perceptions of public transport service quality. The key findings indicate that in order to increase public transport usage, the service should be designed in a way that accommodates the levels of service required by customers and by doing so, attract potential users. Furthermore, the choice of transport is influenced by several factors, such as individual characteristics and lifestyle, the type of journey, the perceived service performance of each transport mode and situational variables. This suggests the need for segmentation taking into account travel attitudes and behaviours. Policies which aim to influence car usage should be targeted at the market segments that are most motivated to change and willing to reduce frequency of car use. Paulley et al. (2006) described a range of factors affecting the demand for public transport, concentrating on the influence of fares, quality of service and income and car ownership.

Hiscock et al. (2002) conducted in-depth interviews with a sample of car owners and non-car owners in Scotland, to investigate the psycho-social benefits people seem to derive from their cars. They found that cars were seen to provide protection from undesirable people and events, and provided autonomy because car use was seen as being more convenient, reliable and providing access to more destinations than public transport. Cars were also seen to give prestige and other socially desirable attributes such as competence, skill and masculinity. To make public transport more attractive, the authors suggested that policy makers consider how make it provide similar sorts of benefits, targeting the different needs of various population groups.

Several studies have analyzed the transport transition that accompanies post-socialist economic and political transition (see e.g. Grime and Duke, 1996). Many urban residents in transition countries now have greater affluence and have a wider choice of private transport options, while the public-sector transport options become less significant. Specific to Georgia, few studies to date have examined the sociological aspects of transport issues in the capital city of Tbilisi. Karanadze (2006) reviewed transport-related issues in Georgia, discussing key barriers to sustainable transport development including the legislation system, fuel quality, traffic management, vehicle condition, health effects, public transport and public participation. Khuchua (2002) investigated car sharing in Tbilisi during the previous decade, revealing several possible barriers to implementation including the inflexibility of existing travel behavior of potential participants and low public and political accessibility. Vardosanidze (2006) offered insight into sociological aspects of transport system functioning in Tbilisi. He reported that the population of Tbilisi feels discomfort from transport chaos, but they also see ways to overcome it. These studies hint at the importance of sociological aspects of urban transport, yet no study to date has specifically focused on the attitudes and behavior of Tbilisi residents to public versus private transportation system. Such a study could potentially contribute to a more effective public policy toward urban transport.

1.2 Study objectives

Tbilisi, with a population of about 1.2 million, is experiencing rapid growth in levels of mobility. During the last decades, traffic volume in Tbilisi has rapidly increased, in particular the number of private automobiles. In Soviet times there were 15 cars per 1000 inhabitants. By 2000 this had risen to about 70 vehicles per 1000 inhabitants, and by July 2005 there were about 100 vehicles per 1000 inhabitants in Tbilisi. The situation is dramatically different in the public transport sector. Tbilisi used to have a very well developed public transport system including metro, city buses, trolley-buses, trams, mini-buses and taxis. The Soviet Union traditionally gave overriding priority to mass public transport (White, 1979). During the 1990s bus service and the number of bus passengers collapsed, and is now slowly increasing after the Tbilisi municipality bought additional buses in 2004. The metro network remained in operation and attracts a significant number of riders, but metro transport is limited to certain areas of the city. Tram and trolly bus service has been eliminated. The gap in urban transport service, for those residents who do not own a car, has been filled by the numerous, flexible, though less comfortable “marshrutka” mini-buses.

No integrated, long-term transport planning has been done for Tbilisi. The increased use of private cars has created problems for city and its inhabitants, though the ongoing transition in urban transport has occurred largely without debate or study of urban transport demand and how it might best be satisfied. Urban transport is a complex issue, and there are multiple factors to consider. Closely tied to many of these factors is the sociological aspect of transport, such as the travel behavior of the urban residents. The present study investigates the relationship between car driving and public transport use, and seeks appropriate policy incentives that encourage people to use public transport rather than drive cars.

A specific hypothesis to be tested is that the people who drive cars never or very rarely use public transport. This study seeks to find out whether car drivers use public transport or not, and why. The study is based primarily on a survey that investigates urban-travel attitudes and behavior, as well as incentives that could help to encourage people to use more public transport. Personal transport depends on many factors that are not directly connected with the transport sector itself, such as lifestyle, economic conditions, location of facilities and services, and residential trends. The problems existing within the Tbilisi transport system are quite serious and will not be solved by purely economic or engineering approaches. Acknowledging the potential gap between stated and revealed preferences in transport-demand analysis, this research project seeks to illuminate the deeper social issues involved in Tbilisi transport. The basis for this study is that peoples' behavior could form obstacles, but also solutions to urban transport problems, by finding practical incentives that encourage them to use public transport. Knowledge of these factors could generate ideas for effective policy measures that the Tbilisi government could implement in terms of public and private transport management that benefits city residents.

2. Methods

The methodology employed in this study is primarily a quantitative questionnaire survey of 322 Tbilisi transport users, complemented by library research and dialogue with Tbilisi municipal authorities.

2.1 Qualitative research

The qualitative study focused on a search of the existing literature and discussions with transport authorities. Government documents, academic articles, books, and internet sources were accessed to increase the theoretical knowledge of the transport situation in

Tbilisi as well as the experiences of other cities experiencing a transport transition. The Georgian governmental statistics department was contacted to find information on previous studies that had been done on Tbilisi transportation problems or resident's travel behavior. Interviews were conducted with municipal transport management staff, to find out their plans, priorities and needs, and to engage in cooperative dialogue to allow this research to be more useful to Tbilisi public policymakers.

2.2 Questionnaire survey

A questionnaire survey was conducted among Tbilisi car drivers (n=159) and public transport users (n=163). The aim of the survey was to find out how people think about and use private and public transport and their anticipated reaction to potential transport policy measures. Within the questionnaire, a number of questions asked for basic demographic variables like age, gender, income, occupation, place of residence, etc. These demographic data served as independent variables for analysis of most of the subsequent questions. Another key series of questions asked for information on usage of public and personal forms of transport. Additional questions were tailored for public transport users and car drivers, and went into further detail on frequency, mode, distance, and other factors related to their urban travel habits.

Further questions were specific to the perceived relative advantages and disadvantages of private cars and public transport options. Specific questions regarding costs, comfort, safety, routes, and other factors explored the advantages and disadvantages of different transport options including cars, buses, metro, trolley-buses, mini-buses, etc. The general aim of the survey questions is to determine the factors that would increase the desirability of using the public transport system, and what policy incentives would encourage public transport use and discourage private car use. Some questions were formulated in a way to find out specific government policy measures that could encourage a change in transport behavior, including residents' opinions about appropriate transport management.

A pre-test survey exercise was conducted among 20 respondents, to find out unclear questions, ambiguities, sensitive issues, and other potential weaknesses of the survey questionnaire. These issues were then corrected in the final version of the survey that was given to the general population.

The full survey was then conducted using the intercept survey method. Convenience sampling was used, whereby people who at the time of the sampling were either using a car or were using a form of public transport were approached and asked to complete the survey questionnaire. Car drivers were approached in parking areas as they

entered or left their vehicles. Effort was made to vary the sampling to include various parts of the city, as well as various times of day and days of the week. Professional drivers such as bus or taxi drivers were excluded from the survey. A total of 159 car drivers and 163 public transport users completed the survey. The refusal rate was higher among car drivers than among public transport users, and generally was motivated by "lack of time" by the potential respondent, though this difference among the groups was not quantified or controlled for. Data from the completed questionnaires were manually entered into a computer database and analyzed using statistical software.

3. Survey results

3.1 Demographic comparison

The survey included demographic information in order to identify the results with different groups of people and better understanding of the problem. Survey questions included different age of the population, gender, occupation and income. The demographic results are shown in Table 1.

Table 1. Summary of demographic information on survey respondents. Some percentages do not sum to 100% due to rounding.

	Characteristic	Car drivers (%)	PT users (%)
Age	≤ 23	12	19
	24-35	39	31
	36-49	37	26
	50-64	12	16
	≥ 65	0	8
Gender	Female	28	78
	Male	72	22
Occupation	Working in the private sector	62	52
	Working in the public sector	28	15
	Student	3	14
	Pensioner	1	9
	Unemployed	7	11
Monthly personal income	≤ 200 lari	11	48
	200-500 lari	41	41
	500-1000 lari	36	10
	≥ 1000 lari	12	1

The public-transport users had a wider range of ages (≤23 to ≥65 years old), while more car drivers were in the 24 to 49 year old range. No car drivers were older than 65 years of age. Significant gender differences were observed, with 78% of the public transport users being female, while 72% of the car drivers were male. The majority of

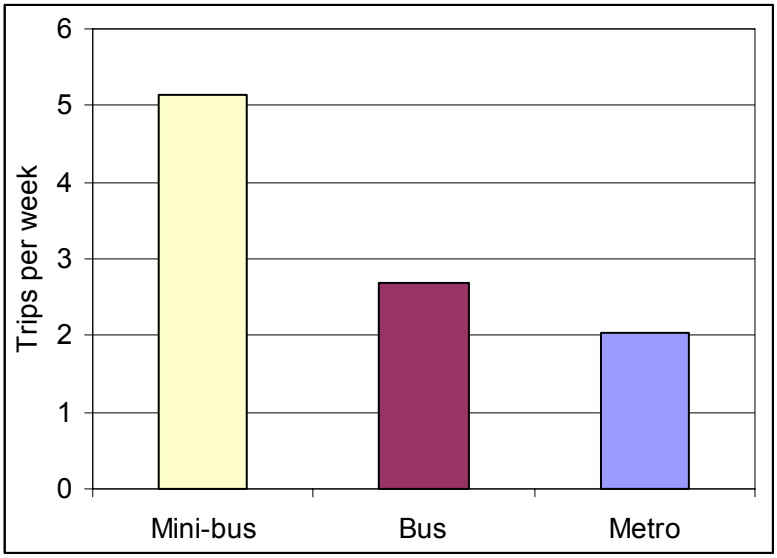
both car drivers and public transport users worked in the private sector. Most of the public transport users were in the lowest income category, while car drivers were more commonly in the middle to high income categories.

3.2 Public transport users

Frequency of using different modes of public transport

Respondents were asked about which type of public transport they use more often: metro, bus or mini-bus. Most of them use mini-buses, with an average of 5.14 trips per week (see Figure 1). A likely reason to explain the greater use of mini-buses is that they have a greater geographic coverage than other forms of public transport, and go to places without metro coverage and where bus route frequency is not good.

Figure 1. Frequency of using different modes of public transport, as stated by public transport users.

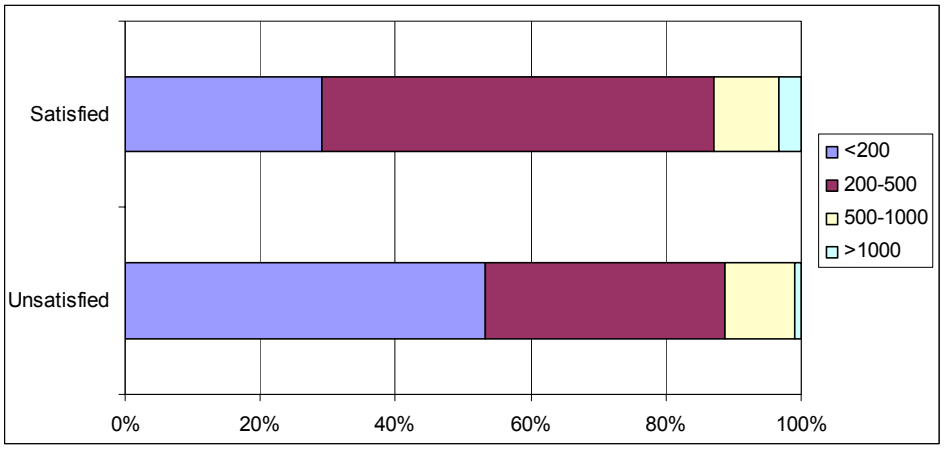


Public transport price

Public transport users' main concern is related to the price of transport fares. 77% of PT users are not satisfied with the price. In July 2007 the PT fare in Tbilisi was doubled to 0.40 lari per trip (1US$=1.55 lari). In general, PT users have lower incomes than car drivers (Table 1), and increases in the cost of transport will more sharply influence their budget. Most of the PT respondents works for the private sector (54%), and only 16% works for governmental sector. 48% of the population has a monthly income of below 200 lari. Figure 2 shows the income breakdown of the 23% of PT users who are satisfied with

PT fares, and the 77% who are unsatisfied. Most of the unsatisfied respondents are the population with low income.

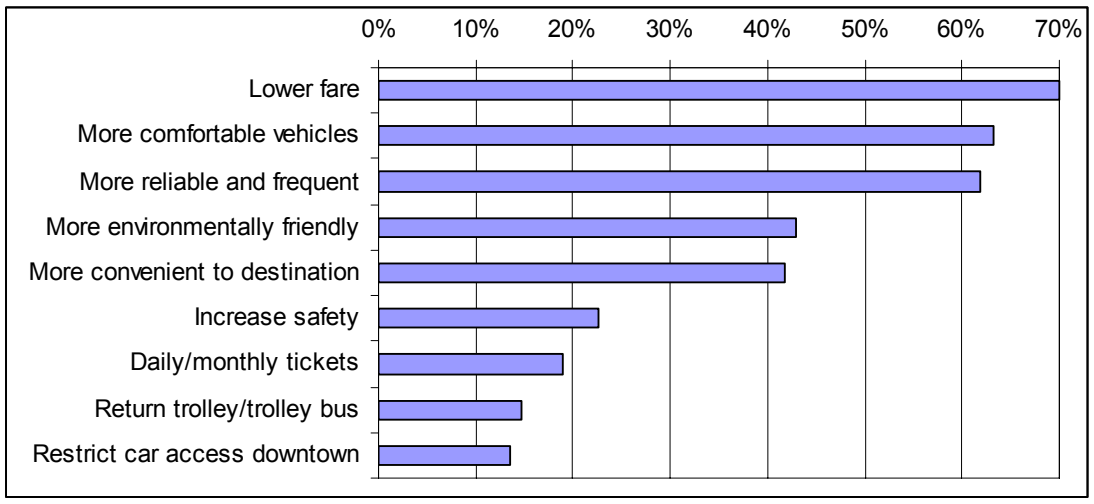
Figure 2. Percentage of public transport survey respondents who are satisfied or unsatisfied with cost of public transport, broken down by income categories.



Suggested improvements to PT service

PT users were asked to suggest improvements to PT service. The results are shown in Figure 3. The most frequent response was to reduce fares (see also discussion above). The next most frequent concerns were for greater comfort, and for more reliable and frequent service. Other concerns include environmental issues and vehicle safety.

Figure 3. Suggestions by public transport users for improvements to public transport service.



Comfort and safety

PT respondents prefer more comfortable journeys, including soft, clean seats, a pleasant temperature, preferably having air conditioning. This is an important issue in Tbilisi because of its very hot summers. Most of the "new" used buses from Europe are designed for using air conditioning and do not have opening windows. To save fuel, the air conditioning systems are not used in Tbilisi, which caused concern for the passengers. Later, new opening windows were installed in the buses, but still air conditioning remains a big issue. Complaints were made about very crowded transport, especially on mini-buses which are frequently very uncomfortable with broken seats, extra seats installed, unpleasant smells, and poor ventilation. Many vehicles are not technically safe, and passengers are very unhappy with it. The main reason people use mini-buses is that their routes are very flexible, and they can be stopped anywhere. This, on the other hand, can develop dangerous situations in the streets. Based on the survey results, there is a desire for more comfortable, flexible, convenient transport that will be able to deliver the passengers to remote areas of the town.

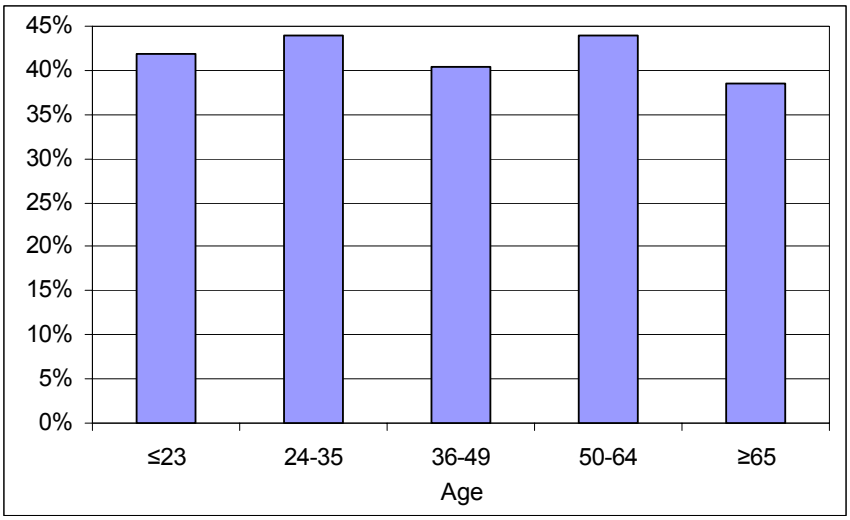
Travel time

Travel time and reliability is a key factor for choosing the transport for the journey, and for the work/ school activity time the importance is much higher. There is a demand for the more frequent direct public transport links. Respondents want brief waiting time, fast journey and reliability. 62% of the PT respondents complained about frequency, waiting time, schedule delay and travel information. Passengers preferred that buses should stop at designated bus stops, rather than at anywhere along the street.

Environmental issues

43% of PT users preferred more "environmentally friendly" transport. This is a positive aspect to change the behavior of the passengers in future. An advertising campaign with the intent of increasing public transport usage could include a focus on the environmental benefits of using public transport by tailoring public transport as an environmental symbol. The survey results were compared with the age of the respondents. There was no major difference in response based on age: about 40% of respondents in each age category desired more environmentally-friendly public transport (Figure 4).

Figure 4. Percentage of public transport survey respondents in various age categories who would prefer to have more "environmentally-friendly" public transport vehicles.

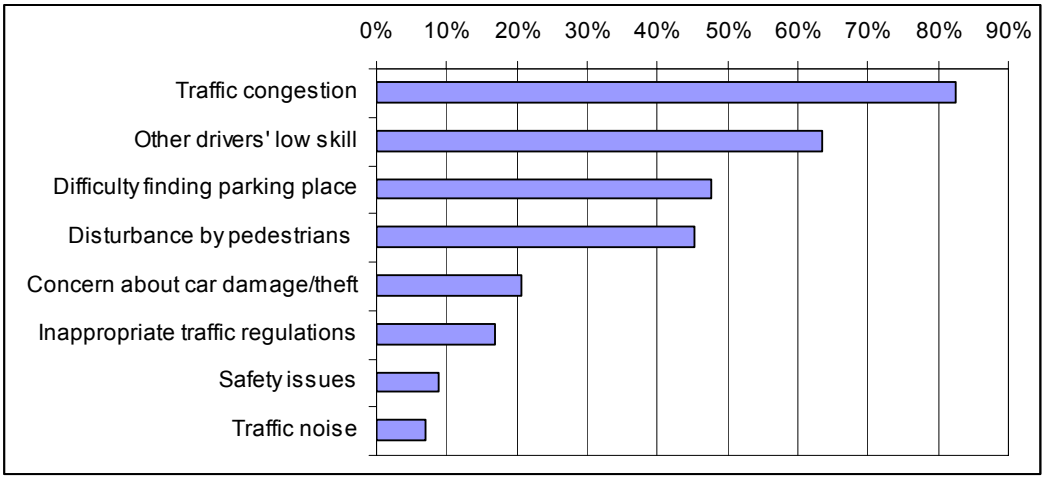


3.3 Car drivers

Perceived advantages and disadvantages

Private car users were asked the main obstacles to driving their cars in Tbilisi. Their main concerns are traffic congestion, difficulty in finding parking, and problems caused by other drivers and pedestrians (Figure 5). Traffic congestion was the main concern for the car drivers, because traffic volume is rapidly growing in Tbilisi, the streets are not designed for high number of vehicles, and there is not an efficient traffic management system, which together creates congestion problems.

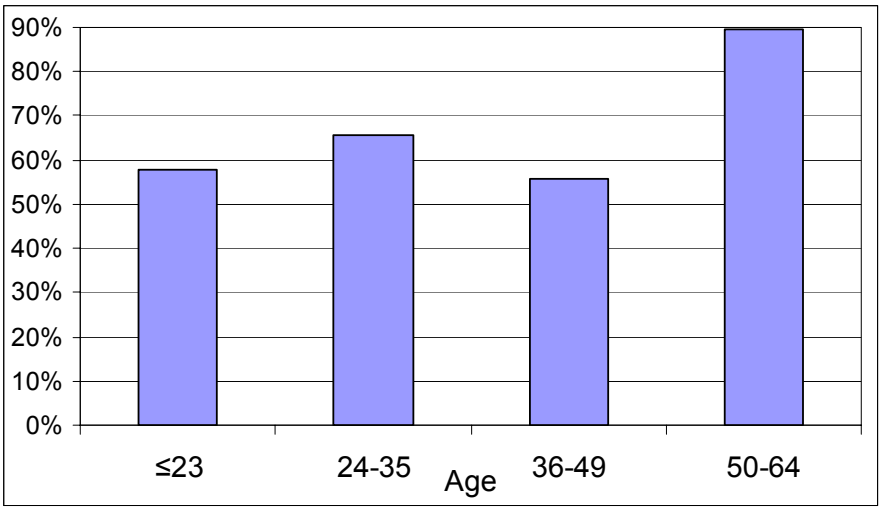
Figure 5. Primary obstacles to driving, as described by car drivers.



They were also asked what they like about driving their own vehicle. 59% liked the convenience, and 53% liked the time saving. This suggests that progressive improvements to the public transport system, such as improving convenience and reliability, may contribute to changing people's attitude toward using public transport in Tbilisi.

64% of private car drivers complained about other driver's low qualification. These respondents were compared in terms of age and driving experience. Our hypothesis suggested that mostly old drivers were potential complainers, because in the Soviet era traffic regulations were more organized than in more recent years. During the post-Soviet transition, driving licenses became easier to get and traffic regulations were not rigorously enforced. In recent years the situation has improved but not everybody follows traffic rules, which irritates the more experienced drivers. This is shown in Figure 6.

Figure 6. Percentage of car drivers in each age category who listed "other drivers' low qualification or skills" as an obstacle to driving.



Traffic rules

Respondents were asked if they obey traffic rules while driving, and why or why not. Most of the respondents (69%) reported that they follow the rules. Of those who do not follow the rules, 61% give the main reason that they are "in a hurry." 37% said that "nobody follows the rules so neither do I." This indicates that traffic regulations should be better organized and that rules should be enforced. From the other hand, respondents show high understanding to follow the roles and obey it, for instance 91%of car users.

Another question about seatbelts gave interesting results. At present seatbelts are required only while driving on highways, but not in towns. When asked whether seatbelts

should also be used in town, 91% of the respondents were positive to the idea, and would use seatbelts if it is required by law.

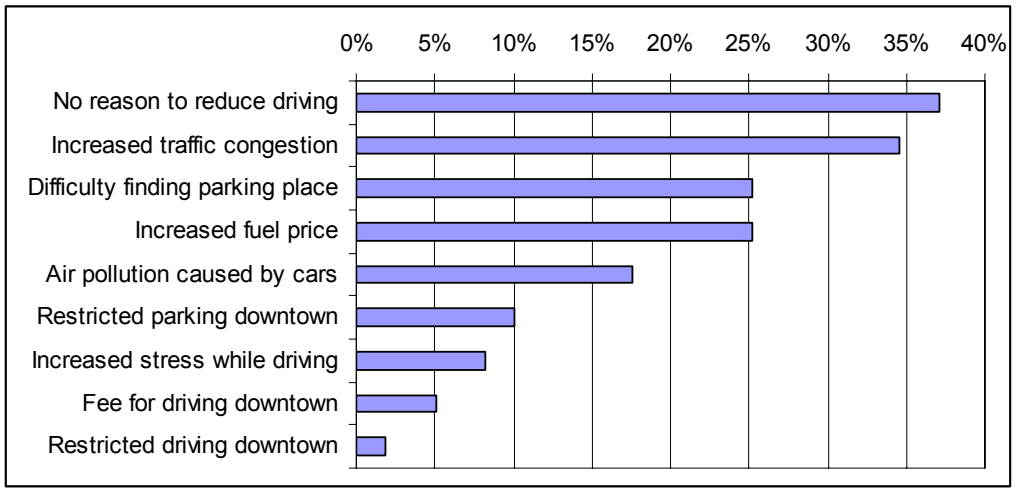
4. Discussion

4.1 Travel behavior changes

Society in Tbilisi appears to be divided into two groups: one group of population that uses public transport and another that uses private cars. They are different not only in terms of their actual transport usage patterns, but also with thinking and attitudes toward transport needs and demand. The results from the transport survey show that 64% of PT users use public transport every day, and 87% of PT users do not own a car. Of the car driver group, 72% of car drivers drive their car every day. While 94% of car drivers have used public transport at some time in their lives, most of them use PT only a few times per month or year. 6% report that they have never used PT; this group mostly works in the private sector and has monthly income of 500-1000 lari.

The key factors are the attitude towards public transport and attachment to the car. It is clear that some of the car users have very low intentions to use alternative modes of travel. Car drivers were asked "what would make you reduce driving," to which 37% replied that there would be no reason to reduce their driving (Figure 7). The same respondents were asked if they ever used public transport and why. 56% replied that they would only use PT if their car was broken or if they had no other option.

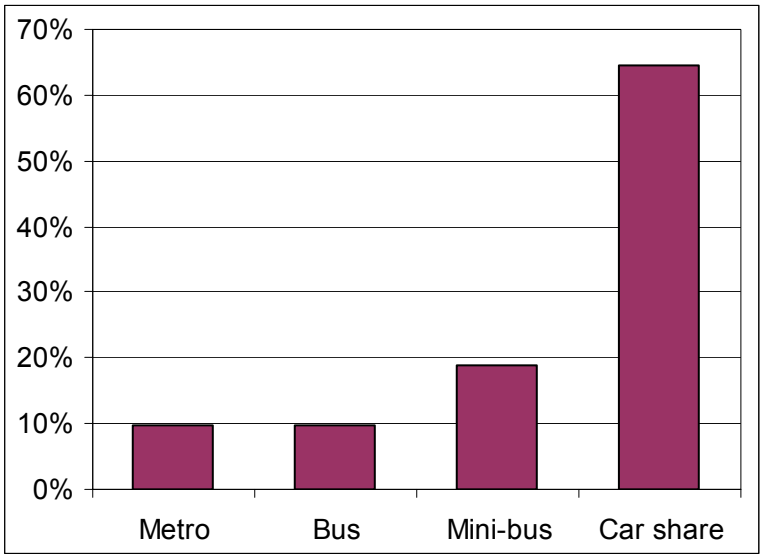
Figure 7. Responses by car drivers to the question "What would make you reduce driving?"



26% of drivers said that difficulty in finding a parking place could affect their decision to drive. Tbilisi has suffered from disorganized parking management. New parking rules have come into effect in Tbilisi as of January 2008 (Tbilielebi, 2007). Tbilisi is to be divided into the three parking zone with varying parking fees. Parking meters will be established in parking places. Monthly parking cards will be available for people who use the same parking place often. Fines of 20 lari per hour will be charged for illegal parking.

PT users were asked to choose among the different transport options, including getting a ride in the car of a family member or friend. Most chose to share a car because it is more comfortable and convenient (Figure 8).

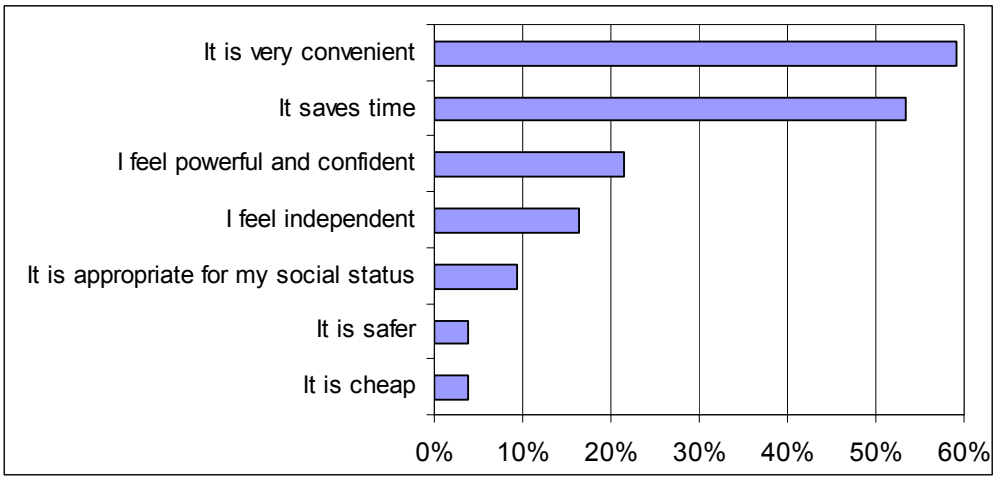
Figure 8. Preferred transport type, as stated by public transport users.



It is important to understand what are the service attributes most important to car drivers, and what would make them switch to using public transport. In response to the question “what do you like about driving your own car,” 53% replied that it saves time and 59% that it is convenient (Figure 9). Thus it is clear that travel time and convenience play a key role in determining transport mode decisions. Respondents want to feel in control when traveling and this means brief waiting times and certainty about scheduling. This information indicates that public transport with reliable time tables, efficient routes, and safe buses could be attractive to car drivers by giving the traveler more control over travel time. Reducing of car use should not be expected simply by requesting individuals to do it voluntarily. In order to reduce car dependence, it is necessary to promote different

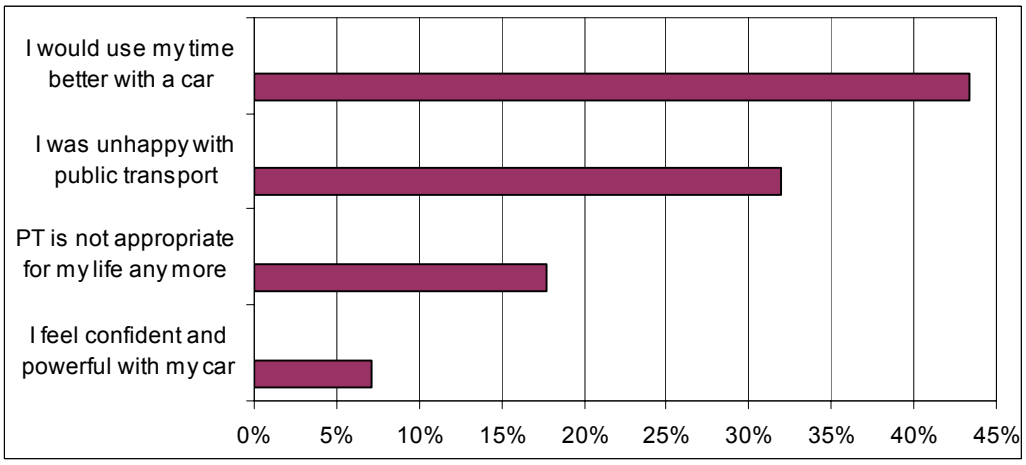
measures such as modifying the opportunity to travel by improving the availability of alternative transport and modifying the lifestyle pattern that will improve the situation.

Figure 9. Responses by car drivers to question "What do you like about driving your own car?"



PT users were questioned whether they would continue to use PT if they had a car. Here the results were divided, with 45% reporting that they would still use PT. The main reasons for using it are that some places are more accessible with PT, and the cost is lower. The 55% of the respondents who stated that they would not continue to use PT were then asked the reason(s) they would not use PT. The main reason stated is more efficient use of time when traveling by car (Figure 10). This supports the earlier conclusions that scheduling, frequency, and reliability issues are critical to effective public transport systems.

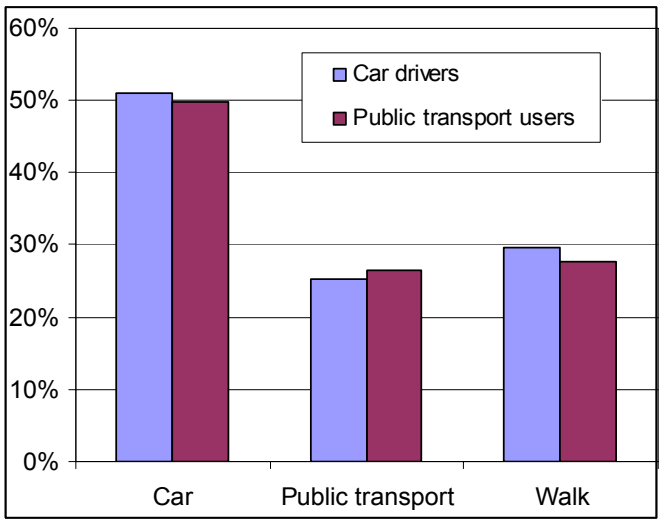
Figure 10. Stated reasons why public transport users would not continue to use PT if they acquired a car.



To have a clearer understanding of car drivers' attitude to PT they were asked a question focused on financial issues that could encourage them to switch to PT. Car drivers were asked, "If public transport were cheaper and service better than maintaining and using your car, would you reduce driving and use more public transport?" 20% said they would, 38% said they would not, and the remainder were undecided.

Private car users as well as PT users were asked to choose the most suitable transport (car, PT, or walking) for short distance trips under 3 km. Both groups considered that the car would be the best transport option, with about 50% of both groups choosing this option (Figure 11). Walking was the next more popular option for both groups, followed by using public transport. Follow-up questions asked the reasons for the choices. The interesting result is that most of the car driver respondents chose walking due to the opportunity for improving health, while only 13% chose PT to save money.

Figure 11. Responses to question "If you are going less than 3km, which transport will you use (if available)?"



In addition to the predetermined questions in the survey questionnaire, the respondents were given the opportunity to write additional information expressing their concerns, opinions, and recommendations. The information is very valuable and helps to deepen our understanding of the Tbilisi population's attitudes toward urban travel, to better develop recommendations for policy makers in transportation issues. The main concern for the public transport users was service quality, including different issues like transport ticket price, comfortable buses with convenient seats and air conditioner; technical safety of vehicles; drivers qualification; well organized routes and short time intervals; overcrowded buses, additional vehicles needed at rush hours; reduce prices for

students; drivers' rude behavior; reduce car traffic, and make separate lanes for buses. Car drivers' complaints include that police do not have high qualification and they don't follow the traffic rules; women as driver; public transport drivers bad driving habits, damaged roads, low qualification of other drivers.

4.2 Public transport improvement

Tbilisi, especially the city centre, was not designed to accommodate the current number of vehicles. The river valley, which gives the city a linear structure, prevents good dispersion of air pollutants. Urban congestion and an unhealthy environment results from the increased traffic flow and unorganized parking. Despite recently improved road conditions, renovated traffic light system and some aborted steps taken towards restriction of vehicle movement in the central part of the city, traffic jams are a common sight on Tbilisi's streets.

Tbilisi had different types of public transport after the collapse of the Soviet Union, for instance trolley-buses and trolleys. However, instead of improving the electric transport options, the city government removed them completely from the system and replaced them with conventional buses. That resulted in increased pollution in the city. The solution was seen to build new roads to improve the situation, in spite of accumulated evidence that new roads are not a long-term solution to congestion.

A key to sustainable urban transport is demand management combined with strong policies to promote public transport and the concentration of development (Banister, 2005). This will both reduce congestion and have environment and social benefits. Public transport management in Tbilisi has experienced big changes during the last decade. New programs for bus networks are currently under development in Tbilisi (Nacvlishvili, 2007). The city government bought 510 new buses, among them 360 small buses and 150 big buses. Tbilisi has a lot of narrow streets so mini buses will be more convenient for streets. The new buses will be more comfortable and pleasant to ride.

Also a new ticket system is being developed. Passengers will buy tickets from a cash desk or ticket office, thus freeing the bus drivers from taking money and allowing them to focus on driving. There will be a control system for passengers. This may begin as early as 2008. A card making it possible to ride both buses and metros is also being developed, which will make public transport use more convenient. There are some social programs on the agenda, especially after the doubling of ticket prices in 2007. After increasing the price up to 0.40 lari per ride, a bus card was developed for the more vulnerable part of the population, allowing reduced ticket prices. Cards can be purchased at metro stations. Children under 6 years old are free. There are no reduced prices for

student or senior citizens. Only vulnerable and disabled citizens, refugees, and parents with more than three children pay a lower price of 0.10 lari per ride. The reason for increasing the ticket price was to fund bus maintenance. All expenses for bus maintenance and service are paid for by passenger fares. The government does not currently contribute any funding for public transport.

4.3 Future transport vision

Tbilisi has clearly become a car-oriented culture over the last decades. While there is still an effective public transport system that the city government tries to maintain, other official actions have been taken that are against improving public transport system. Examples include the complete elimination of electric trolley-buses and trolleys, the restriction against mini-bus travel in the central streets, and facilitation of private car parking. To effect behavioral changes and public transport management improvements, city government and society should act together in order to improve the situation. The public transport system has struggled to compete with the car at every stage. Tbilisi could be developed for people, businesses, prosperity and security as well as high quality environment. As Banister (2005) stated, “transport plays an essential role in creating a sustainable city, but it should not be the main agent in its destruction.”

The number of cars is increasing in Tbilisi, and an alternative might be a more voluntary approach where individuals choose to live in car-free locations within the city. Voluntary travel behavior change is complex, and requires an understanding of people’s motivations for change (Ampt, 2003). Different people have different motivations, and interventions must target realistic behavioral change in specific population groups. Public transport in Tbilisi should be of a sufficiently high standard to make car ownership unattractive among increasingly larger groups, particularly as the costs of ownership are made higher. Car-free housing can lead to wider areas of the city being designated as clear zones or areas where only non-polluting forms of transport would be allowed. Electric vehicles would be used within the area, such as the discontinued trolleys or modern electric cars. This would become increasingly attractive as Georgia further develops its vast potential for hydroelectric energy. All forms of polluting transport would be parked outside of the area. Most travel inside would be by walking, bicycle, electric bus or trolley. These areas should provide clear demonstration of the benefits of zero-pollution transport, and the quality aspects of city living would be enhanced as this area would be both clean and quiet.

Specific recommendations for implementation by city government can eventually lead to the realization of this vision. These include strategies to limit private vehicle traffic

at particular times and places, increasing fuel taxes to internalize the external costs of private car traffic, strategies to reduce traffic speeds, roadway design and management practices that favor more efficient modes, variable road pricing used to reduce peak-period vehicle trips, charging for parking, various fees and taxes based on a vehicle's mileage, giving priority to public transport in downtown, strategies for encouraging non-motorized transportation, and so on. These involve fundamental changes that would be required to implement a more sustainable, integrated urban transport system in Tbilisi.

This is an ideal scenario that might be developed in the future in Tbilisi. It may currently appear unrealistic because the society is not ready for such changes in the transportation fields. Several years ago there was an attempt by the city government to restrict car access along the central street during weekends. This project was not successful because city residents were not ready for the change, and were unwilling to step down from the car and take public transport or walk for one day. Meanwhile it is getting more difficult to find parking places, traffic congestion and air pollution are becoming worse, and eventually society will become convinced of the need to change behavior and will need to take sharp action.

5. Conclusion

The urban transport problem in Tbilisi is complex. A questionnaire survey of 322 Tbilisi transport users reveals that Tbilisi residents are increasingly adopting a car-oriented culture. Most of the survey respondents preferred to own a private car and avoid using public transport. To change this attitude, as well as the resulting travel behavior, will require making the public transport options competitive with the perceived advantages of the car. Particularly important factors include time issues such as schedules and frequency, and comfort and safety issues. Tbilisi residents value their time and want to use it efficiently. Public transport quality has degraded in recent decades, which has led most residents to prefer car ownership. Nevertheless, a sustained and committed effort by municipal transport officials could result in improved public transport service, leading to increased use of public transport and improved social and environmental conditions in Tbilisi.

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References

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology*, 32(4), 665-683.

Ampt, E.S. (2003). Voluntary household travel behaviour change: Theory and practice. Paper presented at *10th International Conference on Travel Behaviour Research*, Lucerne, August 2003.

Bamberg, S. (2006). Is a residential relocation a good opportunity to change people's travel behavior? Results from a theory-driven intervention study. *Environment and Behavior*, 38(6), 820-840.

Banister, D. (2005). Unsustainable *Transport: City Transport in the New Century*. Routledge: New York.

Beirão, G. & Cabral, J.A.S. (2007). Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy,* 14(6), 478-489.

Fujii, S. & Taniguchi, A. (2006). Determinants of the effectiveness of travel feedback programs—a review of communicative mobility management measures for changing travel behaviour in Japan. *Transport Policy,* 13(5), 339-348.

Hiscock, R., Macintyre, S., Kearns, A. & Ellaway, A. (2002). Means of transport and ontological security: Do cars provide psycho-social benefits to their users? *Transportation Research Part D: Transport and Environment*, 7(2), 119-135.

Gärling, T., Gillholm, R. & Gärling, A. (1998). Reintroducing attitude theory in travel behavior research—the validity of an interactive interview procedure to predict car use. *Transportation*, 25(2), 129-146.

Grime, K. & Duke, V. (1996). Urban transport choice: a post-communist dilemma. *Regional Studies*, 30(8), 791-795.

Ibrahim, M.F. (2003). Car ownership and attitudes towards transport modes for shopping purposes in Singapore. *Transportation*, 30(4), 435-457.

Jensen, M. (1999). Passion and heart in transport—a sociological analysis on transport behavior. *Transport Policy*, 6(1), 19-33.

Karanadze, L. (2006). *The Main Aspects of Sustainable and Healthy Urban Transport Development in Georgia*. Ministry of Environment of Georgia.

Khuchua, M. (2002). *Potentials of Introduction of Car Sharing Principles into the Transport Sector of Tbilisi as Important Aspect towards Sustainable Transportation in the Capital of Georgia*. Masters Thesis, Lund University, Sweden.

Lyons, G. (2004). Transport and society. *Transport Reviews*, 24(4), 485-509.

Nacvlishvili, P. (2007). Tbilisi transport union, "Tbilisi Bus" exploitation director. Personal interview with Inga Grdzelishvili, 18 October 2007.

Paulley, N., Balcombe, R., Mackett, R., Titheridge, H., Preston, J., Wardman, M., Shires, J. & White, P. (2006). The demand for public transport: The effects of fares, quality of service, income and car ownership. *Transport Policy*, 13(4), 295-306.

Tbilielebi, (2007). How drivers will be fined according to new parking rules. *Tbilielebi*, No. 42, pg. 13. 15-21 October 2007.

Vardosanidze, L. (2006). *Urban Transport in Tbilisi: Traits for the Portrait of Chaos*. Habitat Georgia.

White, P.M. (1979). Planning of urban transport systems in the Soviet Union: A policy analysis. *Transportation Research Part A: General,* 13(4), 231-240.

Yuko, H. & Gifford, R. (2002). Extending the theory of planned behavior: Predicting the use of public transportation. *Journal of Applied Social Psychology,* 32(10), 2154-2189.