Working paper

International Growth Centre

# Travel mode choice preferences of urban commuters in Dhaka

## A pilot study

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March 2012

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# Travel Mode Choice Preferences of Urban Commuters in Dhaka:

# A Pilot Study

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Submitted to:
Bangladesh Country Growth Program
International Growth Centre (IGC)

Date: March 25, 2012

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# 1 Introduction

Dhaka City presently is one of the 10th largest mega-cities of the world with a population of about 14.0 million and having the highest annual growth rate and is expected to be the second largest city of the world with a population of 22.8 million by 2015 (UNFPA, 2001). The city represents less than 1% of the country's total land area supporting about 10% of the population. There has been a phenomenal growth in terms of population and area in the last four decades. Annual growth rate of Bangladesh's population was 1.8 percent per year between 1998 and 2005 but Dhaka's population has increased at an astonishing average annual rate of 9.1 percent since 1999 (World Bank, 2007). Such a huge population is expected to generate a commensurable number of trips each day. For example, population of greater Dhaka (urban areas of Dhaka) is expected to be 36.0 million by 2024 with estimated total 70 million person trips a day (STP, 2005).

Given the present situation in Dhaka city, it is incumbent for all the stakeholders especially the government is in dire need to accommodate the growing populace not only with developments in the transport sector but also action needs to be taken in the sectors of education, housing, sewerage, water supply and power. The need to provide an efficient transport system to serve the purposes of the population is now more pressing than ever. This system has to take into account all strata of the population in conceptualizing and implementation of it.

## 1.1 Current Transport Situation in Dhaka

The current state of the transport system in Dhaka primarily constitute of vehicles such as non-motorized transportation mainly rickshaws, which has a substantial share with the number being more than 500,000 .On the other hand, motorization level is very low compared to similar sized cities (Rahman, 2008).

The road network in Dhaka is nearly 3,000 km with 200 km primary, 110 km secondary, 50 km feeder, 2640 km narrow roads and few alternative connector roads. The proportion of road surface to built-up area is hardly 7% as against 25% recommended for a good city planning. Alarmingly, in Dhaka only 400 km of footpath is available for pedestrians with 40% occupied illegally by vendors and others. Presently, there are no effective bicycle lanes

and safe walkways. The 37-km long rail-road does not make a significant contribution to the city's transport system due to policy constraints. (Rahman, 2008). Furthermore, the problem of lack of policies are evident from 100 open markets on the streets and 3,000 shopping malls beside roads without adequate parking provisions. A significant number of the signals are controlled manually and there are insufficient traffic policemen for controlling traffic.

The transport environment in Dhaka poses various problems such as mixed-modes transports using the same road space, traffic congestion, delays, mismanagement, conflict of jurisdictions, poor coordination among organizations and increasing environmental problems.

## 1.2 Prior Work

Ahmed, Ahmed and Hoque (1980) investigated in their study about the failure of the traffic management and administration of Dhaka city. The authors recommended modification of traffic management and policies. They found that the existing transport facilities not adequate to fulfill demand given the mixed mode situation of Dhaka.

Since early 1990s the traffic problems of Dhaka have received their due attention in different policy papers. In an earlier attempt, *Dhaka metropolitan area Integrated Transport Study* (DITS, funded by UNDP) project identified chronic traffic congestion, lack of traffic management, conflict of jurisdictions and poor coordination among agencies as some of the major factors needed to be sorted out to address the traffic problems of Dhaka city. It also identified the inadequacy of the then fleet of 1,400 buses to properly meet the travel demand of the city. It also recommended calling for the establishment of a more effective organization structure to coordinate the traffic management and engineering activities of the various agencies and to provide a more effective means of regulating public transport services. It called for the encouragement of the formation of a small number of large operators regarding bus industry rather than continuing with the large number of very small operators. It also recommended infrastructure improvement and proposed traffic engineering improvements at intersections with network importance as well at sites between intersections that caused localized traffic congestion. It was also recommended

that a network of routes for non-motorized vehicles be designated by identifying many such problem areas within Dhaka.

In the late 1990s, *Dhaka Urban Transport Project (DUTP)* was developed by the World Bank with the help of the Government of Bangladesh in two stages to recognize need for sustainable increase in Dhaka's transport sector. This technical assistance project ended DUTP Phase-I in 1998 and DUTP-II began from 1998 onwards.

The goals of DUTP were to provide a detailed plan for structural improvement of road transportation system of Dhaka, Other goals of the project included providing provision of public buses, forming pedestrian only zones in old Dhaka, construction of flyovers in 3 locations, provide routes for non-motorized transport, development of comprehensive parking policy, improvements of freight stands, improvements in the management and enforcement capacities of BRTA, DCC and DMP and also keeping in mind environmental concerns.

As part of the DUTP project, *Strategic transport plan (STP)* was developed to predict the future travel demands of urban transport via the *Urban Transport Planning (UTP)* model. It forecasted future travel demands resulting from different land use scenarios, transport strategies. It was designed to predict performance of existing, committed alternative development strategies for Dhaka's urban transport network infrastructure, services and policies (STP, 2005). STP further identified fifteen key points for the policymakers and the stakeholders to address; revamping public transport system and management of travel demand in a dynamic manner in response to future expansions received special attention. As such the key areas also included development of a mass transit system.

According to the *Strategic Transport Plan (STP)* which was developed for Dhaka city in 2005, mass rapid transport has been recommended as an essential. It also suggested building up satellite cities on the outskirts of Dhaka which would be connected via the mass rapid transport systems. The plan includes the development of a modern and efficient bus rapid transit system which will gradually supersede the existing out of date fleet with new vehicles to suit the image of one of the world's Mega cities.

STP assumed that majority of people will continue to choose public transport as their primary mode of travel. It also recognized the hierarchy of public transport systems in which each vehicle type would have a definite and specific role to play. There will be high capacity buses for carrying greater volumes through the main corridors while smaller mini-buses will serve the more congested areas. Rickshaws and motorized three wheelers will be given the role as feeder services linking neighborhoods with the main transit lines. The *mass rapid transit system (MRTS)* which comprises of Bus Rapid Transport (BRT) was expected to expand proportionally to the expansion in the anticipated growth in population.[1,2]

Hasan (2007) noticed STP (2005) ignored some aspects of the socio-economic characteristics of the people living in Bangladesh and transport structure (e.g. the wide usage of non-motorized transport (NMT) and the different categories of people living in different zones of the city) and are not fully appropriate for study in a developing country context. He finds that locally developed research-based studies on transport in Dhaka suffer from lack of data and sophisticated analytical tool which has been solved somewhat through the Household Interview Survey (HIS) in the STP (2005) and the new more advanced analytical tools.

Earlier, Ahsan (1990) suggested expansion of existing mass transit system, improvement of maintenance facilities, stop and terminal layouts, quality of service and developing more advanced systems like rapid transit systems. Alam and Habib (2003) provided several remedies to alleviate traffic demand and control air pollution related to traffic. He also investigated the policy implications from his recommendations. He suggested alternate transportations to combat traffic congestion and air pollution. Such options include

[1] The river transport services will also be integrated with the overall city-wide transport system. This will be achieved by creating closer and properly designed linkages between river transport and land transport. This will be achieved by re-designing the ferry terminals, providing seamless interfaces between river and land-based transport and by linking the fare structures to allow through ticketing of travel.

[2] While the importance of private vehicles as feeder was well recognized, there were some suggestions to reduce reliance on such travel modes for environmental reason. E.g. Hasan (2007) recommended, as part of the alternative planning options, eliminating rickshaws, auto-rickshaws in addition to improving the bus transit system and introducing the rail transit system and improvement of road networks. He claimed that reducing rickshaws and auto-rickshaws will cut down on the pollution significantly by asserting that rickshaws will do so in the long run. Removal of rickshaws should be supplemented by increase in bus transit service to keep mobility level at present level and to absorb the passengers who would shift from rickshaws to buses.

banning rickshaws, auto-rickshaws from major roads, improving bus service, bottlenecks and missing links in the road network and introducing rail transit.

The paper found that banning rickshaws and auto-rickshaws from major roads will have major improvement on the congestion level which will skyrocket by 2020. The study proposed to increase the number of cars and buses to keep mobility at current levels. Improving modal share of buses, the study found speed of service to be the most sensitive issue to relieve traffic congestion and to cut down on air and noise pollution. It was also advised that speed of service can be increased by reducing waiting times, reducing the number of operators of bus service in the city through developing co-operatives. The benefit of rail transit system would be more apparent in the long run through land use patterns.

Bari and Efroymson (2006) found that projects such as DUTP study seek to improve the condition for cars while banning FFT simply increase the gaps between rich and poor; increase imports of fuel, vehicles, and spare parts and thus of foreign debt; and consequently, only lead to greater traffic congestion and thus fumes, noise, and suffering for all.

They find that the banning of FFT in the demonstration project not only hampered mobility of the majority of road users and greatly increased travel costs, but also resulted in a 32-41% loss of net income for rickshaw and rickshaw van pullers, despite their working longer hours, as revealed by the HDRC report on the rickshaw ban on Mirpur Road (HDRC, 2004).

They discuss how it is unfortunate that some people in DUTP tend to blame FFT as the root cause of transport problems in Dhaka City because in reality it is well known that transport problems in Dhaka City have been attributed to unplanned urbanization without any concerted effort to develop a transport system under an integrated supply and demand management.

The paper also finds that nearly total elimination of Fuel-Free Transport (FFT) combined with a very high increase in bus service resulted in only a 15% increase in passenger capacity, whereas a small decrease in cars combined with only a modest increase in bus

service resulted in a 27% increase in passenger capacity in a VIP road, which has been under Fuel-Dependent Transport (FDT)-only operation in the base case, indicating that as far as road capacity is concerned the problem is cars, not rickshaws.

They posit that rickshaws are not the main source of traffic congestion as is asserted in DUTP and provide relevant statistics to support their claims. Such statistics include rickshaws making up 69.8% of vehicle but only utilizing 43.5% of road space to transport 59.4% of passengers (all trips). On the other hand, it was found that cars made up only 6.4% of vehicles, yet occupied as much as 29.9% of the road space in the base case to transport far fewer passengers (5.5%) than by rickshaw.

Despite being removed from the main roads, their findings indicate that rickshaws are still the most popular mode of transport, serving 30% of the passengers, whereas cars serve only 8.5% of all trips (11% of vehicular trips) while requiring the greatest share of road space (54.2%).

According to the paper, if Dhaka introduces public transit (PT) priority measures, such as Bus Rapid Transport (BRT), there will be no need to give additional priorities to cars and motorized para-transits. This is because BRT will be able to cater to the needs of intermediate and long trips in combination with FFT priority measures, which will address the needs of the majority of short trips. They cite that the city will experience "traffic evaporation by making less room for cars and encouraging less space-consuming transport". This will cause people to drive less to avoid traffic jams, and are more likely to walk, cycle, or take a bus. Thus, unnecessary trips would avoid making use of closer destinations rather than travelling to farther ones. They suggested that a combination of fuel-free transport and public transit would be far superior to a fuel-dependent transport and public transit option.

They recommend emulating the transport practices in successful mega cities around the globe like Singapore, Hong Kong, Tokyo and London where the use of cars has been effectively restricted by imposing measures, such as imposition of lower speed limits, reduction of road capacity by assigning more space to pedestrians and bicyclists, and imposing restrictions on and increasing the price for car parking.

Enam & Chowdhury (2011) discussed the challenges faced in developing a paper on mode choice model due to dearth of data on cost-structure of different modes and level of service. Their paper develops choice set probabilistically using socio-economic characteristics, trip destination and trip purposes.

They assert that contrary to common belief, Non-Motorized Transport (NMT) requires relatively less space than cars and auto-rickshaws. NMT can move within comparatively small spaces due to their relatively slower speeds, and maintain fairly low headways (bumper to bumper time separation between two consecutive vehicles) and fit more vehicles within a given width than larger vehicles such as cars. They conceded that understand-still congested conditions, the proportional share of space occupied by rickshaws would increase, but would always be likely to remain less than their legitimate share of 53.90%. According to the paper, rickshaws are very efficient in terms of road space allocations, and there is no scientific basis to prove otherwise.

They discussed other concerns such as whether the speed advantage of cars can overcome their huge disadvantage in terms of space requirements in urban roads where average operating speeds of cars are not significantly higher than that of rickshaws. They also posited that the economic costs imposed on non-motorized transport by the presence of motorized vehicles in the traffic stream or increases in door-to-door journey times due to any NMT ban should also be included.

For high density mega-city such as Dhaka dependency on private mode is largely inefficient and results in massive congestion. It is important to understand the different attributes that are important to these commuters and learn about the possible trade-offs between different modes. As such it will contribute toward designing a multi-modal hierarchical transport network for the greater Dhaka region given the growth and development of the city as a whole.

## 1.3 Research Motivation

Our study is a pilot which surveyed offices in Dhaka city regarding transport mode preferences between two broad categories namely private car and public bus modes. We wish to identify preference for and determinants of travel mode choice among individuals commuting to work who predominantly use low-occupancy private travel modes (such as

private cars). We propose to conduct a mode choice experiment to learn about tradeoffs people make between different attributes of private and public transportation system. The specific policy aim is to encourage urban commuters to use public transportation mode by providing apposite alternative for getting to work.

Our intention is to identify people's preferences through hypothetical choice experiments to elicit commuters' preferences for alternative transportation modes (e.g. private cars versus public buses). Our choice experiment involves defining attributes and levels of attributes relating to car or bus depending on how the respondents choose to go to work. We aim to choose policy relevant attributes so that policy could directly or indirectly influence behavior.

### 1.4 Organization of the paper

The rest of the paper is organized as follows. In Section 2, we present results from the survey carried out on a random sample of officer workers in Dhaka. We describe the data and summarize the results in this section. In next section (Section 3), we present the results from a choice experiment survey we administered on a subset of individuals from baseline survey (which we described in Section 2). In Section 4, we provide some policy implications from our results while we conclude in Section 5.

## 2 Results from the Baseline Pilot Survey

### 2.1 Data

We carried out the survey in two phases. In the first phase, we collected data with a target of about 1,000 subjects. The main criteria were these subjects were needed to be office goers with a potential to own or have access to private cars and also with a high likelihood to taking such vehicle to commute to their work-place. We decided to interview subjects in office settings which were more accessible to the enumerators. We also selected areas where there were high concentrations of offices (e.g. Kawranbazar, Motijheel-DIlkhusha, Banani, Gulasha etc.). We ended up with 1,058 such subjects. In the second phase we selected a sample of about 300 who uses private cars to commute to office in order to carry out *choice experiments* to elicit preference and willingness-to-pay over public mass transport.

## 2.2 Results

In the first phase of sample, we have 20% women and 39% of the sample belonging to the 30 to 39 years age group. The 40 to 49 years age group follows it with a 26% of the sample. As for education, we sampled a set of individuals 80% of whom have masters' degrees or above. Hence our sample represents a sub-population which is perhaps younger and certainly more educated than the average population. Most of our sampled individuals are employed full-time (about 99%). Majority of the sample belongs to the monthly income group of twenty-five to fifty thousand taka per month (34%). It is followed by fifty to seventy-five thousand taka per month income group (23%) and the top-coded group of one lac taka or more (20%) indicating the sampled individuals belonging to be much richer than the average populace. Among other individual characteristics, about half of the individuals live in dwelling places owned by themselves with about 44% living in rented houses (mostly apartments). The average size of dwelling places is about 1600 sq. ft with majority paying rents between 10 to 20 thousand (55%) followed by rents being between 20 to 30 thousand taka per month (25%).

**Table 1: Socio-economic description of the subjects.**

| | % | | % |
|---|---|---|---|
| **Sex** | | **Total Work Experience (Number of Years)** | |
| % Female | 20.0 | 0-10 | 38.3 |
| | | 10-20 | 32.9 |
| **Age Group** | | 20-30 | 20.3 |
| 20-29 | 14.8 | 30+ | 8.5 |
| 30-39 | 39.0 | | |
| 40-49 | 26.0 | **Household Size** | |
| 50-59 | 16.9 | 1 | 44.3 |
| 60 plus | 3.4 | 2 | 40.4 |
| | | 3 | 10.8 |
| **Highest Level of Education** | | 4+ | 4.5 |
| Higher Secondary | 0.9 | | |
| Bachelors | 19.0 | Area of house/apartment (sq. ft.) | 1601.7 |
| Masters | 67.0 | | |
| | | **Ownership Status of the Dwelling Place** | |
| Above Masters | 13.1 | | |
| | | Owned | 51.8 |
| **Employment Status** | | Govt. quarter | 3.0 |
| Full-time | 98.7 | Office Quarter | 0.6 |
| Part-time | 1.3 | Rented | 43.6 |
| | | Other | 1.1 |
| **Income Group (Taka per month)** | | | |
| less than 25,000 | 9.7 | **Monthly Rent (in Taka if Rented)** | |
| 25,000 to 50,000 | 34.4 | less than 10,000 | 10.7 |
| 50,000 to 75,000 | 23.4 | 10,000 to 20,000 | 54.5 |
| 75,000 to 100,000 | 12.1 | 20,000 to 30,000 | 24.5 |
| 100,000 and above | 20.4 | 30,000 to 40,000 | 7.9 |
| | | 40,000 to 50,000 | 1.1 |
| | | 50,000 and above | 1.3 |

N = 1,058. *Source: Authors' Calculations from Survey Data.*

In Table 2, we look at driving behavior of the respondents. About 51% of the respondents reported knowing how to drive. Of which only 9% of the respondents was female. However, of respondents who knew how to drive most of them were only occasional driver (58%). Less than one-third of those individuals (about 29%) drove regularly. If we look at purpose of driving then people who knew how to drive, drove mostly for recreational activities (60%). However, 48% of these respondents drove for commuting to work (more than one response was permitted). Shopping came next with about 34% of the respondents driving for this purpose.

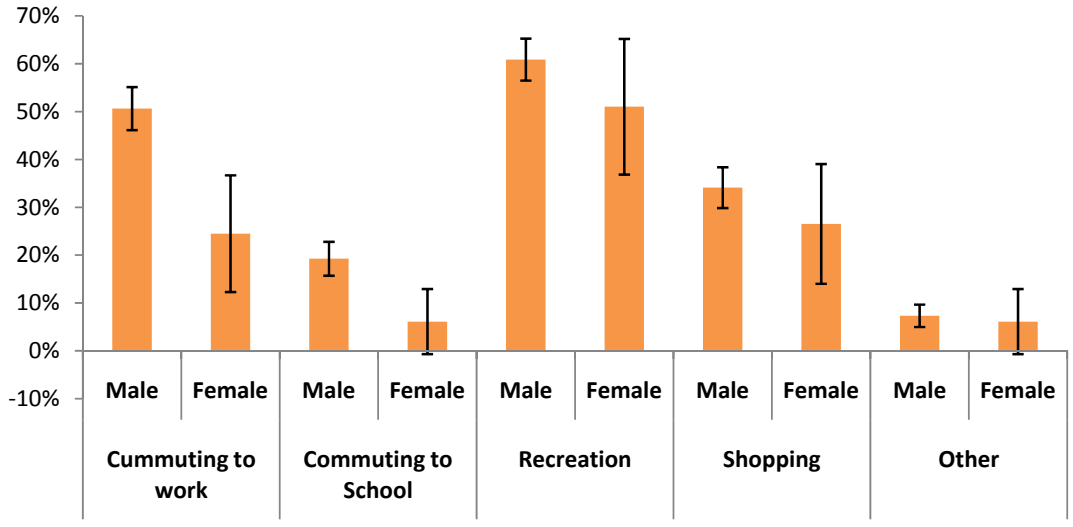
**Table 2: Respondents' driving behavior.**

| | N = 1,058 |
|---|---|
| Can the respondent drive? | |
| Yes | 50.6% |
| Of which | |
| Female | 9.3% |
| How often? | |
| Regularly | 29.0% |
| Sometimes | 58.3% |
| Never | 12.5% |
| Purpose of driving | |
| Commuting to work | 48.3% |
| Commuting to School | 18.2% |
| Recreation | 60.0% |
| Shopping | 33.5% |
| Other | 7.2% |

*Source: Authors' Calculations from Survey Data.*

We have also looked at driving behavior by sex of the respondents. For all purpose women are less likely to drive however, the difference in driving behavior is specially pronounced for commuting to work. Women are much less likely drive for driving to office and also for driving to take children to school (or any other educational institutes). For all other cases, both sexes exhibit similar driving patterns.

**Figure 1: Respondents' driving behavior by sex.**




*Source: Authors' Calculations from Survey Data.*

Next, we look at travel mode choice the respondents made for commuting to office. While multiple responses was possible we can see 81% of responses involved reporting using a car for commuting to work places. Less than 10 percent responses involved taking public transport such as bus and minibuses to office (only 8.1% for bus and 0.5% for minibus). CNG and taxis also constitute a minor fraction of trip modes made towards reaching work places in our sample.

**Table 3: Mode of travel to work.**

| Mode | % Reporting |
|---|---|
| Walking | 6.0% |
| Rickshaw | 8.6% |
| CNG | 4.0% |
| Taxi | 1.2% |
| Tempo | 0.5% |
| Minibus | 0.5% |
| Bus | 8.1% |
| Office Bus | 4.1% |
| Car | |
| Personal | 52.9% |
| Office | 22.0% |
| Family | 4.6% |
| Someone else's | 1.2% |
| Other | 2.2% |

*Source: Authors' Calculations from Survey Data.*

Since this project was focused toward commuters who used car (private) to go to their respective workplaces, we further analyzed such behavior for this sub-sample. We find 18% of the respondents drove to workplace while 36% shared car-ride to workplace. Most of the time (79%) they use the same route. Average travel time to office is about 47 minutes while it takes longer for the same commuters to return from their offices (59 minutes on average).

**Table 4: Travel information for using Car for commuting to office (N = 833).**

| | % of respondents |
|---|---|
| Respondent drives | 18.1% |
| Respondent shares ride | 35.8% |
| Respondent uses the same route | 78.5% |
| Travel time (in minutes) | |
| to office | 46.8 |
| from office | 58.8 |

*Source: Authors' Calculations from Survey Data.*

Next, we elicited factors that the respondent reported as important factor for choosing private and public means of transport for office trip. For the private means of transport travel cost per trip topped the list followed by maintenance cost. So varying these factors would lead a commuter to choose private means of transport one way or other. Environmental concerns come next. Moreover, comfort of travel and parking facilities are also found to be important factors for choosing private means of transport.

**Table 5: Importance of different factors for private means of transport.**

| | |
|---|---|
| Travel cost (per trip) | 2.15 |
| Maintenance cost | 1.94 |
| Environmental concerns | 1.69 |
| Comfort | 1.53 |
| Parking facilities | 1.46 |
| Travel time (commuting time) | 1.36 |
| Safety issues | 1.30 |
| Security issues | 1.28 |
| Waiting facilities (if you use someone else's car) | 0.60 |
| Waiting time (if you use someone else's car) | 0.57 |
| Other | 0.03 |

**Table 6: Importance of different factors for public means of transport.**

| | |
|---|---|
| Fare per trip | 2.74 |
| Distance to bus stop | 2.11 |
| Comfort | 1.65 |
| Waiting facilities | 1.61 |
| Environmental concerns | 1.61 |
| Waiting time | 1.46 |
| Frequency of departure | 1.46 |
| Travel time (commuting time) | 1.25 |
| Security issues | 1.21 |
| Safety issues | 1.20 |
| Punctuality of arrivals/departures | 1.15 |
| Other | 0.02 |

*Source: Authors' Calculations from Survey Data.*

As for public means of transport, fare per trip and distance to the bus stop were reported to be important factors for choosing (or not choosing) public means of transport. Comfort and waiting facilities are next two factors which the respondents mentioned as factors which are important for choosing public means of transport. Interestingly, travel time comes 6$^{th}$ most important factor for private means of transport and 8$^{th}$ for public means. Since better transport facilities will affect both private and public means (say, through better road management) travel time itself does not pose any trade-offs for a particular mean of transport.

Since costs were reported to be important factors for choosing we looked at monthly expenditure on private means of transport per vehicle for a household (see Table 7). There were 907 incidences with few households having multiple private vehicles. The average expenditure is about 18.6 thousand taka per month. The cost for employing a driver is about 9.1 thousand taka per month (an average over 683 observations). There are some incidences of renting a separate garage (241) with an average cost of 1.9 thousand taka per month. The fuel cost for liquid petroleum (patrol or

octane) was reported to be about 4.7 thousand taka per month and for CNG it is about 7.3 thousand taka per month.

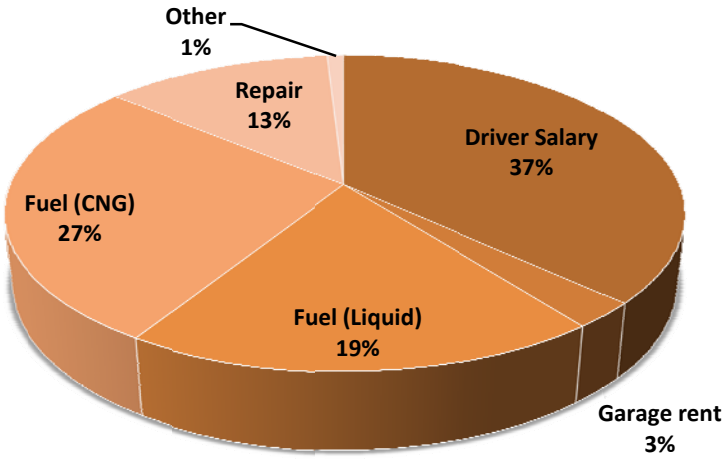
**Table 7: Household Expenditure on Private Car.**

| Item | N | Mean | SD |
|---|---|---|---|
| Total | 907 | 18,637.56 | 9,780.44 |
| Driver Salary | 683 | 9,127.94 | 2,054.78 |
| Garage rent | 241 | 1,854.36 | 1,354.03 |
| Fuel (Liquid) | 698 | 4,683.08 | 4,903.74 |
| Fuel (CNG) | 636 | 7,246.59 | 3,937.84 |
| Repair | 633 | 3,457.46 | 2,808.13 |
| Other | 50 | 3,136.00 | 2,974.78 |

Note: Mean and SD are calculated for number of reports for each item. *Source: Authors' Calculations from Survey Data.*

We further looked at the distribution of these costs by different items as reported above. Total fuel cost is the largest share of total expenditure which is about 46% of total costs. Salary for drivers constituted second largest expenditure share with about 37% of the total expenditure. Repair and maintenance claimed 13% of total expenditure with a minor share going towards garage rentals. One should note that this underestimates the actual cost of owning a car owing to ignoring amortization and payments on loans as well as premium on insurance.

**Figure 2: Distribution of Total Expenditure.**




*Source: Authors' Calculations from Survey Data.*

# 3 Choice Experiments Regarding Travel Mode Choice Dhaka

## 3.1 General Background and Design Related Issues

In this section, we attempt to identify people's preferences through hypothetical choice experiments. The basic idea is to create a hypothetical situation to elicit commuters' preferences for alternative transportation modes (e.g. private cars versus public buses). In a choice experiment, respondents make repeated choices between different alternative goods or projects that are described by their attributes (see Louviere et al., 2000). By giving a respondent the opportunity to answer several choice sets, we would obtain huge amount of information for each respondent. Thus, we will be able to estimate the marginal impact of different attributes on their choice of travel modes.

We can specify the indirect utility function representing individual preference for an alternative (i) mode of transport as follows:

$$V_i = \beta_{0i} + \beta_{1i} f(X_{1i}) + \beta_{2i} f(X_{2i}) + \ \ldots + \beta_{1j} f(X_{ki})$$

Whereas $\beta_{1i}$ is the parameter associated with attribute $X_1$ and alternative i and $\beta_{0i}$ is the alternative i specific constant, parameter not associated with any of the observed and measured attribute, which represents on average the role of all the unobserved sources of utility.

According to the random utility approach (McFadden, 1974), the utility is not directly observable and hence consists of both an observable and unobservable or stochastic components. By introducing a random error term $\varepsilon_i$ to reflect random components we can re-write the utility function as $U_i = V_i + \varepsilon_i$.

The probability that an individual choosing alternative i is equal to the probability that the utility of the chosen alternative is greater or equal to the utility associated with an alternative j not chosen after evaluating available alternatives in a particular choice of j = 1, ...., i, ....J alternatives. This can be expressed as

$$prob_i = prob[(V_i + \varepsilon_i) \geq (V_j + \varepsilon_j), \forall j \in j = 1,2, \ldots, J, i \neq j]$$

We can re-write the above equation to clearly specify the random utility maximization as follows:

$$prob_i = prob[(\varepsilon_i - \varepsilon_j) \geq (V_j - V_i), \forall j \in j = 1,2, \dots, J, i \neq j]$$

This says that probability of an individual choosing alternative i is equal to the probability that the difference in the unobserved sources of utility of alterative j compared to alternative i is less than or equal to the difference in the observed sources of utility associated with alternative i compared to alternative j after evaluating available alternative in a particular choice of j=1, ...., i, ....J alternatives.

The workhorse choice model of discrete choice analysis is the conditional logit choice or multinomial logit model (Louviere et al, 2000). The basic form (below) states that the probability of an individual choosing an alternative( say i) among J alternatives is equal to the ratio of the exponential of the observed utility index for alternative i to the sum of the exponentials of observed utility indices for J alternatives including the i-th alternative

$$\text{Prob}_\text{i} = \frac{\exp V_i}{\sum_{j=1}^{J} \exp V_j}$$

Observed preferences heterogeneity in the choice models can be captured through introducing socioeconomic characteristics of individual in eth systematic component of the utility function. It may be noted that The vector of coefficients associated with k attributes can be assumed to vary across individuals but are constant across choice situations for each individual reflecting an underlying assumption of stable preference for an individual (Train, 1998). However, to capture unobserved preference heterogeneity we need to assume that parameters associated with attributes are random and follows specific distribution random (random parameter model). The assumption regarding the distribution of random parameters is important.[3]

We aim to understand which characteristics are more relevant to achieving a switch from private mode to public mode thus focus on the relative importance of attributes. Our sampling strategy is purposive, given the focus of our study: the sample consists of individual living and working within the metropolitan area of the city. This allows us to ensure that the respondents could actually make choice between private and public transportation at least in the short run.[4] This strategy however excludes people who

[3] See Bhat (2000) for detail on treatment of heterogeneity using random parameter model.
[4] We take similar approach as Alpizer and Carlsson(2001).

cannot potentially afford to own a private transportation for individual or family purposes. We argue that by increasing the cost of using a private vehicle as well as by increasing the attractiveness of public mode of transport might also have longer term impact with regards to car ownership hence congestion as well as environment. Given that we wanted to focus on individuals who commute to work by private mode of transportation or individuals having work and having access to private vehicle, we have chosen the offices of the following location.

In view of this sampling strategy, the baseline survey, our goal was to gather information on the ones who have access to private modes of transport (either own, share/car-pooling, rent, office transport) for commuting to work in Dhaka. In addition, the baseline questionnaire enabled us to learn about office commuters who use other modes of transport as well. Along with trip details and costs, the design of the survey instrument further facilitated us to identify existing and potential car users. We surveyed 1058 personnel at various offices in Dhaka; particularly those who are employed in executive level positions or higher. The type of private and government offices that we covered can be broadly categorized into: banks, insurance, real estate, NGOs, research institutes, IT, Telecoms, Newspapers, Media (Television and Radio), Pharmaceuticals, and Universities. The samples were drawn using the cluster randomization approach; targeting the major commercial areas of the city, namely Motijheel, Dilkusha, Paltan, Kakrail, Shantinagar, Kawran Bazaar, Kazi Nazrul Islam Avenue, Panthopath, Dhanmondi, Mohakhali, Gulshan, Banani, Uttara, Agargaon, and Dhaka University Campus. These areas are situated at varied distances from the city center, and each area feature dissimilar types of industries. Our trained enumerators approached individuals having access to private vehicles or use private vehicles to fill out our baseline questionnaire and took their consent about participating in a mode choice experiment few weeks later.[5]

Based on the baseline sample, we targeted the respondents who own car(s). This subset included office commuters who use diverse modes of transportation, including those who live in close proximity to their workplaces. In terms of location, the same baseline survey areas (except Agargaon) were visited. We targeted 488 car owners from our baseline

[5] Please see Section 2 of this report for the summary of statistics.

survey. The criteria for selecting these respondents were that they own cars, provided us with their business cards and agreed to follow up in the choice experiments survey. At the end of the choice experiments, we followed up with 315 respondents. The remaining respondents could not be reached as most of them have been transferred to other locations, changed jobs, and were away in meetings, etc.

The mode choice survey consists of questions on present work trips, fuel use, distance from home to work place and travel time etc. Then the respondents were introduced to the hypothetical mode choice experiment with two alternative mode of transport for using to commute to work. The alternatives were described in terms of several attributes and the respondents were asked to choose one of these two alternatives. Given that work trips both ways contribute heavily to city's congestion problem during peak hours, we restrict purpose of trip in the choice experiment to work trips only. This also restricts individuals to adjust respective schedules when facing the hypothetical choice situation and ensure that the mode choice decision is not a function of chosen departure time and or congestion levels.

Before the actual experiment was conducted the enumerators carefully explained each of the attributes in the choice experiment. They also read to the respondents a summary of the attributes. The last part of the survey includes follow up questions about understanding of the choice experiment, opinion on relevant issues and socioeconomic characteristics including income.

Prior study focusing on mode choice in Dhaka city concludes the difficulty of modeling mode choices mainly because of various multiple mode used by city dwellers. However we choose to restrict to two alternatives private vehicle (car) and public bus by including policy relevant attributes to look at most important determinants and relative importance of attributes with the policy aim of reducing congestion by inducing people to switch from private mode to public mode of transport. The choice of attributes were based on our baseline responses (discussed in Section 3 of this report), whereby individuals rank a list of attributes (obtained from previous studies as well as expert discussions).

The selected attributes and their levels are presented in the following Table 8. The travel time and cost per trip for car and bus are customized at current level. Before the choice

experiment, we asked individuals about the distance to work, type of fuel used in the car for car users and travel time etc. Enumerators were given conversion formula to calculate and present the relevant numbers while interviewing the respondents. Each respondent's travel time was determined by averaging the time taken to go to office and the time taken to return home from office. Values of the three different levels in the choice experiments were thus found using the averaged time. Travel cost per trip for both car and bus was calculated using the distance between each respondent's office and residence (as stated by them). Travel cost per trip for bus, or bus fare, was found by multiplying distance with Tk. 1.55 per kilometer. This particular fare rate has been set by the Bangladesh Road Transport Corporation (BRTC) for non-air-conditioned buses in Dhaka city. For car, travel cost per trip was calculated by multiplying distance with fuel price per kilometer. On average, Compressed Natural Gas (CNG) costs about Tk. 7 per kilometer and octane/petrol costs about Tk. 15 per kilometer. The survey respondents mentioned the fuels that they use for their cars and based on that information, trip cost was computed. In cases where multiple fuels are used, we considered the highest price, i.e. the price of octane/petrol. The quality improvement in terms of comfort and security was hypothetical but carefully explained.

The experimental design involves creating the choice sets in an efficient way by combining attributes level into alternatives in the choice sets. The choice sets were created by only considering the main effects using linear D Optimal design in *Choice Metrics.* The attributes were combined to create 24 choice sets in 3 blocks and 8 choice situations. The choice sets were randomly assigned to respondents to rule out the possibility of any ordering effects on choices and thus each respondent answered eight choice situations whereby each time they chose one of the two alternative modes they would use while commuting to office.[6] Table 8 provides the description of attributes and levels used in the choice experiment.

[6] We also asked debriefing questions to identify protests responses.

**Table 8: Travel mode attributes and their respective levels.**

| *Mode* | *Attribute* | *Levels* |
|---|---|---|
| Car | Travel time | Same as now |
| | Cost per trip | Same as now, 20% increase, 30% increase |
| | Parking fee | Tk 100, Tk 200 |
| | Congestion fee | Tk 50, Tk 100 |
| Bus | Travel time | Same as car, 30 minutes longer than car, 15 minutes longer than car |
| | Cost per trip | Same as now, 10% increase, 20% increase |
| | Frequency of departure | Every 10 minutes, Every 15 minutes, Every 20 minutes |
| | Distance to bus stop | 5 minutes, 10 minutes, 15 minutes |
| | Comfort and security | Same as now, Much improved comfort and security features |

## 3.2 Choice experiment results

To begin with, we estimated basic discrete choice model, a multinomial logit model. Then we estimated a mixed logit i.e. random parameter logit model, where attributes are assumed to be independently normally distributed. In both models, a mode specific intercept for car in addition to relevant attributes as explanatory variables are specified. Attributes are alternative specific implying the fact that the model coefficients will correspond to the parameters of utility functions for each of the two alternatives in the choice experiment. We also include a variable indicating inertia of car use- a dummy variable defined as equal to one if the respondent regularly use car to office. We report the results of both models in Table 9. The models are estimated with simulated maximum likelihood (Train 1999) based on Halton draws and 500 replications.

**Table 9: Discrete Choice Models - ML Estimates**

| | MNL | RPL | |
|---|---|---|---|
| | Coefficient (Standard Error) | Coefficient (Standard Error) | Coefficient Standard Deviation |
| Car Intercept | -1.278*** | -1.655 | |
| | (0.238) | (0.382) | |
| Car- Travel time | -0.024*** | 0.029*** | 0.011 |
| | (0.003) | (0.006) | (0.007) |
| Car- Cost per trip | -0.001 | -0.001 | 0.00001 |
| | (0.001) | (0.001) | (0.001) |
| Car- Parking fee | 0.076 | 0.11 | 0.024 |
| (Dummy variable) | (0.085) | (0.11) | (0.814) |
| Car- Congestion fee | 0.118 | 0.172 | 0.0042 |
| (Dummy variable) | (0.084) | (0.112) | (0.666) |
| Bus- Travel time | -0.029*** | -0.035*** | 0.002 |
| | (0.003) | (0.006) | (0.023) |
| Bus- Cost per trip | 0.023*** | 0.032** | 0.003 |
| | (0.009) | (0.013) | (0.0160) |
| Bus- Frequency of departure | -0.022** | -0.026** | 0.001 |
| | (0.011) | (0.013) | (0.104) |
| Bus- Distance to bus stop | -0.055*** | -0.069*** | 0.021 |
| | 0.011 | (0.016) | (0.11) |
| Bus- Comfort and security | 1.0303*** | 1.263*** | 2.11** |
| | (0.087) | (0.221) | (1.01) |
| Regular car user(Inertia) | 0.692*** | 0.856*** | |
| | (0.109) | (0.382) | |
| Log-likelihood | -1592.45 | -1590 | |
| No. of observations | 2520 | 2520 | |
| Pseudo R square | 0.09 | 0.082 | |

As the model coefficients corresponds to the parameters of utility functions for both the car and bus alternatives a negative parameter, for example, for a specific alternative indicates that an increase in that item will reduce the utility in choosing that alternative. Although MNL model performs slightly better in terms of pseudo R square, using a likelihood ratio test we can reject the restriction imposed by the MNL model( chi square statistic 310 and p value $<0.001$). The models provide similar coefficient estimates in terms of statistical significance. The standard deviation estimates of parameter distributions in the RPL model does not appear to be significant (collapsed to mean) indicating no preference heterogeneity (at least that we could observe given the distribution parameters were derived) expect for the case of bus comfort attribute.

As observed for the bus mode all the attributes are significant determinates of mode choice. We observe larger coefficients for the bus comfort attribute; this attribute have much higher mean effect on the utility derived from a bus trip compared to other bus attributes (e.g. level of service in term of frequency of departure). The travel time, distance to bus stop, frequency of service as well is significant determinants of bus mode choice. The cost attribute for the bus mode however, shows unexpected sign. This might result from the fact that levels provided for bus cost per trip was too low for respondents to make tradeoff or that respondents were focusing on other bus attributes specially bus comfort when choosing bus alternative.

For the car mode, however travel time appears to be significant determinants of mode choice. It s surprising that parking fee as well as congestion charge (dummy variables equal to one for higher fee in both cases) are not significant. It may be noted here that parking is generally free in the city whereby drivers are responsible for watching the car all the time. The strong effect of inertia for car users as observed by the significance and sign of the variables explains a lot here.

**Table 10: Estimated Elasticity and Marginal Effects for Car and Bus Mode.**

| | Average Elasticities | | Average Marginal Effects | |
|---|---|---|---|---|
| | **Direct (Car)** | **Cross (Bus)** | **Direct (Car)** | **Cross (Bus)** |
| **Travel Time (Car)** | -0.610<br>(-0.57) | 0.657<br>(0.61) | -0.541<br>(-30.35) | 0.545<br>(29.10) |
| **Cost per Trip (Car)** | -0.042<br>(-0.47) | 0.046<br>(0.05) | -0.025<br>(-2.308) | 0.025<br>(2.558) |
| **Parking Cost (Car)** | 0.016<br>(0.020) | -0.018<br>(-0.022) | 1.674<br>(1.08) | -1.687<br>(-1.01) |
| **Congestion fee (Car)** | 0.026<br>(0.031) | -0.028<br>(-0.033) | 2.60<br>(1.639) | -2.62<br>(-1.546) |
| | **Cross (Car)** | **Direct (Bus)** | **Cross (Car)** | **Direct (Bus)** |
| **Travel Time (Bus)** | 0.904<br>(0.868) | -0.974<br>(0.933) | 0.638<br>(46.04) | -0.643<br>(-43.78) |
| **Cost per trip (Bus)** | -0.118<br>(-0.125) | 0.128<br>(0.134) | -0.526<br>(-6.166) | 0.53<br>(6.770) |
| **Bus- Frequency of departure** | 0.146<br>(0.137) | -0.157<br>(-0.147) | 0.502<br>(7.282) | -0.506<br>(-6.879) |
| **Distance to Bus stop** | 0.236<br>(0.235) | -0.254<br>(-0.253) | 1.219<br>(12.67) | -1.228<br>(-11.68) |
| **Comfort for Bus** | -0.221<br>(-0.119) | 0.238<br>(0.182) | -22.66<br>(-7.38) | 22.8<br>(10.257) |

Note: Figures in the parentheses are estimates from RPL model.

In Table 10, we report the responsiveness of mode choice to changes in the given attributes in the context of choice experiment. In particular we provide estimates of elasticity and marginal effects for different attributes obtained from both the MNL and the RPL model. The elasticities are the percentage change in choice probability for a percentage change in the corresponding attributes and the marginal effects are the marginal change in the choice probability for a marginal change in the corresponding attributes. For dummy variables however these estimates are rather approximations. The aggregate elasticities are computed in NLOGIT as probability (of choice) weighted average of the individual elasticities and marginal effects are also weighted by the choice probabilities (see Bhat, 1998). The higher elasticities and marginal effects are reported for travel time in case of both travel modes in the choice experiment. However, the magnitudes of elasticity and marginal effects are rather small consistent , which is also consistent with earlier studiesas marginal effects and elasticity may suffer from inertia with regards to car use as well limited adjustment possibilities in the experiment (Alpizer and Carlsson, 2001; Bhat 2000; Swait and Eskeland, 1995). For illustration, we conducted simulation in NLOGIT to see how changes in some of the attributes changes market share for a particular mode. A ten minute reduction in travel time by bus produces estimated market share for bus mode increase by more than 5 percent. This increase in market share for car mode is less than 5 percent resulting from a ten minutes reduction in travel time by bus. This later result is indicative of higher value of time for bus (disutility of time spent by bus likely to be higher) compared to car suggesting that reduction in travel time due to reduced congestion can have substantial benefits for population. A doubling of full cost for the car alternative will produce an estimated market share for the car down by 2% only where as a two fold increase in the bus service quality (e.g. comfort and security) produces an estimated market share for bus mode increased by 11 percent.

## 4 Policy Implications of our findings

The analysis shown above has some obvious policy implications/conclusions. The highly significant inertia variable indicates survey respondents' strong inertia in travel behaviour. This is not unexpected as the car mode has many advantages, for example if we look at

flexibility of timing, route as well as comfort and safety. Although our sample is not random *per se* one may still argue that breaking this behavioural pattern would not be very easy unless coordinated effort on the part of policy makers to make bus as an attractive alternative to the travelers. As the elacity estimates indicate focusing on bus fare reduction may not be a good option but policies pertaining to increasing quality service both in terms of frequency and adequate comfort and security can have much better impact. The low direct elasticity for bus fare is indicative of the feasibility of relatively more expensive but faster and better quality bus targeting middle class or relative lower income sample in our study. In the short and medium term measures such as exclusive bus lane with faster and accurate connections and providing priority traffic for buses during peak hours could make substantial impact in terms of reducing congestion. At the same time introduction of high congestion fee for car users during peak hours could do further trick. Given that elasticity of car use with respect to parking and congestion fee is low, policies increasing parking cost may not be as effective as one might argue. However, we do not want to make any strong conclusion based on our result.

## 5 Conclusions

Generally results indicate that mode substitution is sensitive to characteristics and performance of each mode. Travel time for both car and bus and comfort and security for bus appears most important determinants of mode choice. Travel time for car as well as bus cost per trip has higher elasticity and marginal effect. Our study reveals the most important features for a successful public transportation system that can attract people away from private mode at least for the purpose of commuting to work reducing congestion and saving travel time – increased productivity. Benefit from reducing congestion is expected to be high which has obvious implication for productivity and growth. Given any uncertainty pertaining to sampling, one obvious conclusion is that program aiming at reducing congestion during peak time should focus on substantial increase in the cost of private transport and provision of faster and reliable and comfortable public transport.

Our limitation of analysis is that it is partial in nature as the elasticity of transport demand may not be representative of the Metropolitan Dhaka as we intended to be. It is however

expected that individuals would attempt to adjust higher costs per trip by reducing number of trips beginning with the less important to them; for example non work trips. Future research should conduct comprehensive mode choice experiment by modeling all relevant modes an individual would have access to.

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| *Area code* | *Enumerator code* | *SL* |
|---|---|---|
| | | |

# Baseline Survey Questionnaire

*This survey is part of a research on the transport situation in Dhaka. We intend to gather knowledge about people's preferences for different modes of transport.*

*The research is supported by the International Growth Center (IGC) at London School of Economics (LSE) and the University of Oxford .*

*It will take only about 15 minutes of your time. All information will be kept confidential.*

| | | | |
|---|---|---|---|
| 1.1 | Name | | |
| 1.2 | Gender | 1) Male | 2) Female |
| 1.3 | Age group | 1) 20-29 | 2) 30-39 3) 40-49 4) 50-59 5) 60 or older |
| 1.4 | Education level (highest) | 1) Higher secondary | 2) Bachelors 4) Masters 4) Above Masters |
| 1.5 | Can you drive? | 1) Yes | 2) No |
| 1.6 | If YES -- How often do you drive? | 1) Regularly | 2) Sometimes 3) Never |
| 1.7 | For what purposes do you drive? (*Multiple options applicable)* | 1) Commuting to work<br>3) Recreation<br>5) Other, specify: | 2) Going to school<br>4) Shopping |

## 2. Information on how you commute to work

| | | | |
|---|---|---|---|
| 2.1 | Where is your residence located? | | |
| 2.2 | Which mode of transport do you usually take to commute to work? | 1) Walk<br>4) Taxi<br>7) Bus<br>10) Someone else's car<br>12) Family car<br>14) Other, specify: | 2) Rickshaw 3) CNG<br>5) Tempo 6) Mini-bus<br>8) Office car 9) Office bus<br>11) Personal car<br>13) Motorcycle |

*If 2.2 = 3 to 10*

| | | | |
|---|---|---|---|
| 2.3 | How far do you travel to avail that transport? | | *km* |
| 2.4 | How do you go there? | 1) Walk | 2) Rickshaw 3) Other: |
| 2.5 | How long does it take to go there? | | *minutes* |

*If 2.2 = 10*

| | | | |
|---|---|---|---|
| 2.6 | Whose car do you use? | 1) Friend's | 2) Relative's 3) Colleague's 4) Other: |

*If 2.2 = 11, 12*

| | | | |
|---|---|---|---|
| 2.7 | Do you drive the car? | 1) Yes | 2) No |
| 2.8 | Does anyone else travel with you? | 1) Yes | 2) No |

| | | | |
|---|---|---|---|
| 2.9 | Time taken to commute to work: | | *minutes* |
| 2.10 | Time taken to return home from work: | | *minutes* |
| 2.11 | Do you use the same route every day? | 1) Yes | 2) No |
| 2.12 | Your average monthly transport expenses (for commuting to work): | *Tk.* | |

## 3. Attributes of private and public transport modes

3.1 How important are each of the following factors if you choose to use *private transport* (car) for commuting to work?

| *Rank according to their importance to you:* | *Extremely important* | → | | *Least important* | *or* | *Not important* |
|---|---|---|---|---|---|---|
| Travel cost (per trip) | *1* | *2* | *3* | *4* | | *5* |
| Maintenance cost | *1* | *2* | *3* | *4* | | *5* |
| Safety issues | *1* | *2* | *3* | *4* | | *5* |
| Security issues | *1* | *2* | *3* | *4* | | *5* |
| Comfort | *1* | *2* | *3* | *4* | | *5* |
| Travel time (commuting time) | *1* | *2* | *3* | *4* | | *5* |
| Waiting facilities (if you use someone else's car) | *1* | *2* | *3* | *4* | | *5* |
| Waiting time (if you use someone else's car) | *1* | *2* | *3* | *4* | | *5* |
| Parking facilities | *1* | *2* | *3* | *4* | | *5* |
| Environmental concerns | *1* | *2* | *3* | *4* | | *5* |
| Other, specify: | *1* | *2* | *3* | *4* | | *5* |

3.2 How important are each of the following factors if you choose to use *public transport* (bus, metro rail, etc) for commuting to work?

| *Rank according to their importance to you:* | *Extremely important* | → | | *Least important* | *or* | *Not important* |
|---|---|---|---|---|---|---|
| Fare per trip | *1* | *2* | *3* | *4* | | *5* |
| Frequency of departure | *1* | *2* | *3* | *4* | | *5* |
| Safety issues | *1* | *2* | *3* | *4* | | *5* |
| Security issues | *1* | *2* | *3* | *4* | | *5* |
| Comfort | *1* | *2* | *3* | *4* | | *5* |
| Travel time (commuting time) | *1* | *2* | *3* | *4* | | *5* |
| Waiting facilities | *1* | *2* | *3* | *4* | | *5* |
| Waiting time | *1* | *2* | *3* | *4* | | *5* |
| Distance to bus stop | *1* | *2* | *3* | *4* | | *5* |
| Punctuality of arrivals/departures | *1* | *2* | *3* | *4* | | *5* |
| Environmental concerns | *1* | *2* | *3* | *4* | | *5* |
| Other, specify: | *1* | *2* | *3* | *4* | | *5* |

## 4. Respondent's General Information

*About your profession:*

| | | |
|---|---|---|
| 4.1 | Current occupation | |
| 4.2 | Designation | |
| 4.3 | Employment status | 1) Full-time 2) Part-time |
| 4.4 | Your monthly income range | 1) Less than 25,000 2) 25,000 to 50,000<br>3) 50,000 to 75,000 4) 75,000 to 100,000<br>5) 100,000 and above |
| 4.5 | Past occupation | |
| 4.6 | Duration of employment in current job | *years* |
| 4.7 | Total work experience (since first job) | *years* |

*About your household (HH):*

| | | |
|---|---|---|
| 4.8 | Household size | |
| 4.9 | No. of adults | |
| 4.10 | No. of students | |
| 4.11 | No. of income-earners in your household | |

*About your residence*

| | | |
|---|---|---|
| 4.12 | Area of your house / flat (in square feet) | *square feet* |
| 4.13 | Ownership of your house / flat | 1) Owned 2) Govt. quarter 3) Office quarter<br>4) Rented 5) Other, specify: |
| 4.14 | If rented, Monthly house rent: | 1) Less than 10,000 2) 10,000 to 20,000<br>3) 20,000 to 30,000 4) 30,000 to 40,000<br>5) 40,000 to 50,000 6) 50,000 and above |

| | | |
|---|---|---|
| 4.15 | Does your household have cars? | 1) Yes 2) No |

## 5. If your household HAS cars

| | | |
|---|---|---|
| 5.1 | How long have you been using cars? | *years* |
| 5.2 | How many drivers does your HH employ? | |
| 5.3 | For what purposes do you use cars? *(Multiple options applicable)* | 1) Commuting to work 2) Going to school<br>3) Recreation 4) Shopping<br>5) Other, specify: |

| | | | *How many?* |
|---|---|---|---|
| 5.4 | Please list the vehicles that your houshold has | 1) Car | |
| 5.5 | | 2) Microbus | |
| 5.6 | | 3) Jeep | |
| 5.7 | | 4) Motorcycle | |
| 5.8 | | 5) CNG | |
| 5.9 | | 6) Other, specify: | |

*Information on the two most used cars in your household:*

| | | | *Car # 1* | *Car # 2* |
|---|---|---|---|---|
| 5.10 | Type of car | | 1)Car 2)Microbus 3) Jeep | 1)Car 2)Microbus 3) Jeep |
| 5.11 | Model year | | | |
| 5.12 | In what condition did you buy the car? | | 1)Brand new 2)Reconditioned<br>3) Used<br>4) Other, specify: | 1)Brand new 2)Reconditioned<br>3) Used<br>4) Other, specify: |
| 5.13 | How long have you been using the car? | | *years* | *years* |
| 5.14 | Monthly expenses on your car(s) | 1) Driver's salary | *Tk.* | *Tk.* |
| 5.15 | | 2) Garage rent | *Tk.* | *Tk.* |
| 5.16 | | 3) Fuel (octane/petrol) | *Tk.* | *Tk.* |
| 5.17 | | 4) Fuel (CNG) | *Tk.* | *Tk.* |
| 5.18 | | 5) Repair costs | *Tk.* | *Tk.* |
| 5.19 | | 6) Other, specify: | *Tk.* | *Tk.* |

6. If your household DOES NOT have cars

| | | | |
|---|---|---|---|
| 6.1 | Do you have access to cars? (*Multiple options applicable)* | 1) None<br>3) Colleague's car<br>5) Friend's car | 2) Office car / bus<br>4) Relative's car<br>6) Other, specify: |

| | | | |
|---|---|---|---|
| Do you plan to buy vehicle in the next 1 year? | | 1) Yes | 2) No |
| 6.3 | If YES -- What will you buy? | 1) Car<br>3) Jeep<br>5) CNG | 2) Microbus<br>4) Motorcycle<br>6) Other, specify: |
| 6.4 | In what condition? | 1) Brand new<br>3) Used | 2) Reconditioned<br>4) Other, specify: |
| 6.5 | Your budget? | 1) Less than 10 lacs<br>3) 20 to 30 lacs | 2) 10 to 20 lacs<br>4) 30 lacs and above |
| 6.6 | For what purposes will you use the vehicle? *(Multiple options applicable)* | 1) Commuting to work<br>3) Recreation<br>5) Other, specify: | 2) Going to school<br>4) Shopping |

*We will conduct another survey from 21st January 2012 to 10th February 2012 to learn more about the factors that influence people's choice of public and private modes of transport. You are invited to participate.*

*If you are willing to provide feedback, we can ensure your participation at your convenient place and time.*

7.1 How would you like to participate in our upcoming survey? *(Multiple options applicable)*

| | | |
|---|---|---|
| *Over phone* | Your telephone / mobile number(s): | |
| *Online* | Your email address: | |
| *In person* | Place: | 1) Office<br>2) At home -- Home address:<br><br>3) Elsewhere -- Address: |
| | Day(s) of the week: | 1) Saturday 2) Sunday 3) Monday 4) Tuesday<br>5) Wednesd 6) Thursday 7) Friday |
| | Your convenient time: | |

*Thank you for your time and cooperation!*

| Enumerator's Section: | | *Office Address:* | |
|---|---|---|---|
| 8.1 Team no. | | 8.5 Organization | |
| 8.2 Date (dd/mm/yyyy) | | 8.6 Type of Org. | |
| 8.3 Time (hh:mm) | | 8.7 Address *(in detail)* | |
| 8.4 Comments: *Write overleaf* | | | |
| Data Entry Operator's Section: | | 8.8 Area | |
| 9.1 Entered by: | | 8.9 GPO Box No. | |
| 9.2 Date (dd/mm/yyyy) | | | |

Set A

Area:

# Choosing between public and private modes of transport

TO:

Name:
Designation:
Organization:

0.1) Survey Q ID:

0.2) Baseline Q ID:

0.3) Area:

0.4) Q Set: A

Dear Sir/Madam,

Thank you for participating in our baseline survey conducted in January 2012. With this follow up survey, we intend to know about the transport mode preferences of car users/owners commuting to work in Dhaka.

Your participation in this final round of transport survey automatically enables you to take part in a lottery to win attractive prizes as follows:

- 1st prize: 16 GB pen drive (1 item)
- 2nd prize: 8 GB pen drive (1 item)
- 3rd prize: 4 GB pen drive (1 item)
- 4th prize: Attractive coffee mugs (4 items)

It will take only about 15 minutes of your time, and all information will be kept confidential.

For your information, this survey is part of a research on the transport situation in Dhaka. The study is supported by the International Growth Center (IGC) at London School of Economics (LSE) and the University of Oxford.

Thank you for your time and valuable feedback!

Best regards,

Transport Preference Research Team

## Background:

Dhaka is one of the 10th largest mega-cities of the world. Although less than 1% of Bangladesh's total land area, the city supports about 10% of the country's population. Under such circumstances, the current state of the transport system in Dhaka is widely talked about.

With a road network that is less than sufficient, people suffer from huge amount of traffic jams and congestion throughout the entire city on a daily basis. Consequently, the government and researchers and have been proposing the construction of a rapid transit system which comprise of buses and metro rails. In the existing situation, bus-based rapid transit system can offer fast and cost-effective travel.

## General Questions:

A.1) How long does it *normally* take to commute to your office *(in minutes)*?

A.2) How long does it *actually* take to commute to your office *(in minutes)*?

A.3) How long does it *normally* take to return home from work *(in minutes)*?

A.4) How long does it *actually* take to return home from work *(in minutes)*?

A.5) Where is your residence located?

A.6) Estimated distance between your residence and office *(in km)*:

*For your information, your estimated BUS FARE = DISTANCE x Tk. 1.55*
*This will help you to answer the choice questions later.*

A.7) Which types of fuel do you use for your car?
*(Circle all that apply)*

1. CNG
2. Petrol
3. Octane
4. Other [Please specify: .....]

A.8) How often do you use a car to commute to work?
*(Circle one)*

1. Regularly
2. Sometimes

A.9) In addition to a car, do you use any other mode of transport to commute to work?
*(Circle one)*

1. Yes
2. No

A.10) If yes, which mode of transport do you use most along with your car?
*(Circle one)*

1. Walk
2. Rickshaw
3. CNG
4. Taxi
5. Tempo
6. Mini-bus
7. Bus
8. Office car
9. Office bus
10. Someone else's car [Please specify whose car: .....]
11. Motorcycle
12. Other [Please specify: .....]

*FOR ENUMERATORS:*
*A.11) BUS—Cost per trip (fare): Tk.*
*A.12) Car—Cost per trip : Tk.*

## In the questions that follow:

You will be presented with hypothetical situations where you will be asked to choose between car and bus to commute to work.

When choosing between car and bus, a number of attributes/factors are involved. Basically, you will be presented with two alternatives with varied levels of improvements or deterioration of those particular factors.

For example, some bus option will involve improved bus service at lower cost, improved comfort and safety features. Similarly, other car options will feature reduced travel time, increased parking fee, congestion fee.

Therefore, you will be asked to consider both the alternatives and their respective factors, and then choose your preferred option.

—-

Now suppose there are two different transport options:

1. Private car
2. Bus (mass transit)

Each differ with respect to individual characteristics.

The characteristics of bus:

- *Travel time*
- *Bus fare per trip*
- *Frequency of departure*
- *Distance to bus stop* — Time taken to reach the nearest bust stop from your home.
- *Comfort and security*

The characteristics of private car:

- *Travel time*
- *Travel cost per trip*
- *Parking fee per day*
- *Congestion fee* — The daily amount of road toll to be paid for using car during peak hours (a proposed measure to reduce traffic congestions).

Assume that you have to choose between any two alternatives to commute to your office.

See the example below:

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | 15 minutes longer than car |
| Travel cost (per trip):  | 30% increase | Same as now |
| Parking fee:  | Tk. 200 Per day | --- |
| Congestion charge:  | Tk. 50 for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 20 minutes |
| Distance to bus stop:  | --- | The bus stop is 10 minutes from your home |
| Comfort and security:  | --- | Same as now |

Like above, you will be presented with eight choices—each with two alternatives.

Consider both the alternatives and their respective factors/attributes, and then choose the transport mode you would take to work.

Our survey team can help you with any questions or clarifications.

# CHOICE 1

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | 30 minutes longer than car |
| Travel cost (per trip):  | 30% increase | Same as now |
| Parking fee:  | Tk. 100 per day | --- |
| Congestion charge:  | Tk. 50 for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 10 minutes |
| Distance to bus stop:  | --- | The bus stop is 10 minutes from your home |
| Comfort and security:  | --- | Same as now |

Considering the two alternatives above, which mode of transport would you use for commuting to work?
*(Circle one)*

1. Car
2. Bus

# CHOICE 2

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | 30 minutes longer than car |
| Travel cost (per trip):  | Same as now | 20% increase |
| Parking fee:  | Tk. 100 per day | --- |
| Congestion charge:  | Tk. 50 for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 10 minutes |
| Distance to bus stop:  | --- | The bus stop is 5 minutes from your home |
| Comfort and security:  | --- | Much improved comfort and security features |

Considering the two alternatives above, which mode of transport would you use for commuting to work?
*(Circle one)*

1. Car
2. Bus

# CHOICE 3

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | Same as car |
| Travel cost (per trip):  | 30% increase | Same as now |
| Parking fee:  | Tk. 100 per day | --- |
| Congestion charge:  | Tk. 100 for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 15 minutes |
| Distance to bus stop:  | --- | The bus stop is 10 minutes from your home |
| Comfort and security:  | --- | Same as now |

Considering the two alternatives above, which mode of transport would you use for commuting to work?
*(Circle one)*

1. Car
2. Bus

# CHOICE 4

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | Same as car |
| Travel cost (per trip):  | Same as now | 20% increase |
| Parking fee:  | Tk. 200 Per day | --- |
| Congestion charge:  | Tk. 50 for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 10 minutes |
| Distance to bus stop:  | --- | The bus stop is 5 minutes from your home |
| Comfort and security:  | --- | Much improved comfort and security features |

Considering the two alternatives above, which mode of transport would you use for commuting to work?
*(Circle one)*

1. Car
2. Bus

# CHOICE 5

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | 15 minutes longer than car |
| Travel cost (per trip):  | 20% increase | 10% increase |
| Parking fee:  | Tk. 200 Per day | --- |
| Congestion charge:  | Tk. 50 for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 20 minutes |
| Distance to bus stop:  | --- | The bus stop is 5 minutes from your home |
| Comfort and security:  | --- | Same as now |

Considering the two alternatives above, which mode of transport would you use for commuting to work?
*(Circle one)*

1. Car
2. Bus

# CHOICE 6

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | 30 minutes longer than car |
| Travel cost (per trip):  | 20% increase | 10% increase |
| Parking fee:  | Tk. 100 per day | --- |
| Congestion charge:  | 100 Taka for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 15 minutes |
| Distance to bus stop:  | --- | The bus stop is 5 minutes from your home |
| Comfort and security:  | --- | Much improved comfort and security features |

Considering the two alternatives above, which mode of transport would you use for commuting to work?
*(Circle one)*

1. Car
2. Bus

# CHOICE 7

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | 15 minutes longer than car |
| Travel cost (per trip):  | 20% increase | 10% increase |
| Parking fee:  | Tk. 100 per day | --- |
| Congestion charge:  | 100 Taka for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 20 minutes |
| Distance to bus stop:  | --- | The bus stop is 10 minutes from your home |
| Comfort and security:  | --- | Much improved comfort and security features |

Considering the two alternatives above, which mode of transport would you use for commuting to work?
*(Circle one)*

1. Car
2. Bus

# CHOICE 8

| | Option A<br>PRIVATE CAR  | Option B<br>BUS  |
|---|---|---|
| Travel time:  | Same as now | Same as car |
| Travel cost (per trip):  | 30% increase | Same as now |
| Parking fee:  | Tk. 100 per day | --- |
| Congestion charge:  | Tk. 50 for using car during peak hours | --- |
| Frequency of departure:  | --- | There is a bus every 15 minutes |
| Distance to bus stop:  | --- | The bus stop is 10 minutes from your home |
| Comfort and security:  | --- | Much improved comfort and security features |

Considering the two alternatives above, which mode of transport would you use for commuting to work?
*(Circle one)*

1. Car
2. Bus

# C. Concluding questions:

C.1) How difficult was it for you to understand the alternatives from the choices (choices 1 to 8)?
*(Circle one)*

1. Easy
2. Moderately difficult
3. Very difficult to understand

Regarding the choices you have just made,

C.2) Which attribute is did you consider *the most*?
*(Circle one in each column)*

| a) CAR | b) BUS |
|---|---|
| 1. Travel time | 1. Travel time |
| 2. Travel cost per trip | 2. Bus fare per trip |
| 3. Operating cost | 3. Frequency of departure |
| 4. Parking fee per day | 4. Distance to bus stop |
| 5. Congestion fee | 5. Comfort and security |

C.3) Which attribute did you consider *the least*?
*(Circle one in each column)*

| a) CAR | b) BUS |
|---|---|
| 1. Travel time | 1. Travel time |
| 2. Travel cost per trip | 2. Bus fare per trip |
| 3. Operating cost | 3. Frequency of departure |
| 4. Parking fee per day | 4. Distance to bus stop |
| 5. Congestion fee | 5. Comfort and security |

C.4) Please indicate the extent to which you agree or disagree with each of the following statements:
*(Tick which applies for each statement)*

| | 1. Strongly agree | 2. Agree | 3. Neither agree or disagree | 4. Disagree | 5. Strongly disagree |
|---|---|---|---|---|---|
| a) I would prefer money to be spent on other things than improving public transport | [ ] | [ ] | [ ] | [ ] | [ ] |
| b) I have no interest on improved transport in Dhaka | [ ] | [ ] | [ ] | [ ] | [ ] |

C.5) Which category below best describes your own personal monthly income?
*(Circle one)*

1. Less than 25,000
2. 25,000 to 50,000
3. 50,000 to 75,000
4. 75,000 to 100,000
5. 100,000 and above

C.6) Lastly, what is your opinion of this survey?
*(Circle all that apply)*

1. Interesting
2. Too long
3. Unrealistic
4. Informative
5. Difficult to understand
6. Other [Please specify: .....]

*Thank you for your time!*

*Please return your completed questionnaire to our survey team for your chance to win attractive prizes.*

*BLANK*

*BLANK*

ENUMERATOR'S SECTION:

D.1) Team No.:

D.2) Enumerator No.:

D.3) Date (dd/mm/yyyy):

D.4) Time (hh:mm):

Please write down the answer code for choices 1 to 8. (Car = 1, Bus = 2)

| Question No. | CHOICE | Answer Code |
|---|---|---|
| B.1 | Choice 1 | |
| B.2 | Choice 2 | |
| B.3 | Choice 3 | |
| B.4 | Choice 4 | |
| B.5 | Choice 5 | |
| B.6 | Choice 6 | |
| B.7 | Choice 7 | |
| B.8 | Choice 8 | |

DATA ENTRY OPERATOR'S SECTION:

D.5) Entered by:

D.6) Date (dd/mm/yyyy):

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