Popularization of Office Bus Service to Reduce Congestion in Dhaka

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Abstract- Dhaka is one of the most densely populated cities in the world and the entire place is badly affected by traffic congestion. One of the major reasons behind traffic jam is the popularity of private cars rather than mass transits among the people living here. A major portion of the city dwellers is office going people and a large part of them do not use office bus service. In this study, the office employees of Farmgate area in Dhaka city are selected for a questionnaire survey. There are lots of challenges like scarcity of sample data, multimodal services available for office goers etc. However, the survey focused on how to popularize the office bus service to reduce congestion. Though the result shows that there is preference for increased comfort levels as well as strong cost and time sensitivities, more than 80% respondent believe that office buses would be effective for reducing congestion. The popularity of buses can be ensured by increasing the utility of service and by reducing travel duration or fare, or increasing the comfort level for users in addition to reducing the utility of the car by imposing restrictions on parking and increasing travel time and cost.

Keywords- *farmgate, office, bus service, congestion*

I. INTRODUCTION

Office related traffic has become a major source of congestion in various parts of the world and generally with a higher proportion of old population and steep curve of car-ownership. Focusing on travel mode choice for office trips several studies have been done in recent years. In accordance with Rhoulac, investigation on the factors that affects mode choice by performing mode choice modeling on two modes-office bus and cars, his findings indicated some important factors such as total number of office goers in a household, office goers grades, household income, comfort level and perceptions of safety plays significant role in the process of decision making [1]. A study has been made on the factors affecting mode choice of office going people and found the convenience and ratings of important roles of modal safety play [2]. In 2007 McDonald investigated the relationship between distance and office location and found that walking to office is very sensitive to travel time. Schlossberg et al. investigated the effects of urban form and distance on office travel mode choice for middle office going people in Oregon and found that both factors play important roles in featuring

office going peoples travel mode [3]. The effect of sex on mode selection was investigated has found that ladies are 40% less likely to walk or bike to office compared to gents [4]. A study has also found that investigated the interrelationship between the built environment and the willingness of being driven or walking to office and concluded that built environment only moderately affects travel mode choice on the basis of cost and travel time [5].

The factors affecting office travel mode choice using revealed preference data from offices in Gainsville, Florida has been analyzed by Ewing, Schroeer and Greene [6]. They found factors such as office size, office enrollment and land use variables like density and mix are not sufficient in mode choice. A study has concluded that due to financial, legal and other constraints on the use of private cars, office going people prefers public transit more than the general population [7]. An investigation has been found on the decision making process of people and developed a choice model for ride sharing. Factors like the attendant's gender and age contributes significantly in the decision making [8].

A detailed study has been made on different socioeconomic factors which affect office travel mode choice [9]. A table that is included in that paper also highlights all the significant research conducted on office travel mode choice in recent years [9]. From the table and our literature review, two conclusions were drawn: difference have got the main focus between non-motorized and motorized transportation modes, and all the research on office travel mode choice have been done in developed countries especially in North America and Europe. Previously, studies on travel mode selection have indicated that mode choices depend significantly on some factors: modal attributes, socio-economic characteristics and condition of network [10]. Since four of these factors will not remain same for developing countries, the above mentioned models are not likely to be applicable for developing countries.

In this paper, we basically focus on developing a model of mode choice for office trips in Dhaka with special focus on modeling preference for office bus services. Dhaka is the 11th largest city in the world with a mammoth population of 10 million but per-capita income below 1100 dollar per year. From the review of previous mode choice models for Dhaka city, no detailed analysis related to office trips was found, in spite of the fact that these trips have different features than other trips [11]. Also, there was not enough revealed

preference (RP) data that has been collect during these studies to develop a rigorous model for mode choice for office trips, especially in presence of office buses (which are not common in Dhaka). Farmgate, the traffic analysis zone (TAZ) that houses majority of the corporate offices in Dhaka is chosen as a case study. In this paper, the extent of the problem and challenges are described on the background study and were presented based on collected data basically questionnaire survey. The paper concludes with a summary of findings from the survey and proposals for future work based on it.

II. Study Location and Critical Issues

Farmgate, originally designed as a commercial area has experienced the massive development than most other areas within Dhaka of many private offices over the past fifteen years and now houses more than a hundred offices. A report has found that this development also led to increasing traffic congestion during office hours [12]. The primary cause of congestion in Farmgate is the sheer volume of traffic and this large number of vehicles far exceeds the carrying capacity of existing roads. A visual demonstration of regular traffic conditions in Farmgate during office hours are shown in Figure 1.

Figure 1. Traffic congestion in Farmgate during office hours (Evening and Morning time) [13], [14]

Most offices in this area don't have an office bus system; many office goers ride their own cars to office, so the employee-to-vehicle ratio is very high. Our preliminary investigation also reveals that around 74% of the office goers do not share office rides. It is established in literature that introducing office buses can go a long way in curbing congestion caused by office traffic. Dhaka Traffic Coordination Board has also noticed the potential of office buses in assuaging traffic congestion in Farmgate but also acknowledges lack of data for its implementation [15]. These have inspired the focus of our research on factors affecting office buses.

A. Challenges

1. Scarcity of sample data: There was a dearth of available data both on the offices of Farmgate as well as the travel behavior to these offices. For example, there was no published inventory of offices and numbers of students in these offices let alone the residential locations or travel modes to offices. All data for this research was forced to collect manually.

2. Multimodality: Many different modes of transportation are used by office employees in Farmgate. The main modes are privately owned cars, rickshaws and motorized auto-rickshaws (also called CNGs). Besides, a few numbers of students also use office bus, bicycles, motorcycles or walk to office. Cars are expensive for operation and maintenance (15000 taka/month + 5 taka/km), in contrary, rickshaws and CNGs are more economical to use (15 taka/km and 20 taka/km respectively). Availability of all modes of transport may not be uniform to everyone though, for example, office buses are operated only by few offices; rickshaws are banned from several major roads and thus causing inaccessibility to a lot of employees.

3. Heterogeneity of data: The levels of services and characteristics of data are also very different. For example, the rickshaw is cheaper but lack in comfort and security; on the other hand, private cars are very costly but provide excellent security, comfort and accessibility during travelling. Also, since there is no office zoning, some employees come from very far while others live relatively close to their offices. Heterogenic socioeconomic characteristics are also found during the study. For example, some employees are substantially well-off than others.

B. Focus Group Attributes

Several parents and office administrators were requested to contribute in order to identify important attributes and opinions of an office bus system. The general sentiment was on favor of reducing congestion anyhow, provided that the cost was not excessive. Office administrators were found more enthusiastic than parents about adopting office buses. A factor analysis and multiple regression method were taken in order to determine factors that affect passengers to choose bus as the mostly used mode of transport in Dhaka [16]. Based on these studies and the focused group consultation, six attributes were chosen for survey maintaining the Integrity of the Specifications.

1. Cost: The monthly fare of office bus service (round trip) per employee, in taka (1 US dollar = 78.53 taka@2016.02.01). Since cost increases with distance, two sets of fares are provided. Shahbag, Tejgaon, and Mohammadpur are local areas, while Mirpur, Gulshan, and Motijheel are further away than others.

2. Travel time: The relative amount of time it takes for a one-way trip (either going to or returning from office). In general, office bus will be slower than car or rickshaw/CNG

because they are not as capable of weaving in and out of traffic, as most vehicle drivers usually do.

3. Time to the bus stop: The time it takes for the student to walk from his home to a bus pick-up spot or drop-off point. Door-to-door pickup may be feasible for microbuses, but for large buses it would take longer time.

4. Comfort: Air conditioning (A/C) during travelling is highly desired because it is hot and humid much of the time in Sahbag. However, money can be saved by eliminating A/C or using older buses, which were usually built without A/C.

5. Vehicle size: Microbuses (for 10-12 people) or large buses (for 20-30 people). Large buses may be safer in collisions and more efficient if they service employees from multiple offices. Microbuses can probably travel at higher speeds and are more agile in traffic.

6. Security: An assistant may be hired to accompany the bus. Employees feel more comfortable if an office authority is on the bus with their children to maintain order.

III. SURVEY FORMAT, QUESTION TYPE AND UNDERSTANDABILITY

The questionnaire is intended for the office employees. Since there were six attributes of interest, it was very important to limit the mode choices to 2 at a time (there is the scenario of no Car vs. Rickshaw/CNG vs. Office Bus), lest the scenarios become too cumbersome to contemplate. From the research, it was found that any choice set having more than three attributes gradually become difficult to understand; that's why preliminary studies were done to make sure the choice sets that consist of six attributes were understandable [17].

Section 1. Behavior of Current Travel: This section obtains information about the respondent's current mode choice: car, rickshaw, CNG, walk, or any other modes of travelling. After these, there are questions focusing on travel time, distance from home to school, and behavior of carpooling.

Section 2. Stated Preference Choice Scenarios: In this section, four scenarios are presented for the respondents in which a choice should be made between the current mode and the school bus system; such a scenario is exemplified in Table I. Some mode-specific questions are asked after or before the scenarios, such as fare costs.

Section 3. Socio-economic questions: This section contains general questions about the employee family, such as employee's education and number of family members, their occupations, availability of personal cars, and net household income.

Section 4. Diagnostic questions: In this section, users are asked for feedback to help improve the clarity and realism during the revision of the survey.

Section 5. Attitude and perception questions: This part of survey asks respondents for ratings; from strongly disagree to strongly agree to express their decision with several statements which are based on various aspects of school buses and cars.

TABLE I.   QUESTIONARIE SAMPLES

Attributes	Car	Office Bus
Travel time (each way)	Same as now	5~10 minutes more than now
Vehicle size	Same as now	Large bus (20-30 people) serving multiple schools
Security	Same as now	Accompanied by an assistant
Time to the bus stop	Same as now	Up to 5 minutes' walk
Comfort	Same as now	Old buses without A/C
Cost		Dhanmondi, Lalmatia, Mohammadpur etc. (Nearby areas of Farmgate): Tk 1000/month Mirpur, Gulshan, Banani etc. (Distant areas of Farmgate): Tk 2000/month
Which mode would you choose? (Give Tick mark)	Car / Office Bus	

IV. COLLECTION OF DATA

Data collection was done from several different offices in Farmgate. The best effort was made to ensure to select a random sample by distributing surveys to a wide variety of offices and different age groups. However, 220 responses were received out of 2000 distributed surveys.

1. 73% of the correspondents were male.

2. Most of the employee received a Bachelor's degree or higher.

3. 26% of the respondents had access to a car, and most employed a driver.

4. The average income was 43,000 taka per month, and 10% of the respondents had income over 1,00,000 taka per month.

At present, one tenth of the responded drive car to office in the morning. Rest use rickshaw, CNG or other local bus services. The current mode of transportation is presented in Figure 3.

The mode usage was similar in the afternoon or for evening. The travel times in mornings were spread out, mostly ranging from 10 minutes to 45 minutes; the average duration is 10-20 minutes. Three-quarters of the people don't carpool, a behavior which is largely responsible congestion. The current travel time is shown in Figure 4.
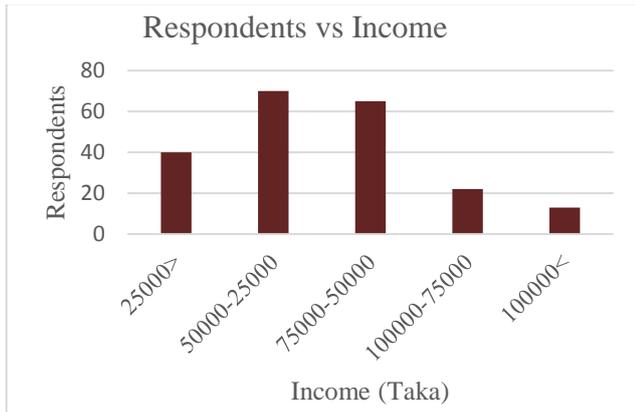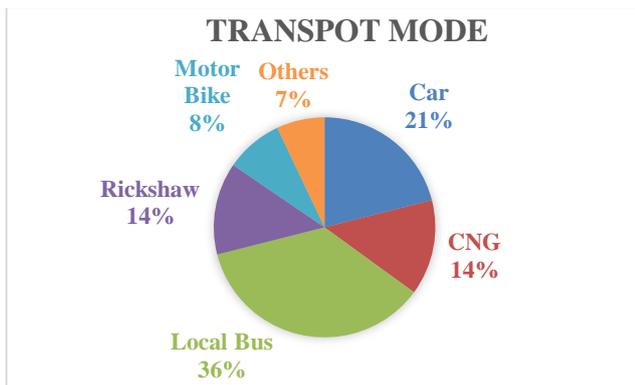
Figure 2. Respondents' income level

Figure 3. Current mode of transportation

Figure 4. Current travel time

The selection of travel mode is influenced by the perception of traveler toward those modes, and the results are shown in Table II. Majority of respondents believed that office buses can reduce congestion and benefit the environment, while more than 30% pointed as less comfortable and time consuming. When comparing office buses with cars, more than half described cars as a safer, faster, and more convenient modes than office buses. Sixty percent wanted offices to ban parking.

Opinions	Agree	Disagree	Neither
Office buses can reduce congestions	85%	7%	8%
Office buses are comfortable	60%	35%	5%
Office buses are environment friendly	69%	23%	16%
Office buses are cheaper than cars	92%	4%	4%
Office should ban parking	75%	21%	4%
Buses do not arrive in time	82%	16%	2%
Cars are faster than buses	92%	5%	3%
Cars are safer than buses	42%	41%	7%

Respondents were also involved in evaluating the importance of several aspects of office buses and the results are shown in Table III. From the results, it was found that affordability as bus fees are a major deciding factor. Most respondents agreed that measures to transport employee to office on time and increased comfort were of high importance but secondary to cost and security.

TABLE III.   IMPORTANCE OF MISSELENIOUS FACTORS

Opinions	Important	Not Important	Neither
Direct service	70%	22%	8%
Affordable fees	85%	11%	4%
New buses	44%	51%	5%
Air conditioned bus	36%	47%	15%
Security of women	94%	1%	5%
Comfort in sitting	56%	39%	5%
Pick and drop service	68%	26%	6%

V.   CONCLUSION

The findings of this research can be useful not only for Dhaka Transport Coordination Board but also for many private players trying to implement an office bus system to improve the traffic situation in Farmgate. An example can be drawn as the results indicate that, before actually implementing the system by modifying the level of services (LOS) of the different attributes which are related with each mode of travel, proper ridership can be ensured. This can be done by increasing the utility of the bus by reducing travel duration or fare, or increasing the comfort level for the users and reducing the utility of the car by imposing restrictions on parking and increasing travel time and cost.

There is an indication of a strong inertia by the result for the current mode which indicates that special initial enticements can be effective to make the parents more supportive which is useful to overcome the preliminary hesitance. It may be noted that the findings can be implemented on other developing countries, especially with socio-economic likenesses.

The study has some limitations though. First of all, the response rate was not very good. The results of this research were based on a smaller sample size (two hundred and twenty) in comparison with the target population. Improvement of result is possible by increasing the sample size to at least up to

2000. Some unique and innovative techniques can be explored to attract respondents to the surveys for further research in future. Moreover, there is an issue of non-response bias, which has been ignored in this paper, should have been considered. Furthermore, most of the data used for this research was based on data obtained from paper-based surveys as execution of an adaptive survey was not possible. In addition, a model can be developed which can be improved by studying other type of models which have more flexible error structures.

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