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Analyzing the patterns of travel behavior of Jessore City

Analisando a distribuição de viagens na cidade de Jessore

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Abstract

The purpose of this paper is to examine what is known about travel behavior and analyzing the existing pattern of travel behavior of Jessore City. In Jessore City about 83% trips are home based. There are a large number of decisions that people make about their travel behavior, such as their destinations, the mode (car or bus, for example), the time of day they travel, organizing individual trips into chains, and so on. In addition, broader factors such as population, economic growth, and technological changes can impact travel decisions. In this study several spatial or geographical factors, like the local service accessibility, have been studied in order to explain the differences in travel patterns. It is found that once monthly household income increased, the number of home-based trips per household per day also increased. Among the different mode of travel available in Jessore City, rickshaw (tri cycle human hauler) is the most popular and easily available mode of travel. The study also tries to define how local factors – so called spatial factors – affect the travel behavior. The basic hypothesis is that in Jessore City, where the local service level is low and distances to service areas are long, the number of daily trips is smaller.

Keywords: Traffic Analysis Zone. Travel behavior. Forecasting. Jessore City. Bangladesh.

Resumo

O objetivo deste artigo é examinar o que é conhecido sobre distribuição de viagens nas cidades, e analisar esta distribuição na cidade de Jessore, Bangladesh. Em Jessore, 83% das viagens têm como origem ou destino a residência. As pessoas levam em conta um conjunto de fatores quando decidem suas viagens, como os destinos, o modo de transporte (carro ou ônibus, por exemplo), a hora do dia em que ocorre a viagem, a organização das viagens em cadeias, e assim por diante. Ademais, fatores mais abrangentes como população, crescimento econômico e mudanças tecnológicas podem influenciar decisões de viagens. Nesta pesquisa diversos fatores espaciais e geográficos, como a acessibilidade a serviços locais, foram estudados com a finalidade de explicar as diferenças nos padrões de viagens.

Foi constatado que um incremento na renda familiar mensal reflete um aumento, por família e por dia, no número de viagens que têm como origem ou destino a residência. Dentre os diferentes modos de transporte disponíveis na cidade de Jessore, o rickshaw *(triciclo com tração humana) é o mais popular e o mais comum. Este estudo também tenta definir como fatores locais – conhecidos como fatores espaciais – afetam a distribuição de viagens. A hipótese básica é que na cidade de Jessore, onde o nível de serviços locais é baixo e as distâncias para áreas de serviço são longas, o número de viagens diárias é pequeno.*

***Palavras-chave**: Zona de análise de tráfego. Distribuição de viagens. Previsões. Jessore. Bangladesh.*

Introduction

Travel behavior is complex, not only in terms of its motivations, but also in terms of how it manifests itself (PBQD, 2002). People travel because they get benefits from it, or more precisely, because they get benefits from the things they do or buy at the end of the trip (PUGET SOUND REGIONAL COUNCIL, 2001). The reason there is so much travel is because people are gaining something by doing it – travel is a benefit, not a burden. Jessore City which stands on the Bhairab consists of whole municipality area and upashahar, Noapara, Fatehpur, Arabpur, Ramnagar adjoining area. Jessore municipality was established in 1864. The total area of the city is 577.125 acre. The town has a population of about five lakhs (half a million); with male-female structure of 52.97% and 47.03% respectively. The transportation system in Jessore City is now being challenged with rapid urbanization, unequal distribution and a rapid growing population. The main reason is no integration between traffic management and economic growth of Jessore City. Thus it needs traffic management policy which will integrate economic growth with future demand of the city. As day to day trips by household members are concerned in Jessore City, over 50% take their trips on foot, while almost one half use rickshaw, which is expensive for common people (NURUL, 2004). Except a few points, roads are mostly under utilized and dominated by non-motorized transports (NURUL, 2004). Jessore is one of the least motorized municipalities of the country. Few percent use motor vehicles for their trips to workplaces. Major commuting trips take place by maxi and tempo (*maxi* is a local four wheeler human haulers and *tempo* are three wheeler human haulers). To turn the city into an important regional transit point but also to build it up as an important hub of economic activities based on trade, commerce, manufacturing and processing, which in turn will generate tertiary activities the future transport network of the city must be visionary to accommodate its future demand (GEC, 2000). Due to low level of traffic the current deficiencies of the transportation system are yet to be exposed. With the growth of population and consequent increase in traffic volume, efficiency of the current roads will surely deteriorate (KADIYALI, 1991).

The aim of this paper is to find out the existing dimensions of travel behavior in terms of socio-economic and travel characteristics information such as trips purpose, trips mode, trips distance and cost of trips of Jessore City.

The importance of travel

A good starting point for thinking about the importance of travel is the question: Why do we live, where we do? There are obvious disadvantages to living in a big city. It is expensive, noisy, congested, and the threat of crime. But at the same time, big cities offer advantages that are not available in less populous areas. Access to a wide variety of unique shopping and recreational opportunities is one of them. An even more important consideration for many people is the availability of a variety of jobs, or of specialized work that doesn't exist at all in smaller cities. People incur the expense and inconvenience of living in a large city because they want access to a variety of destinations or to a few specific ones (CHARLES, 2001). People travel because they get benefits from it, or more precisely, because they get benefits from the things they do or buy at the end of the trip. Since people are under no legal obligation to travel, it must be the case that the benefits they gain from traveling, or from the lifestyle that it makes possible, must outweigh the costs they incur

(although the costs to society as a whole might be larger). Otherwise the trip would not be made, or a way would be found to attain the same benefit with a less costly trip. This needs to be said because of the current popular emphasis on the costs or negative impacts of travel. The reason there is so much travel is because people are gaining something by doing it – travel is a benefit, not a burden.

Methodology

The methods that were adopted in this research are divided into the following stages:

a) Stage one: this stage has been concern for formulating objectives, to have a clear perception of the topic and the subject matter of the study. Afterwards, a sample size of household survey has been finalized. Random sampling survey technique is being considered and a total of 210 households have been surveyed during the field survey in 2008. Sample size is representing significant number of households in each Traffic Analysis Zone (TAZ). Exceptional cases have been observed as many sampled households were not interested to answer questions. In this case, the next household survey has been carried out to stick into the 210 numbers of samples.

b) Stage two: this stage illustrates the way of data collection. Most of the data for this research are collected from primary sources. For primary data collection, structured questionnaire, reflecting household interview survey and rider ship survey were designed to collect information regarding the socio-economic characteristics of an individual trip maker, trip information and service attributes of different public transport services. For the purpose of this study, the whole Jessore City areas were into several TAZ (BRUTON, 1975). The major determinant factor for the identification of TAZ boundary in this study is land use homogeneity. In this research access to major road, road network and location of major activities was used to identify the TAZ boundaries of Jessore City. Here Land use map of Jessore City is super imposed to the road network map of Jessore City. In this method, twelve traffic analysis zones are created in Jessore City. In this study a large volume of data regarding transportation supply and demand of different part of city were collected from both primary and secondary sources. For the Household Interview survey, a household is chosen as a sampling unit. From the Model *Pourashava* Jessore Land use Plan Volume-2, the number of household in Jessore City is found as 69,520. After identification of TAZ boundary a sample questionnaire survey is conducted in different TAZs.

c) Stage three: in this stage, Statistical Package for Social Science (SPSS) was used for data entry and data analysis. GIS techniques are also used to draw different maps of Jessore City (Figures 1 and 2).

Analysis and major findings

Jessore is situated at the south western part of Bangladesh. This city is well known in Bangladesh because of producing diversified kinds of agricultural products and heading the biggest land port named as Benapole port. Almost 90% of the imported goods coming through land from India is arriving in Benapole port only a 30 km distance from Jessore City center. Benapole port authority is situated under the jurisdiction of Jessore district. Per capita national GDP (Gross Domestic Product) of Bangladesh is 456 USD and it has been estimated in that Jessore is behind the average national GDP (BBS, 2008). Strategically Jessore is a very important city for Bangladesh to maintain a good business relation with the neighbor India. Besides, Jessore is also supplying significant portion of fish foods and vegetables to other parts of the country. Transportation plays an important role for carrying goods and passengers especially for the business people who are heavily involved in import and export businesses. When it comes to explain about transportation system, Jessore is still not growing as fast as Dhaka, Chittagong, Khulna

and Rajshahi. Number of vehicles registered in Jessore is only contributing 0.5% of the total registration in Bangladesh per year in comparison to Dhaka (44%), Chittagong (9%), Khulna (1.14%) (RHD, 2010). However, number of non-motorized vehicles, especially rickshaws and bicycles are growing significantly in Jessore (almost 8% per year). This represents the travel behavior of urbanites in Jessore City to some extent. Major findings are discussed in the following part of this paper.

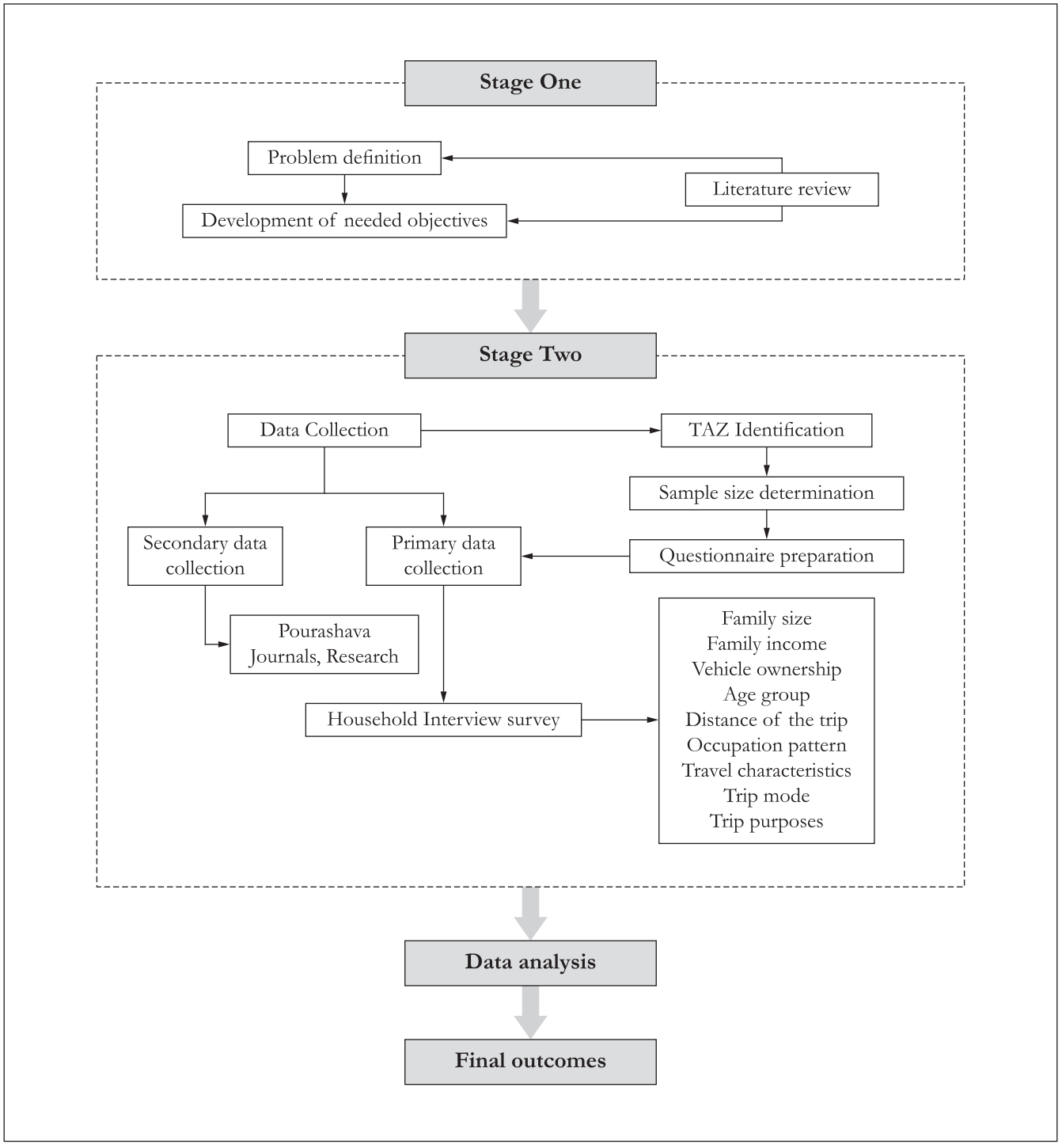

Figure 1 - Research methodology

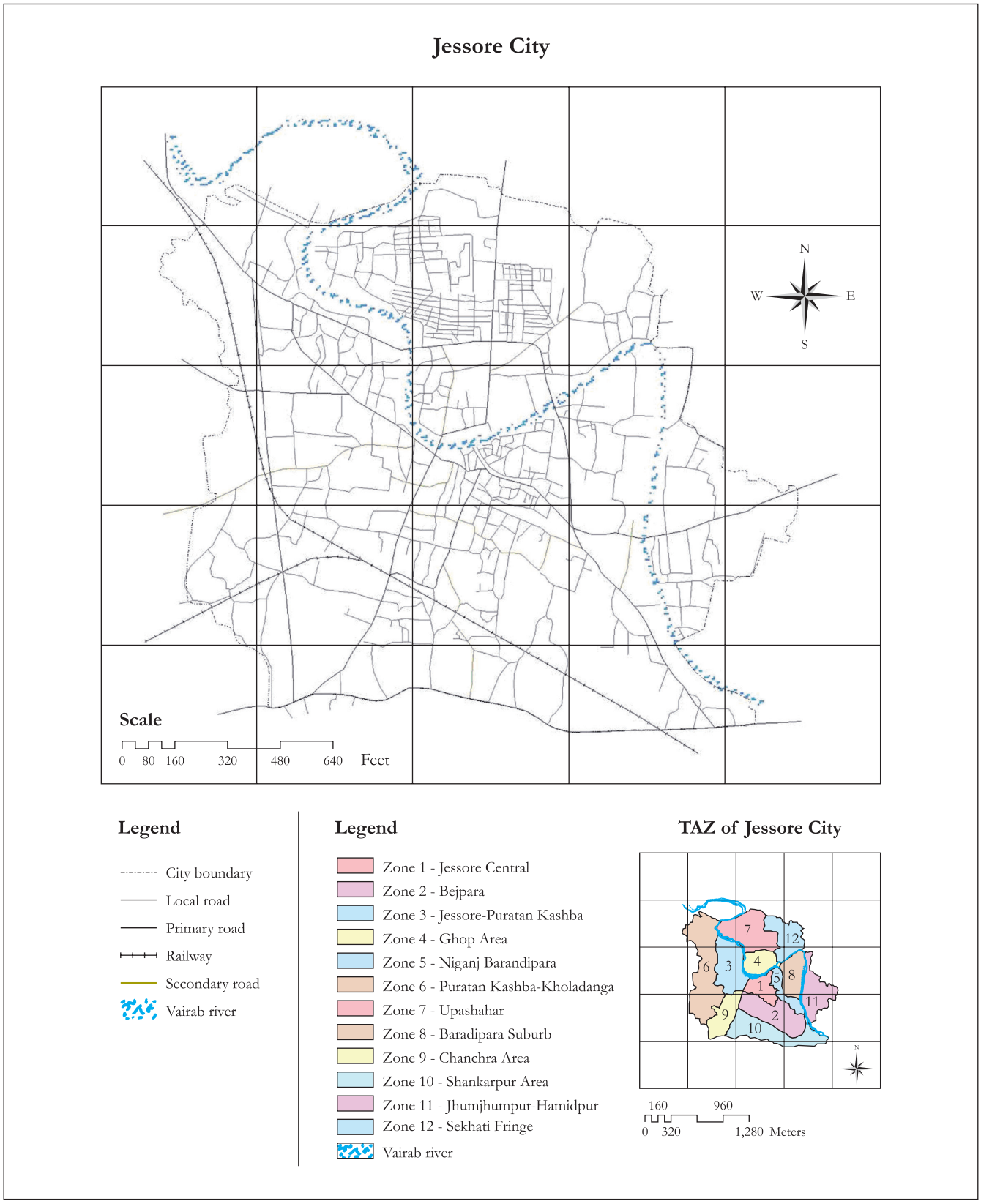

Figure 2 - Jessore City map
Source: Geographic Information System (GIS).

Dimension of travel behavior

The full complexity and difficulty of the transportation policy problem can only be fully appreciated by looking at some of the details of travel behavior (DAVIS; BARNES, 2001). These details are significant to policy for several reasons. The first reason is the accuracy of forecasting. Predicting the quantity of traffic and transit usage on every road in the area requires forecasts of the numbers of trips traveling between every possible origin and destination, the time those trips are taken, and the mode that are used, among other things. This in turn requires that the characteristics of individual trips be described at a considerable level. The details of travel are significant is that; to understanding the likely effect and magnitude of policy initiatives is second reason. It also requires knowing how much impact the particular characteristics that were influenced on the problem under consideration. Problems arise not from travel in general, but from specific details of travel, and policy can be far more effective by focusing on the relevant details of a problem rather than by seeking to influence travel in general.

Figure 3 shows the dimensions of travel behavior in Jessore City. There are six different criteria have been analyzed to see the travel behavior of urbanites in Jessore City. This city is typically composed the travel behavior likely other Bangladeshi cities except from Dhaka. Dhaka, the capital of Bangladesh is composed highly with motorized trips (almost 60%) and travel time is likely three times higher than in Jessore City (KHAN, 2006).

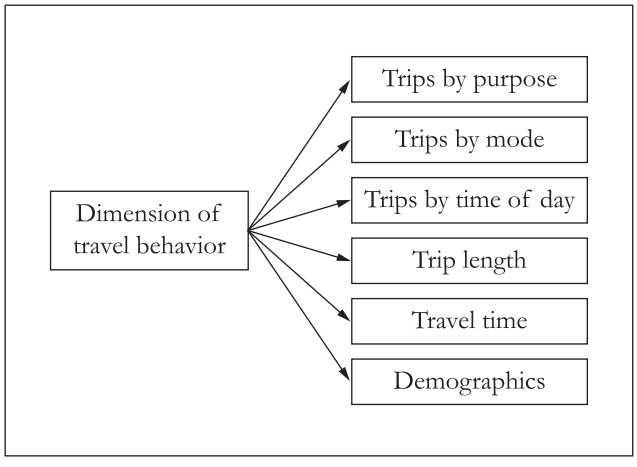

Figure 3 - Indicator of dimensions of travel behavior of Jessore City

Trip types

A trip is defined as single directional movement, for example home to work or work to home. Generally we know two types of trips; home-based trips and non-home-based trips. In Jessore City 82.7% are home based and 17.3% are non home based trips.

Figure 4 shows the typology of trips in Jessore City. In the southern part of Bangladesh, the situation remains likely same for other major cities such as: Khulna City (home based 78% and non-home based 22%), Faridpur City (Home based 81% and non-Home based 19%). However, the situation is not same in compare to Dhaka, the capital city. In the capital city, the home based trips are almost 60% and non-home based trips comprise almost 40% (DTCB, 2008).

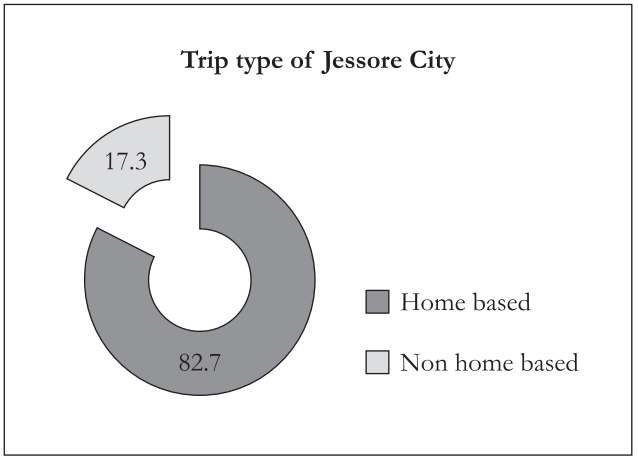

Figure 4 - Types of trips in Jessore City
Source: Field survey (2008).

Purpose wise trip composition

This is perhaps the most important single characteristic of a trip, in that it tends to influence many other relevant details. Trips undertaken for different reasons tend to have different characteristics (JOHNSTON; RODEER, 2001). Work trips, for example, are longer than other trips, more likely to use transit (in some cases), more likely to go to the downtowns, and more likely to be taken during peak periods. Other types of trips, such as shopping and recreation, differ from work trips inmost characteristics.

In this study, trip is a defined as one-direction movement which begins at the origin at the start time,

ends at the destination at the arrival time, and is conducted for a specific purpose. Home-based trips are major constituents of urban travel demand. Survey results showed that trip purpose composition include "home to work place" 20%, "home to educational institution" 21%, "home to shopping" 7%, "home to social" 8%, "home to others" 2%, and "back to home (from any site after conducting a specific purposes)" trips 42%.

Figure 5 shows the activity wise trip composition in Jessore City that have been formulated from the field survey. It has been observed that institutional trips are almost 21% which is quite high in Jessore City. This scenario is different than in Dhaka and Chittagong which are comprising only 9% and 10% educational trips (DHAKA CITY CORPORATION, 2004).

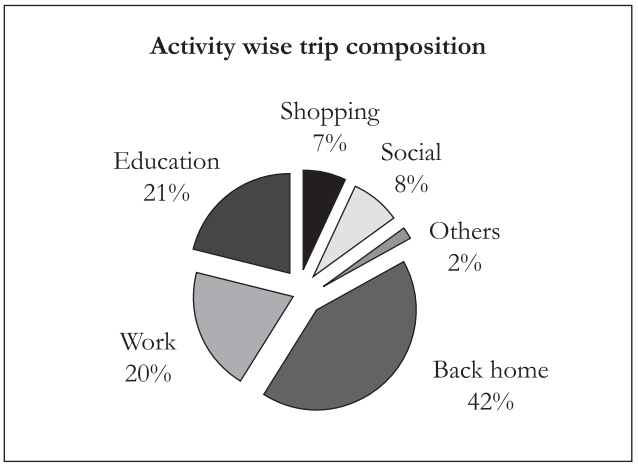

Figure 5 - Activity wise trip composition in Jessore City
Source: Field survey (2008).

Age wise trip purpose

In Jessore City most of the trip-makers are between 15 to 45 years of age. Figure 6 shows that 38% respondents are "30-45 years" of age, where 26% are from "15-29 years", 14% are from "45-57 years" and 19% from "8-17 years"; rest 2% above 57 years of age.

Figure 6 shows the composition of trip purpose based on age group. This scenario is almost same like other cities in Bangladesh like Dhaka, Chittagong, Khulna and Rajshahi, the four major cities.

Purpose wise trip distribution

Trips are produced for different purpose and different types of mode are use for different types of trips. Following chart represent trip distribution for different purposes. In Figure 7 it is seen that for work purposes person trip flows are dominated inTAZ-1. In education purposes person trip flows are dominated in TAZ-2 & 3 which are respectively 35% and 21%. On the other hand shopping, social and others purposes person trip flows are dominated in TAZ-4, 9 and 4 which are respectively 37%, 31% and 25%.

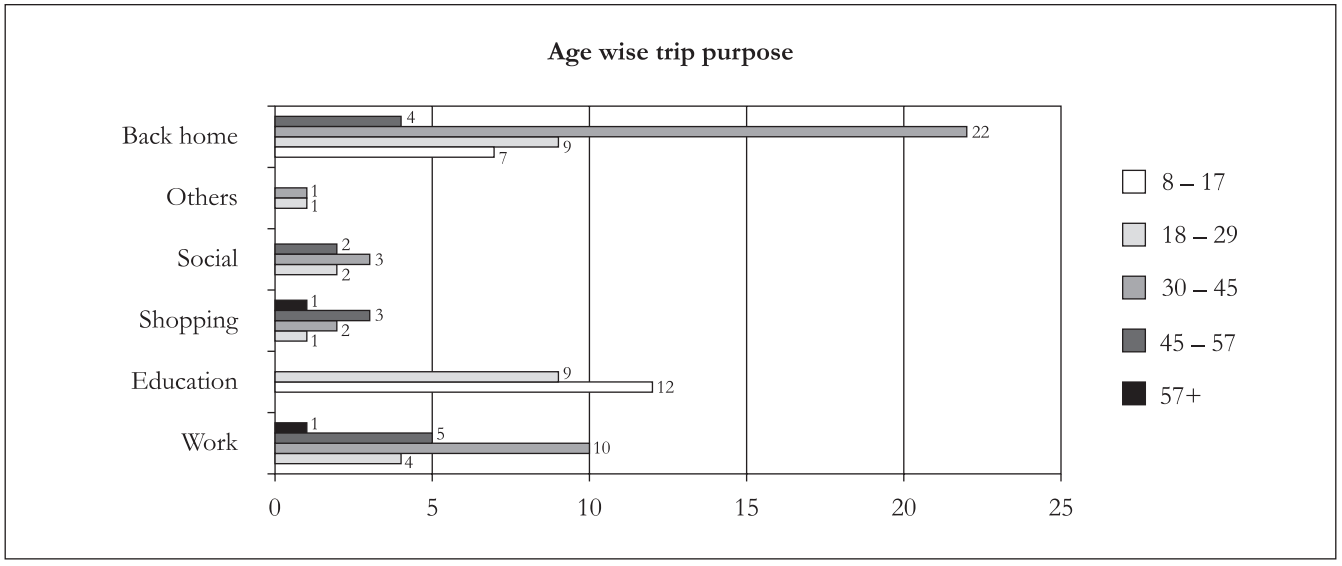

Figure 6 - Age wise trip purpose in the study area
Source: Field survey (2008)

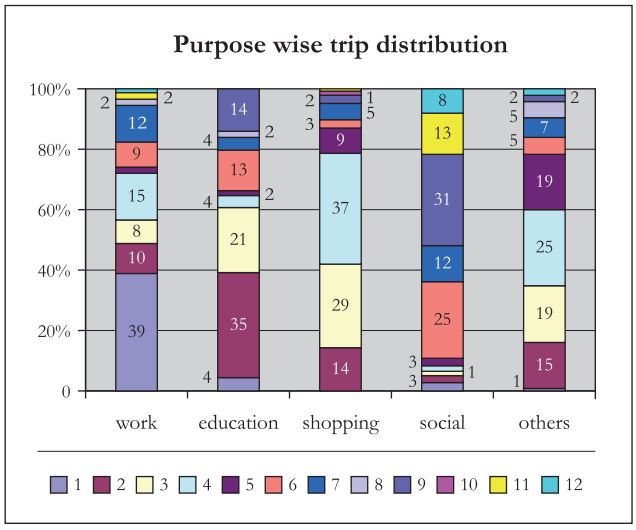

Figure 7 - Trip distribution according to purpose
Source: Field survey (2008).

Figure 7 shows the trip distribution according to purpose in twelve different TAZ in Jessore City. It can be seen that the central area (TAZ 1 in the figure 2) is comprised with 39% work trips. Whereas TAZ 4 comprises with 37% trips for shopping. This result is interesting to see and to put more public transportation services in TAZ 4 during off peak hours as people are going to shop in off peak hours.

Time of day

No one will be surprised to hear that traffic is much heavier at some times of day than at others; indeed, if this were not so, it is not likely that transportation would be of much interest to the average person. People travel during peak periods because that is when it is convenient (congestion notwithstanding) or necessary, so to induce them to travel at other times would not only be difficult, but would probably not make them better off. In large congested cities the difference between the peak and off-peak periods is shrinking. Roads can fill to near capacity early in the morning and stay that way until late in the evening (Figure 8).

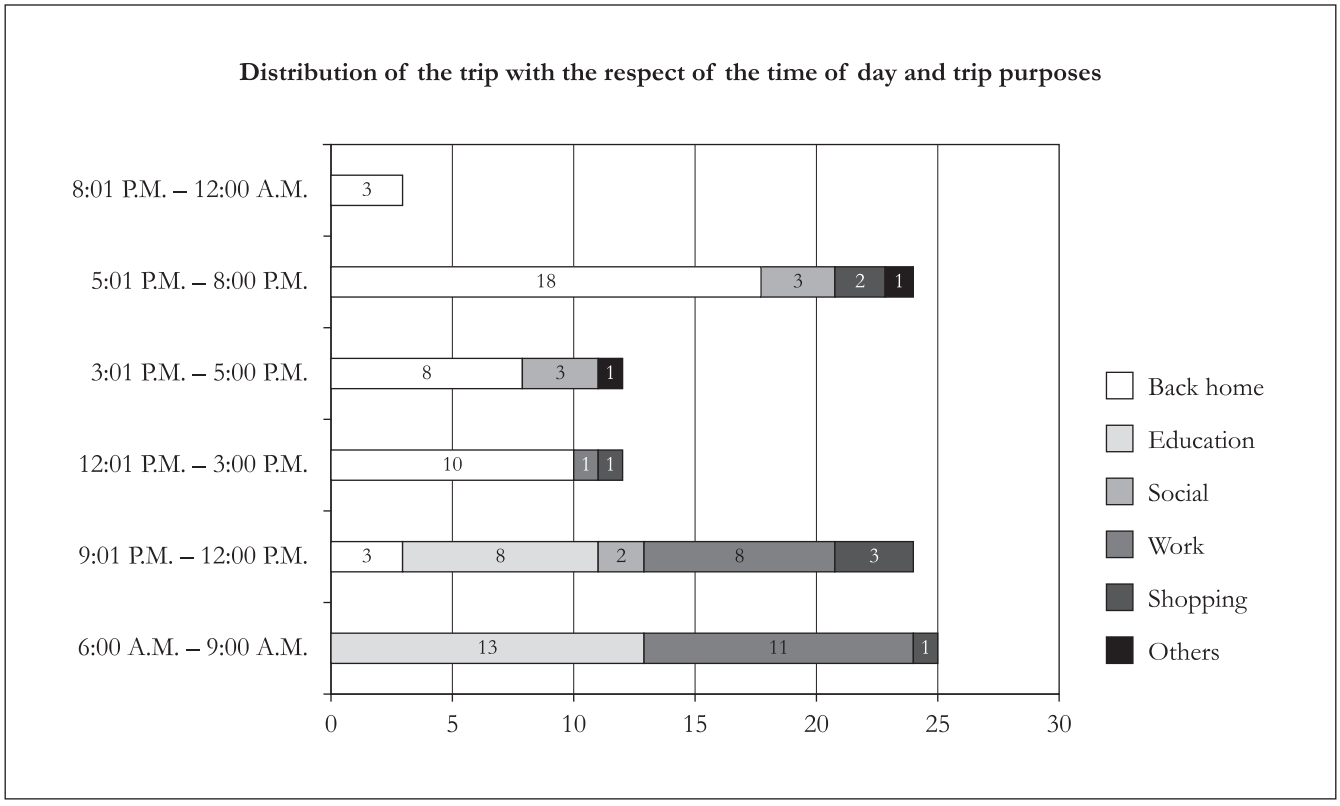

Figure 8 - Trip distribution according to time of the day
Source: Field survey (2008).

Generally, these are "morning peak" between 8 AM to 10 AM, and "mid-day peak" between 1 PM to 3 PM and "evening peak" between 4 PM to 7 PM. In Jessore City, morning trips are connected with work, education and shopping. Both men and women are made work and education trips. There are some early morning trips to the market places for daily bazaar or groceries. The majority of non-home based trips are made between 10 AM to 14 PM, and all work trips are made by males. Work and educational trips again caused the afternoon peak, but during this time people are mainly returning to their home. Another peak is again found between 16 PM to 19 PM.

Mode of travel

Modal composition varies substantially depending on trip purpose as shown in Figure 9. Thirty-eight percent of "home based work" trips, which are major constituents of morning and evening peaks, are made by rickshaw, followed by 28% by walking.

Home based education trips such as going to school, college and heavily depending on rickshaw (tricycle human haulers). More than 13% of education trips are made by rickshaw, followed by walking 11%. Rickshaws are most commonly used for "home based shopping" trips also. Seventeen percent of people go to market by rickshaw. Walking is the second preferable mode for "home based shopping" trips in Jessore City, carrying 6% people to the market. Private vehicle like car/jeep carried 5% people to market.

Social trips often involved traveling to see a friend or relative. Four percent of social trips are made by the rickshaw, followed by 10% by walking and 21% by motorcycle.

Modal compositions of "back to home" trips are dominated by rickshaw by carrying 30% people to home. Walking is another major mode of transportation for carrying people to home and contribute 43%, as shown in Figure 9.

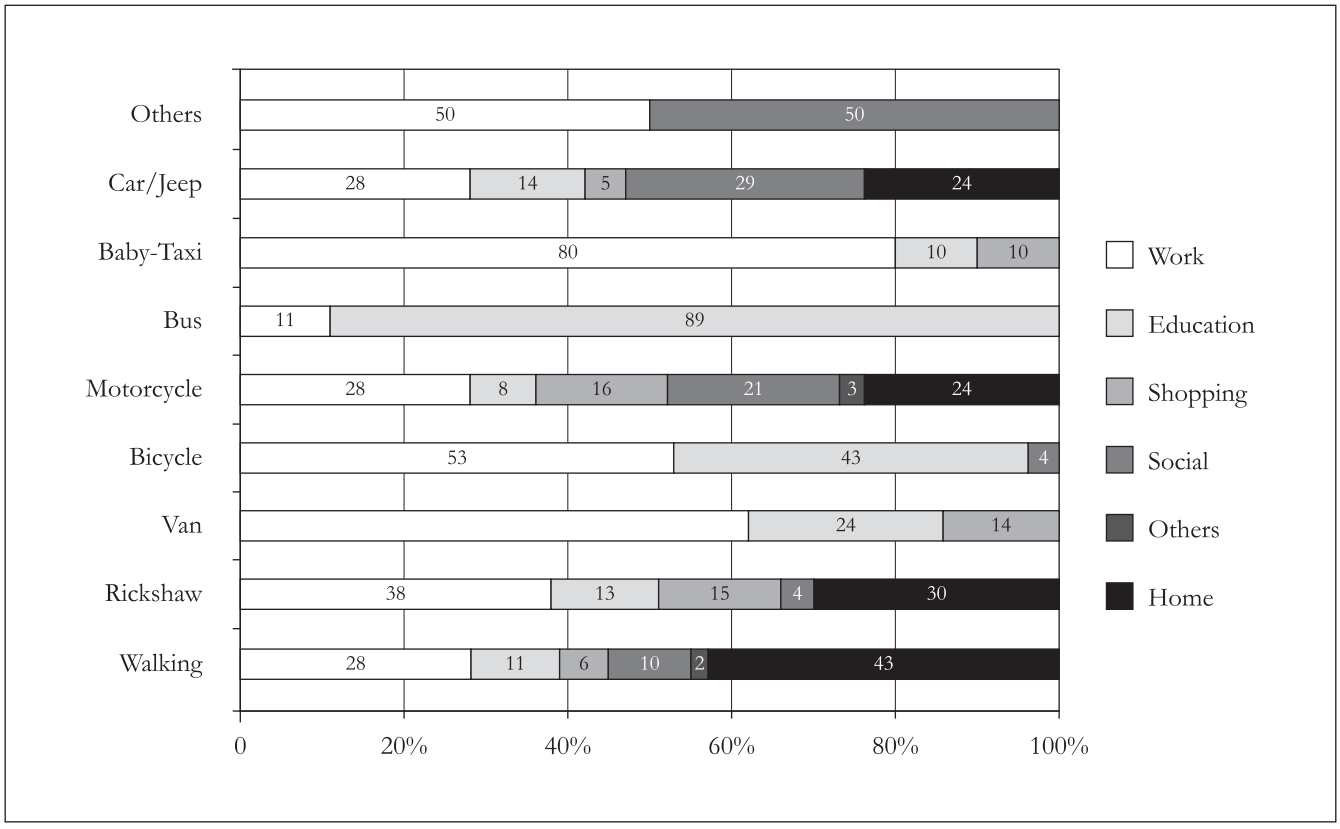

Figure 9 - Modal composition of trip purpose
Source: Field survey (2008).

It has been clearly seen from the above figure that modal composition is a bit different in this city in compare to other cities of Bangladesh. Tri cycle rickshaws and open tri cycles are contributing significant number of trips everyday (almost 40%). Social trips are made mainly by Rickshaws. This mode of transport is always available to serve door to door service within reasonable price (10 BDT/ km and 68 BDT = 1 USD).

Figure 10 shows typical picture of rickshaws and vans those are carrying passengers in Jessore City. Vans are common for carrying goods in most of the Bangladeshi cities and Rickshaws are common in every cities of Bangladesh and in Dhaka, it comprises with almost 15% daily trips.

Figure 10 - Rickshaws (a) and Vans (b) in Jessore City

Income wise mode choice

In this study it is found that rickshaw is dominant mode in this city. In Jessore City 43% people use rickshaw where as only 23% people use motor vehicle (Motorcycle, car, bus and Jip). Among them middle income group of people use rickshaw and it is 16%. Higher income group of people are dominant user of motor vehicle like car/Jeep etc.

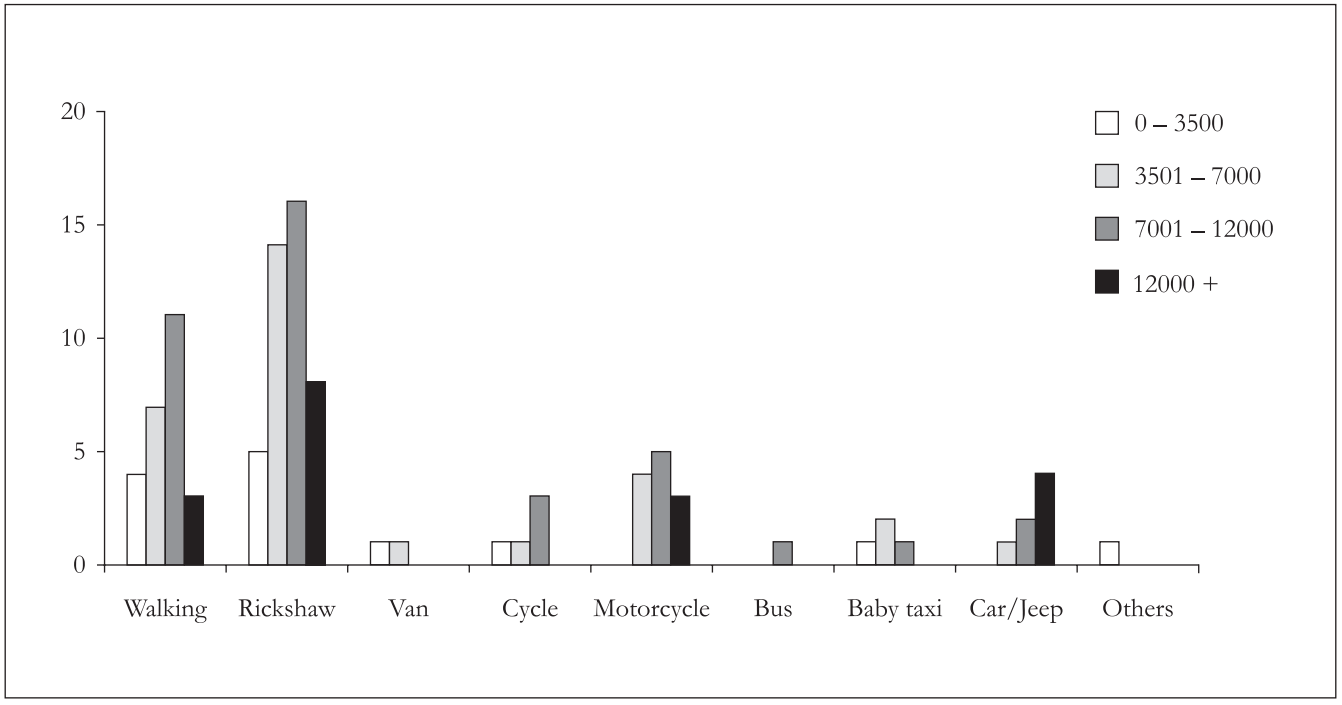

Figure 11 - Income wise mode choice of residents
Source: Field survey (2008).

In compare to Dhaka City, the situation is a bit different in Jessore City. The highest income group usually feels comfortable to take a rickshaw for shopping and visiting friends because it is convenient to find one and passengers do not need to depend on drivers of motorized vehicles.

Besides, family size comprises with five people are depending both on rickshaw and motor cycles. Total modal shares of motor cycle is rather high in Jessore City in comparison to similar cities in Bangladesh (Khulna 9%, Faridpur 8%, Kushtia 9%) (JESSORE MUNICIPALITY, 2008).

Family structure wise mode choice

Number of family member is an influential determinant to choose the mode of transportation. The average family size of Bangladesh is 5.4 according to the Bangladesh Bureau of Statistics (BBS) in 2006. In Jessore municipality master plan, it says the same situation. In the Table 1, it shows that family sizes of four persons are usually dominating the city with 44.8%. Most of them are riding rickshaws (23%) and walking for their daily trips (8.8%). Family size comprises with eight persons is highly depending on non-motorized mode of transportation in Jessore City. It has been experiencing from Dhaka and Chittagong city that a family size of more than seven people are depending mostly on public buses. The situation is different in Jessore City in comparison to other cities in Bangladesh.

Trip distance by different modes

Urbanites always feel convenient to take rickshaws in Jessore City. However, walking is also a very good choice for shorter trips. Table 2 shows that almost half of the total regular trips in Jessore City are made on Rickshaw and 19% are made on foot. At the same time, it can be seen that motorized modes are not dominant at all in this city which is completely different in Dhaka, Chittagong and Khulna cities in Bangladesh. Dhaka as a mega city, people are depending more on motorized transports for their daily trips. According the strategic transport plan of Dhaka City, it shows that motorized trips comprise at least 65% of daily trips in Dhaka. However, rickshaw is also a dominant mode of transport in Dhaka which comprises almost 20% regular trips.

Table 1 - Modal choice according to family composition

Family size	Mode choice(in percentage)									Total
	Walking	Rickshaw	Van	Cycle	Motorcycle	Bus	Baby/ taxi	Car/Jeep	Others	
3	3.8	7.3	.4	1.5	3.1	.4	1.5	1.1	.4	19.5
4	8.8	23	3.4	.8	3.4	.8	2.7	1.9	0	44.8
5	10	10	.4	1.5	4.6	.4	1.5	.4	0	28.7
6	1.1	1.5	0	.8	0	0	.8	.4	0	4.6
7	.8	0	.4	.4	0	0	0	0	0	1.5
8	.4	.4	0	0	0	0	0	0	0	.8
Total	24.5	42.1	5	5	11.1	1.5	6.5	3.8	.4	100

Source: Field survey (2008).

Table 2 - Travel distances by different modes of transport

Mode	Travel Distance (in km)						Total trips
	Less than 1	1-2	2-3	3-4	4-5	Above 5	
Walking	11	6	2	0	0	0	19
Rickshaw	10	30	9	2	0	0	51
Van	0	0	1	0	0	0	1
Cycle	2	1	9	2	0	0	14
Motorcycle	2	1	2	2	0	0	7
Bus	0	0	0	0	0	1	1
Baby taxi	0	0	3	1	0	0	4
Car/Jeep	0	0	0	0	1	0	1
Others	0	1	1	0	0	0	2
Percentage	25	39	27	7	1	1	100

Source: Field survey (2008).

In the above table, it can be seen that cars and baby taxis only comprise 5% of the total daily trips in Jessore City. It also depicts one clear notion that the pollution from transportation is very less in this city.

Reasons for selecting the mode

In Figure 12 it can be seen that most of the trip makers select that mode for inexpensive reasons. About 40% people select that mode for this reason.

Jessore City is among one of the oldest cities in Bangladesh. However, the economy is shrinking a lot after the liberation in 1971. Almost 45% people are still depending on agricultural jobs in compare to only 8% in Dhaka and 14% in Khulna city. For instance, people are trying to find the cheapest mode of transport in here. Most of the people depending on non motorized transports for their regular trips those are less expensive and more time consuming. However, almost 17% people are concerned about their safety to and from the destination. This is typically a situation that well describes the travel behavior in one of the poorest countries in the world. Only 5.5% travelers notice that they do not have alternative choices to make a trip. This is happening especially for the people who are living in the outskirts of the city. In that case, people need to depend either on bicycle or motor cycles to come to the city center for different purposes.

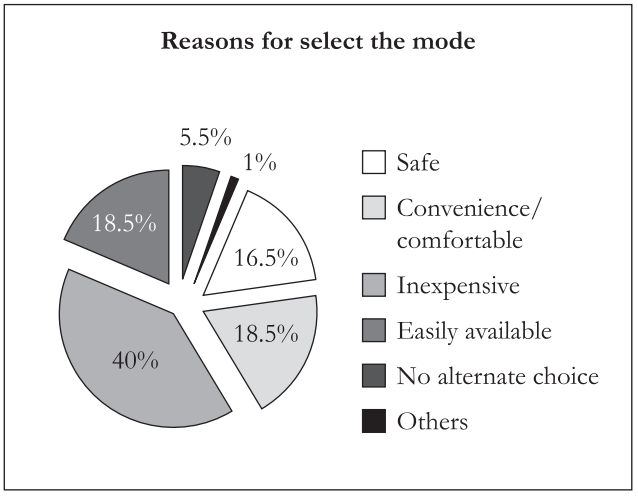

Figure 12 - Reasons for selecting specific mode
Source: Field survey (2008).

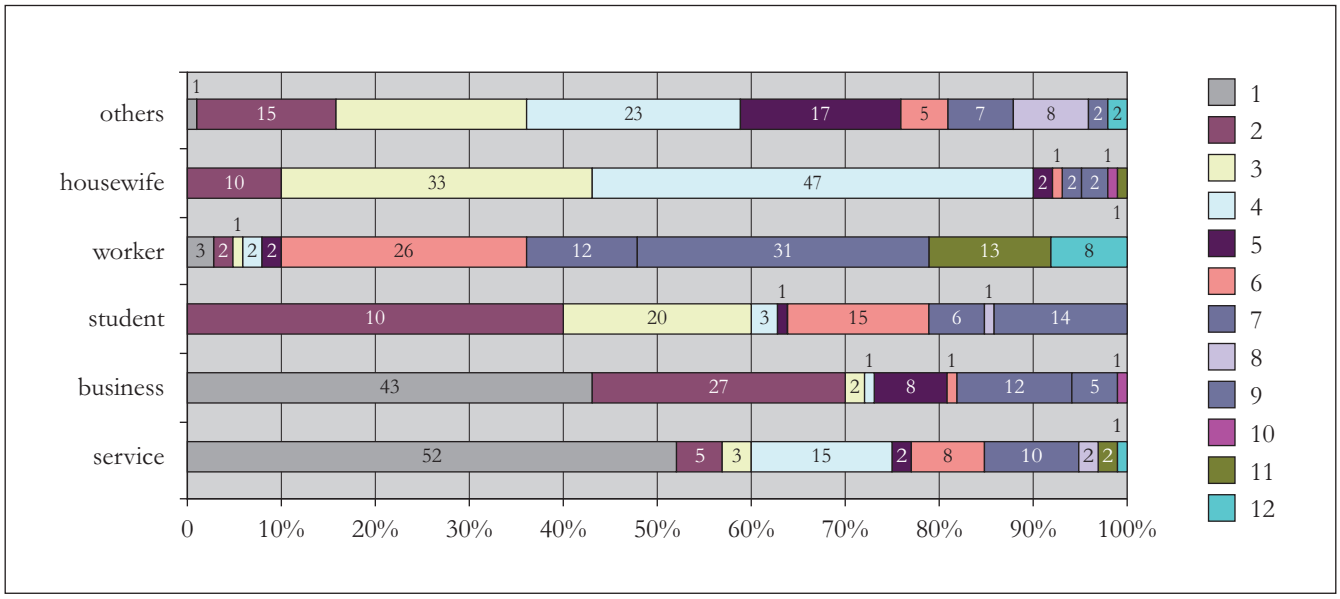

Figure 13 - Occupation wise trip distribution
Source: Field survey (2008).

Occupation wise trip distribution

From the study area different occupation of people are going to the other zones for different purpose at different time. Following chart represents the occupation wise trip distribution by different time at different zone. In this figure it is seen that service and business person trip flows are dominated in TAZ-1 which is respectively 52% and 43%. On the other hand student's trip flows are dominated in TAZ-2. Worker and housewife trip flows are dominated in TAZ-9 and TAZ-4.

The above figure represents trip distribution by profession among different TAZ in Jessore City. The TAZ map can be found in Figure 2. It has been depicted from the figure that business people are making diversified trips among the zones than other professional people. This means, business people need to spend lot of time and money for their trips among the zones and interestingly those people are depending mostly on motor cycles to avoid the traffic congestations especially in the rush hours.

Conclusions

Jessore City is still growing as an economic hub in the south western part of Bangladesh. The largest land port is attracting more businesses and investments in this area to tie a nod with India in terms of importing and exporting goods. Bangladesh is supplying lots of shrimps and leather goods to India every year which are going through the land port. Besides, the fish items and fish products are exporting through Benapole land port. Motorization rate is growing faster in India and in other parts of Bangladesh. However, Jessore is still depending more on non-motorized transportation modes and on tradition modes of transportation especially for carrying goods and passengers within the district.

Jessore municipality has shelved its municipality plan which included the municipality transport and mobility plan back in 1998. Revision of those plans have not conducted because of financial crisis and funding. As a result, this study is highly based on primary information that has been collected during field survey and during interview survey to the households. Secondary sources of information has not been found so far as travel behavior survey or documents are not conducted either by the municipality or by the local governing bodies earlier to predict motorization rate and choice of transportation modes. In Jessore City, rickshaw is the most popular and most widely available mode of travel from almost last two decades. The second popular mode of travel is bicycle and the city is also known as bicycle city in Bangladesh. According to the findings of this research, rickshaw,

bi-cycle and walkers made almost 73% of all trips. For shopping trips, rickshaw constituted the highest percentage as well. This study exposed that most of the trips were made in the morning hours between 5 AM to 9 AM and evening hours between 5 PM to 8 PM. The results also depict that people always choose the mode considering money and convenience. Rickshaws can offer the most convenient trip from door to door service within reasonable cost. This is one of the reasons that people are choosing rickshaws over other mode of transports. The bicycle is an important mode for the low- and mid-income households in Jessore City because the maintenance cost is almost flat for a bicycle in whole year. Walkers are also enjoying trips especially for short distance. Walking mode may also be used because public transport is expensive for short distances.

This research work is thus an attempt to let the municipality, local government organizations and stakeholders in Jessore City know about existing travel behavior of urbanites based on primary survey. More scientific research is in demand to represent the situation in detail so that cities in the south western part of Bangladesh can understand the need of transportation planning within their own territory. It is therefore hoped that the results will provide transport administrators with a better understanding of travel pattern of Jessore City to offer a safe and convenient transportation plan to the local people.

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