HOW SAFE ARE THE WALKERS IN DHAKA CITY? A COMPREHENSIVE APPROACH TO MODEL PEDESTRIANS' SAFETY IN DHAKA

1. INTRODUCTION

Walking is by far the most important mode of transport, as it not only acts as a crucial link for inter-modal transfers in major activity centers, but also helps to fulfill recreational and utilitarian trips (Sheila Sarkar, 2001). When designing circulation systems, it is important to recognize that walking is not only an integral part of the network, but that it can also fulfill many activities in an environmentally sensitive way. A comfortable environment makes a journey by foot pleasant and enjoyable. However, in Dhaka city, about 40% trips are making on foot but the pedestrians are facing many problems while using the walkways (Strategic Transport Plan, 2005). A lot of research works are going on for assessing the pedestrian's level of services in the developed nations but in developing countries like Bangladesh, it is not a significant one for the transport planners. It is because; the transport planners or researchers are always emphasizing the problems of the motorized vehicles. Besides, budget allocation is not sufficient to continue research in the field of pedestrians. However, the pedestrians are not well aware of their comfort level as well as safety issues. They don't have any place to complain nor even any instructions for them to use the walkways properly. In this paper, the pedestrian's safety has been divided into three different parts as: Buffer, Sight Distance and Accident Vulnerability to the pedestrians. These three different variables have been measured in a comprehensive modeling using ordered probit model to build relationships and dependency on other socio-economic and physical aspects of the city's walkway.

2. OBJECTIVES

The specific objective of this paper is:
- to know the status of pedestrian's safety in Dhaka city and
- to develop a comprehensive model that may express the condition for the policy makers to take some actions for the betterment of the walkways in Dhaka city

3. STUDY AREA

Dhaka, the capital of Bangladesh is located at the central part of the country with having a 10 million population (TMP, 1998). This city is now called one of the mega cities of the world. The urbanites of the city are depending on foot for 60% of their daily trips.

The figure bellow shows 5 different blocks that have been selected for the present study. Five blocks offer five different characteristics. For this, the pedestrian's level of service could be different. Mohakhali is a transit area for the daily commuters. Here people are coming from the hinterland by bus and then walk for changing another mode of transport. Farmgate is located at the central part of the Dhaka city area which offers commercial and transit areas for the urbanites and for the commuters as well. Malibagh is a mixed use area with many residential buildings and many shopping areas. New Market area is composed with some institutional land use and with

some shopping centers. Well known Dhaka University campus is very close to this area and some other institutions are at a walking distance too. However, CBD area is fully composed with the service area and commercial district of the city.

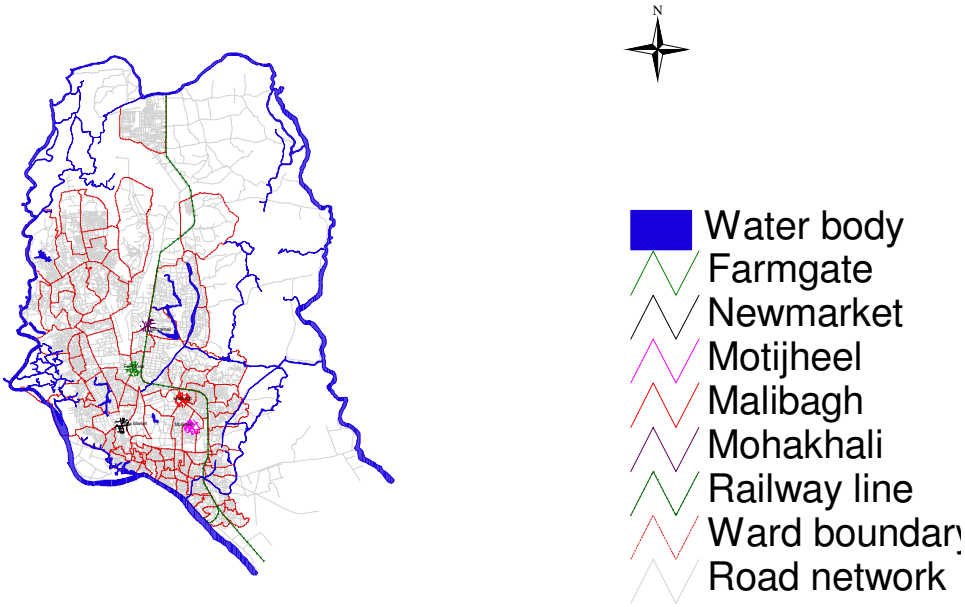


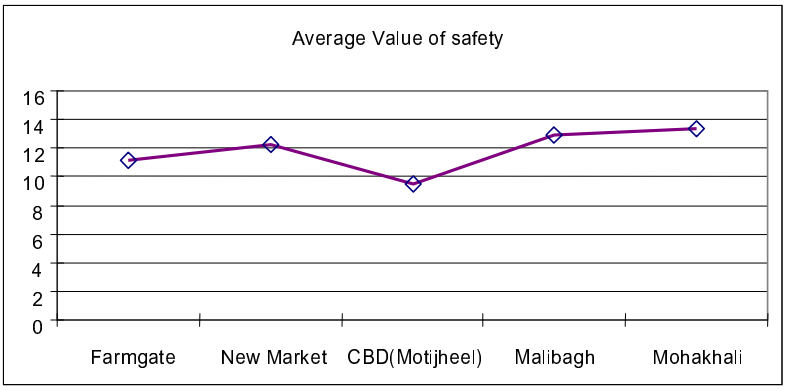
Figure 1, Road map of Dhaka City with the 5 study blocks

By considering all the 5 blocks different types of pedestrians were found. This data is very important to focus the total impression of Dhaka city and its walkway environment indeed.

4. SOME BASIC FINDINGS OF THE STUDY

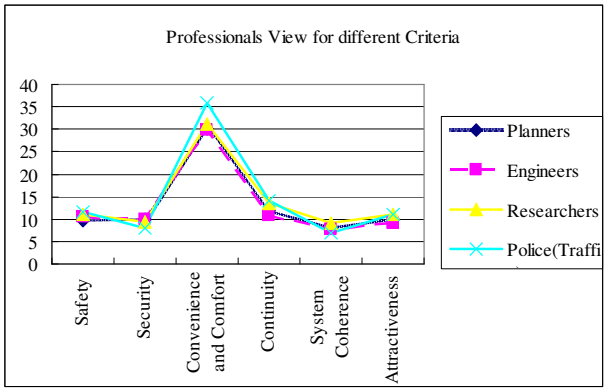
Some basic facts and findings can be summarized here after the field investigation. While considering the issue of pedestrian safety, we got a scale of 1 to 5 were found where 5 means the worst condition of safety in the studied blocks and 1 mean the best case in each block surveyed from the walkers. Figure 2 shows the average safety value in 5 different study blocks in Dhaka City. In the developed scale, 1 means the best case and evaluation from the walkers and 5 means the worst case in this survey. In total, 500 samples were surveyed to carry out this study. In each study block, 100 questionnaires have been surveyed to know the pedestrian's level of satisfaction.

Figure 2, Average value of safety in 5 studied blocks .(Source: Field Survey, 2006)



Among the 5 studied blocks, Mohakhali area got the worst case for pedestrian safety. In fact, safety has been considered here in three different aspects like: Buffer (the item or fence that segregate walkways from the road space), sight distance (minimum sight distance of the moving vehicles from the walkways at intersections) and accident vulnerability (openness of the walkways at the major intersection to promote more injuries). At the same time, it can be seen that in Motijheel area, the safety value is better than any other studied blocks. This could be one of the reasons as Motijheel got wider walkways (almost 10 feet wide) in compare to other places (almost 6 to 8 feet wide). However, in Dhaka City, walkers consider safety as one of the major criteria while using the walkways in daily basis. But the professionals also see walkways should be given proper convenience and comfort to the walkers so that they can easily use the given facilities. Following graph will show the six different criteria and the views from the experts.

Figure3, Different professional's view regarding safety and other criteria for walkers in Dhaka City.(Source: Field survey 2006)



From the figure 3, it can be seen that Planners, engineers, researchers and traffic policemen all consider walkways as one of the major means of transport and give their valuable comments while interviewing them. The total scale was considered from 1 to 40 where 1 means the best case and 40 means the worst case for Dhaka City's walkway evaluation. Traffic policemen consider safety as the major problems in compare to other professionals as the policemen are the main witnesses of regular injuries of walkers in everyday life. However, everybody also considers convenience and comfort as one of the major issues while giving their opinion regarding this study.

5. USING ORDERED PROBIT MODEL

Ordered probit models were calibrated for investigating factors that are affecting the socio-economic as well as the observation data for getting the relevant output. Probabilities of dependent variables (for example *Y*) are formulated as follows (Alpu, 2004):

$P(y=1) = \Phi(-\beta x)$

$P(y=2) = \Phi(\mu_1-\beta x) - \Phi(-\beta x)$

$P(y=3) = \Phi(\mu_2-\beta x) - \Phi(\mu_1-\beta x)$

$P(y=4) = \Phi(\mu_3-\beta x) - \Phi(\mu_1-\beta x)$

……..

$P(y=n) = 1 - \Phi(\mu_n-\beta x)$

The μ's are unknown threshold parameters to be estimated with β. Explanatory variables x were identified by both the observation and the questionnaire survey conducted in the field. Based on this analysis, there are almost 3 output models in this study. Safety has been measured in considering three several variables like: buffer, sight distance as well as the threat or vulnerability to pedestrians while walking on the streets. Sight distance did not bring any significant impact with socio-economic considerations in this study. For instance, buffer and accident vulnerability were combined to plot possible problems with pedestrians in Dhaka. These models are now discussed below.

5.1 Buffer

Buffer is defined here as the separated fences or other materials that is dividing the carriage ways and walkways to ensure safety for the walkers. In Dhaka city, iron/steel sheets have been in place to offer the buffer for pedestrians so that they can get rid of from any possible collision with the motorized transports.

Table 1, Model estimation for buffer in Dhaka

Variables	Coefficient	t – value
Sex	-0.100326	-0.813661
Age group 0 to 15	-0.374512	-1.84648
Age group 16 to 45	-0.372692	-2.23561
Income less than 1500 taka	0.529391	1.55312
1501 to 3000 taka	0.841317	2.44640
3001 to 5000 taka	0.764200	2.21868
5001 to 7501 taka	0.421805	1.19289
7501 to 10000 taka	0.591591	1.66156
Buffer Material (steel)	-1.35490	-7.70770
Broken Buffer at every 20ft.	1.07581	6.12073
Broken Buffer at every 30 ft.	-0.148214	-0.909240
μ_1	1.69877	14.6898
μ_2	4.03580	21.7675
L(c)	-586.49	
L(θ)	-419.79	
Sample Size	500	

In the table 1, the output model of the variable buffer can be seen. In this model, it can be seen that women pedestrians feel more uncomfortable than men walkers if there is no buffer in place (dummy variable was declared in this model to compare the level of satisfaction between men and women pedestrians). At the same time, lower income group of people feels problem if there is no buffer in place. With the basic information from other researches, it has been observed almost 55% of the walkers are fallen into the lower income group (Khan, 2006). Besides, pedestrians feel more secure if they see steel or iron buffers than wooden made dividers on the streets. This model is an output of socio-economic data observation survey and questionnaire survey from the

pedestrians. The sample size was 500. However, the L(c) and L(θ) reflects the aspects of possibilities of introducing the explanatory variables in the research.

5.2 Accident Vulnerability

Accident vulnerability implies the possible threats to the walkers with any possible collisions with motorized vehicles or with other non-motorized modes.

Table 2, Model Estimation for Accident Vulnerability of the Pedestrians

Variables	Coefficient	t – value
Sex	-0.075551	-0.6153
Age group 0 to 15	-0.128711	-0.6315
Age group 16 to 45	-0.279939	-1.68012
Income less than 1500 taka	0.764796	2.3096
1502 to 3000 taka	0.688790	2.06097
3001 to 5000 taka	0.631827	1.8853
5001 to 7501 taka	0.599977	1.74137
7501 to 10000 taka	0.331882	0.961245
No fatal Injury	3.44433	6.88454
Less than 5 Fatal Injury	3.59435	6.95826
No serious Injury	-0.998345	-7.93544
μ_1	1.11327	11.1887
μ_2	2.97634	23.7810
L(c)	-490.57	
L(θ)	-442.95	
Sample Size	500	

In the same way, the model calibrated in ordered probit model for accident vulnerability can be found in table 2. Here, the notion is that women walkers feel more problems and threats while using the walkways in Dhaka than male walkers. At the same time, the lower income group has more threats than the high income group for accident as poorer groups are walking more to save money (Khan, 2005). In the same way, the other variables imply the present scenario of pedestrian's problem in terms of safety in Dhaka case.

6. RECOMMENDATIONS

Present study shows that walkers feel comfortable if there are any buffers on the streets to segregate the walkways from the carriage ways of the streets. In this regard, steel made buffers have got better values in compare to wood made or concrete made buffers. Policy makers thus easily bring this idea to implement any possible projects with the likings of pedestrians in Dhaka city. On the other hand, pedestrians also felt problems with possible threats to accident. In this regard, the policy makers or researchers must bring out better road design options considering the pedestrians as one of the major parts in transport management.

7. CONCLUSION

This research is an attempt to use several data sets for using it in a comprehensive model building so that the issues of socio-economic conditions of the walkers reflect the evaluation of existing system of the walkways. Indeed, a 1 to 5 scale has been introduced to evaluate the present system before the walkers. Often, the pedestrians might bias with any decision while they filled up the information in the questionnaire sheet. To overcome this error, observation survey brings support to build this model so that the information can be cross-checked. Finally, this research is also focusing one of the neglected areas of transportation planning so that pedestrians' safety and security can be ensured through proper planning interventions.

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