Please cite this article as:
Hoque, M.S., Debnath, A.K., and Mahmud, S.M.S. (2006) Road Safety of Garment Industry Workers in Dhaka City. In: Proceedings of the International Conference on Traffic Safety in Developing Countries, Dhaka, Bangladesh, pp.489-498.

IMPACT OF GARMENT INDUSTRIES ON ROAD SAFETY IN METROPOLITAN DHAKA

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ABSTRACT:

There are about 4,000 garment industries in Bangladesh, most of them are clustered in and around the capital city. Together they account for 75 percent of the country's export earnings and employ around 1.8 million people which is almost one half of the total industrial workforce of the country. Though it is the most important economy sector of Bangladesh, unplanned and haphazardly built garment factories are also inducing many social, housing and most importantly urban transportation problems which are a great cause of concern. This study investigates the impact of garment industries on transportation, in particular road safety issues of garment workers. Data is collected to identify the locational problems of garment factories, spatial distribution of worker residences, and their travel pattern as well as to assess their walking and road crossing problems. Finally, recommendations are put forward to tackle transport problems arising from these unplanned establishments of export oriented garments industries in Dhaka Metropolitan City.

INTRODUCTION

In Bangladesh, ready-made-garment (RMG) industry has emerged as the most important economic sector and accounts for employing approximately 1.8 million people which is one half of the total industrial workforce and contributing about a quarter of the gross value-addition in the manufacturing sector [Bhttacharya, D. and Rahman. M (2001)]. Export earning from this sector accounts for more than 75% of Bangladesh's total export earnings. As a result, the foreign exchange reserve of the country largely depends on the ready-made-garment (RMG) sector. This is the only sector that has achieved phenomenal growth almost unaided by anybody. Today more than 4000 RMG units together exporting $ 5 billion worth of clothing every year contribute about 9.5 % to GDP [Haq F. (2005)]. It has empowered some 1.5 million female workers with economic power and independence which in turn has earned for the economic recognition as an emerging nation [Montero D. (2005)].

Besides these positive hallmarks of this sector, it has also created negative impact on social, housing, transport and most importantly workers safety and security problems. Among 4,000 garment factories in Bangladesh, about two-thirds are mushrooming in and around Dhaka city. Due to lack of strict landuse planning and control, most of the garment factories are established mainly besides the major arterial roads and using buildings that are built primarily either for residential or commercial use and without giving any attention to inevitable consequences of these labour intensive factories on fragile urban transport infra-structures.

Development of these garment industries in the core areas of Dhaka city, not only induced huge influx of pedestrian traffic but also generated large sized semi-trailer truck movements for which city roadway facilities are not planned. Besides, establishment of these labour intensive industries in the high rise buildings, pose a great safety concern particularly in case of fire.

This paper addresses only transport problems that are induced by unplanned development of garment industries in Dhaka Metropolitan city.

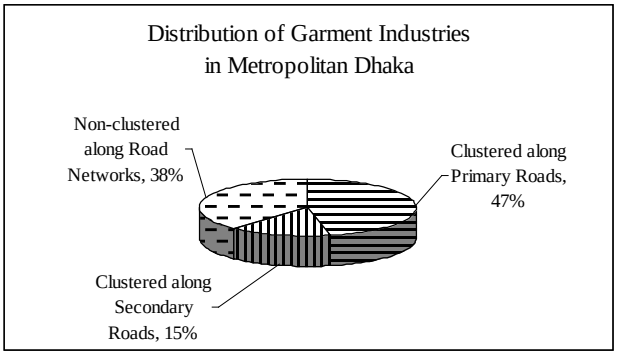
LOCATION OF GARMENT INDUSTRIES AND EMPLOYMENT SITUATION

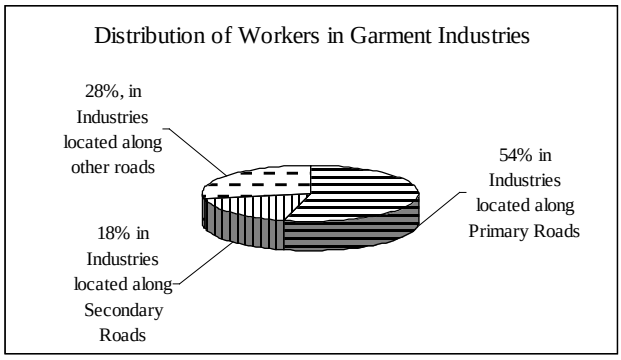
In order to find spatial location and employment statistics of each garment industry of Dhaka city, necessary information is collected from the head office of Bangladesh Garment Manufacturers and Exporters Association (BGMEA). Based on the gathered information a comprehensive database is developed that comprises name, address, number of employees, etc. of each garment industry that are enlisted with BGMEA till 2004 [BGMEA (2004)]. Analysis of database shows that there are a total of 2960 enlisted garment industries in and around Dhaka Metropolitan City and about 1,070,754 workers are employed in these industries [Debnath, A.K. (2005)]. Among the total labour force about 90% are female workers. Out of the analyzed 2960 garments industries, from Table 1 and Pie Charts it is observed that about 62 % are found to be clustered along the primary and secondary roads of Dhaka city and located within the central business district (CBD) areas. The remaining 38 % are spreaded scatteredly along the city road network. Clustering is considered if more than one industry is found to be bunched together at a particular location. Table 1 also reveals that all together about 72 % workers are working in these industries. Spatial distribution of clustering type of garment industries is shown in Figure 1 superimposing them on Dhaka City Road Network Map.

Table 1: Summary Statistics of Garment Industries

Clustering*/Non-Clustering	No. of Garments Industries	Percentage	No. of Employee	Percentage
Clustered along Primary Roads	1,380	46.62	576,454	53.84
Clustered along Secondary Roads	452	15.27	191,666	17.90
Non-clustered along Road Networks	1,128	38.11	302,634	28.26
Total	**2,960**	**100.00**	**1,070,754**	**100.00**

*Note: * Clustering is considered if more than one industry is found to be bunched together.*





From Table 2 and Pie Charts it can be seen that nearly 47 % garments industries are bunched together along the busy primary roads namely Airport Road, Begum Rokeya Sharani, Progoti Sharani, Mirpur Road and these industries are attracting about 54 % workers of total labour force that are engaged in garment industries of Dhaka City. Table 3 and Pie Chart also show that 15 % industries are flocked together along the major secondary roads of Dhaka city and about 18% workers are employed in these industries.

Table 2: Number of Garments Industries and Employees along Different Primary Roads

Name of Primary Roads	No. of Garments Industries	Percentage	No. of Employee	Percentage
Airport Road	432	31.3	195,485	33.91
Rokeya Sharani	354	25.65	144,973	25.15
Progoti Sharani	353	25.58	144,029	24.99
Mirpur Road	241	17.46	91,967	15.95
Total	**1,380**	**100.00**	**576,454**	**100.00**

Table 3: Number of Garments Industries and Employees along Different Secondary Roads

Name of Secondary Roads	No. of Garments Industries	Percentage	No. of Employee	Percentage
Motijheel C/A	146	32.30	68,284	35.63
Elephant Road	75	16.59	34,498	18.00
Purana Paltan	43	9.51	15,718	8.20
Dilkusha C/A	42	9.29	17,832	9.30
Kamal Ataturk Avenue	36	7.96	20,169	10.52
Motijheel Circular Road	36	7.96	10,348	5.40
Kachukhet	26	5.75	9,534	4.97
Kafrul, Ibrahimpur	24	5.31	7,175	3.74
Naya Paltan	13	2.88	3,419	1.78
Mirpur # 14	11	2.43	4,689	2.45
Total	**452**	**100.00**	**191,666**	**100.00**

Further from Table 2 it appears that among the primary roads, maximum concentration of garment industries are along the Airport road where 31 % industries are situated and attracting nearly 200,000 workers a day. In the ranking, the next highest congregation of industries are found to be at Rokeya Sharani (26 %), Progati Sharani (26 %) and Mirpur road (18 %). Everyday these industries are generating 145,000, 145,000 and 92,000 workers movements respectively. Field investigation reveals that most of these garment industries are established very near to the main roads, without any provision of service road and in particular compromising with workers commuting safety. Close proximity of these industries to main busy roads are creating undue and hazardous conflicts between through traffic as well as large sized semi-trailer based feeder vehicles and most importantly between workers in the form of pedestrians and high speed vehicles.

Among the next group of garment industries that are located along the secondary roads, Table 3 shows that Motijheel Commercial Area C/A is the most densely populated garment industrial area. A total of 146 and 42 numbers industries are found to be clustered along the main streets of Motijheel and Dilkhusha C/A respectively. Field observation reveals that these industries are established within many high rise commercial buildings and are generating nearly 68,000 worker movements in the busy central business district (CBD) areas. Mushrooming of these garment industries in CBD areas is not only creating unhealthy mixed landuse pattern, also creating hazardous conflicts between large number of pedestrians and vehicular movements. Similar types of problems are also found with other secondary roads of Dhaka city namely Elephant Road, Purana Paltan, Kamal Ataturk Avenue, Motijheel Circular Road, Kachukhet Kafrul, Ibrahimpur etc.

LOCATION OF GARMENT WORKERS RESIDENCE

In order to get information regarding garment workers' residence, workplace, income level, mode of travel, travel expenses etc. a questionnaire survey is carried out among the garment workers of the study areas. A total of 228 workers are randomly interviewed at their workplaces. Among the respondents there were 90 % female and 10 % male workers. From the analysis of questionnaire survey, it is found that by and large the garments' workers live in the fringe areas particularly in the Eastern and Western low lying areas as well as

in different slum areas of Dhaka City. Analysis of spatial distribution of workers' residences shows that most of the workers of Mohakhali, Rampura, Motijheel C/A, Elephant Road, etc. are originating from the Eastern part of Dhaka like Badda, Guran, Bashaboo, Madartech, Kamalapur etc. The slums at Damalcoat, Vasantak, Begunbari etc. areas which are located inside the city are also providing workers' housing. The workers of Mirpur road, Dhanmondi area and Green road live mainly in the Western low-lying areas like Diabari, Harirampur, Kamrangir Char, Nawabganj, Hazaribagh etc. Workers' housing areas i.e. origins of garments' work trips are schematically shown in Figure 1 superimposing with Dhaka City Map.

From the questionnaire survey analysis as presented in Table 4, it is found that 26 % workers get salary in the range of Taka 1000 - 1500, 63 % get Taka 1500 - 2000 and the remaining 11% get Taka 2000 - 2500. This revelation essentially suggests that the workforce engaged in this sector is poorly remunerated. With this meagre amount of take-home salary, they are compelled to live in slums and low-cost slum areas at the city periphery. Analysis of workers' house rent expenses as shown in Table 4 reveals that out of 228 workers surveyed, 19 % spends less than Taka 500 only, 48 % spends in the range of Taka 500 - 800, 18 % spends Taka 800 - 1000 and only 15 % spends more than Taka 1000 for this purpose. By and large those who live without family spend 40 % of their income for house rent and forced to live outside the built-up areas forming mess system.

It is also found that due to very low income level, poor garment workers are not only forced to live in miserable conditions at slump areas also about 88 % workers can not afford to pay travel expenses and are compelled to commute on foot and only 12 % workers are using bus services. Non-availability of cheaper and female friendly public transport along their travelling direction is another main reason for the high percentage of walk trips. Though, bicycle is considered as one of the cheapest and affordable modes of transport for low income group people but as most of the workers are female, this space efficient mode are not playing any role to solve their transport problem. Moreover, it is observed that even male workers are also not using bicycles for commuting purpose. When they were asked about this, they mentioned lack of purchasing capacity and having no secured bike-parking stands at workplaces as the main reason for not using bicycle. Finding no other alternatives presently most of the workers are commuting on foot and quite naturally to reduce length of walking trips they prefer to reside in those slum areas that are close to their job places. May be because of this reason, low lying areas particularly that are located at the Eastern and Western fringes of Dhaka city are found to be the most popular residential areas of the poor garments workers. Availability of cheaper mess facilities as well as close proximity (2 - 3 km) of these areas with respect to the position of vast majority of garment industries of Dhaka city are considered to be the main reasons to choose these areas by the garment workers.

Table 4: Summary of Questionnaire Survey Data

Questionnaire Survey Site	Total Person Surveyed	Travel Mode		Take Home Salary (Taka)			House Rent (Taka)				
		Walk	Bus	1000-1500	1500-2000	2000-2500	< 500	500-800	800-1000	1000-1200	>1200
MOHAKHALI	54	48	6	16	34	4	8	22	14	8	2
RAMPURA	50	46	4	8	34	8	10	24	8	8	0
GREEN ROAD	70	58	12	18	44	8	16	38	8	4	4
MIRPUR-10	54	48	6	18	32	4	10	26	12	6	0
Total	**228**	**200**	**28**	**60**	**144**	**24**	**44**	**110**	**42**	**26**	**6**
Percentage		87.72	12.28	26.32	63.16	10.53	19.3	48.25	18.42	11.4	2.63

IMPACT OF GARMENT INDUSTRIES

Having locations of both garments industries and workers residences on the city map, O-D analysis and field observations are made in order to assess the impact of garments industries on road network. Based on workers origins (O) or residences and destination (D) or workplaces, desired lines (O-D) of travel paths are

shown in Figure 1. From the Figure it can be seen that in general O-D lines are aligned in the E to W and W to E directions, whereas all the major arterial roads of Dhaka city are oriented in N to S direction. In consequences, huge walk trips generated by the garment industries are directly conflicting with the high speed vehicular traffic of many primary and secondary roads. Field observations reveal that in the absence of adequate pedestrian friendly walking facilities, the garments workers are being forced to walk on the active carriageways and thereby exposing themselves to the main road traffic and increasing possibilities of pedestrian-vehicular conflicts.

This undue conflicting situation is not only causing safety hazards for the workers but also reducing effective width of carriageway by a big margin. From the field observations it is seen that serious safety situation occurs particularly in the morning shift when workers have to face and negotiate lightly travelled high speed traffic stream. Moreover, in the morning hour it is observed that due to unsaturated traffic streams, workers get more opportunity to make short cut and to cross the roads randomly without using the designated road crossing facilities. This uncontrolled crossing behaviour and undue conflicts with the high speed main road traffic increases pedestrian safety hazard significantly. On the contrary, in the afternoon shift, field observations reveal that high volume of pedestrian and over saturated vehicular traffic recurrently cause serious congestion as well as safety problems at many primary and secondary roads of Dhaka city. Female workers hardly get any easy chance to cross the roads randomly along their desired directions and have to wait a long time for crossing. As such, during the afternoon peak periods, frequent forced crossing attempts seriously interrupt smooth flow of traffic operation and thereby affect level of services (LOS) of primary roads significantly.

In order to assess the pedestrian safety situation of Dhaka Metropolitan area, in particular relation to garments worker, accident analysis is carried out by using MAAP software for the period of 1998 – 2004 and considering pedestrian casualty data for 15 - 30 years age group, as most of the garments workers age are within this range. From the hourly distribution of pedestrian accident data as graphically shown in Figure 2, it can be seen that a large number of pedestrian accidents and casualties occurred within the time period of 6 am to 8 am. This essentially supports the findings of field observations, i.e. garment workers encounter serious safety problems in the morning hour as compared to evening peak period.

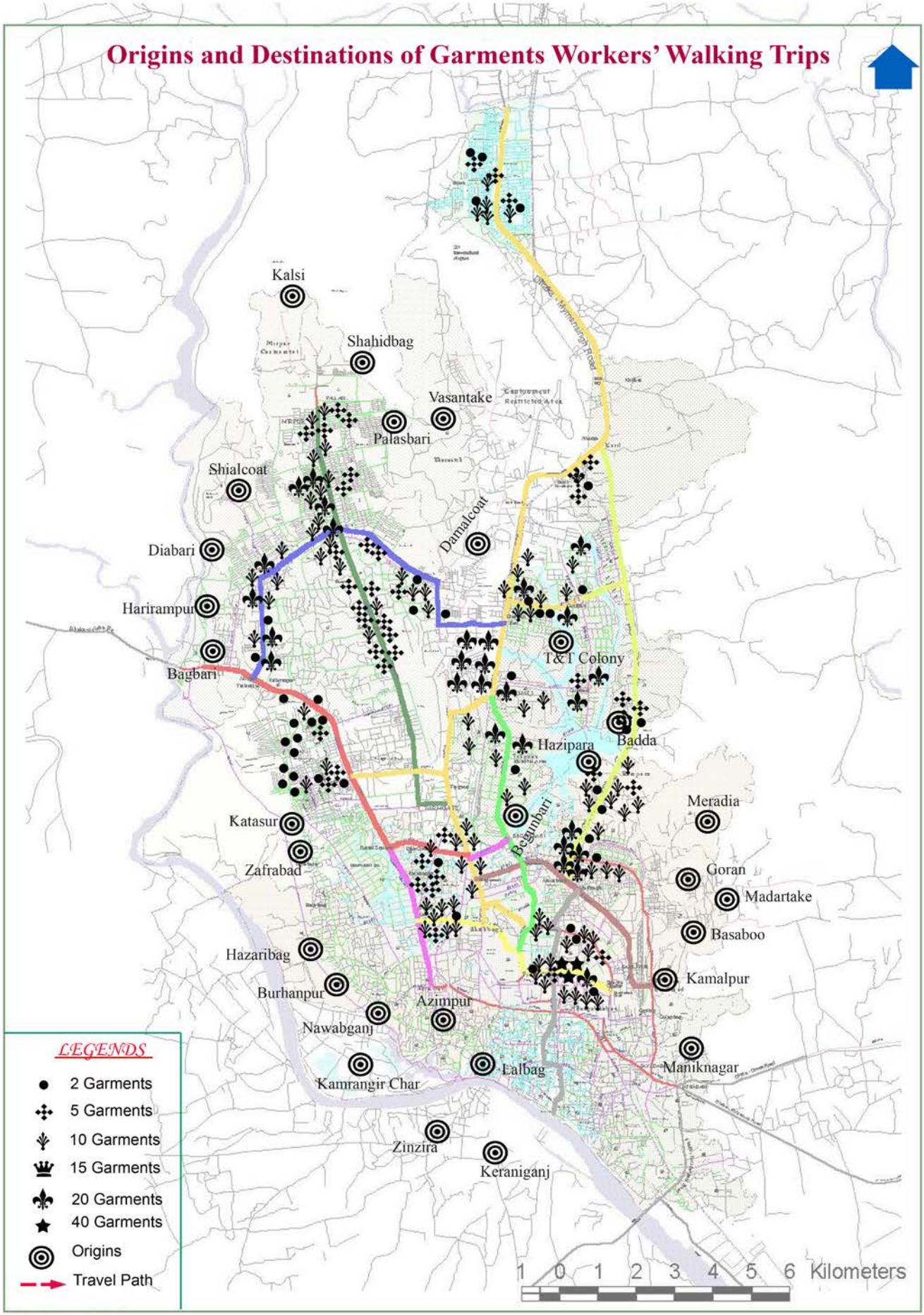
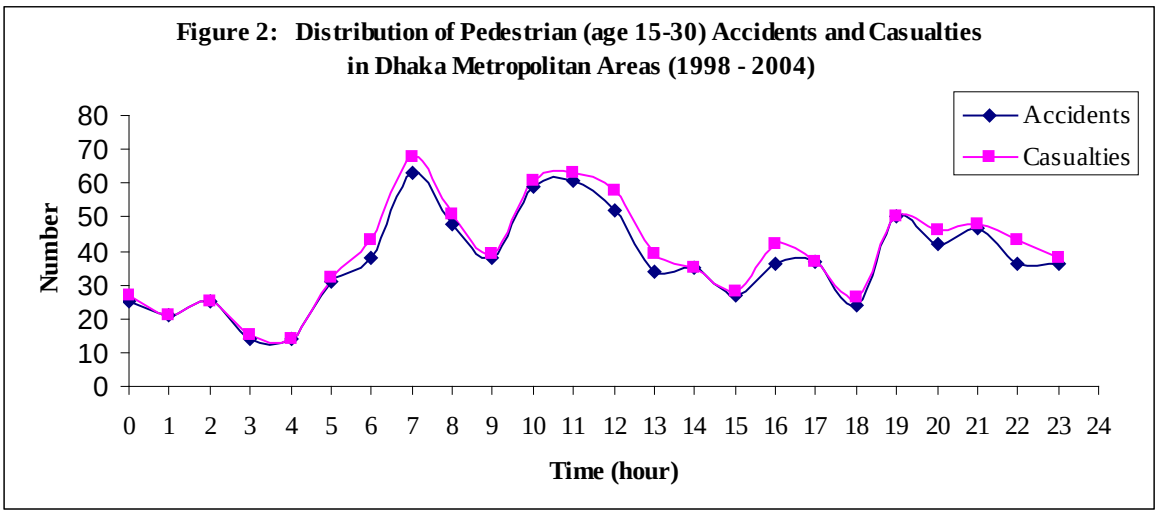
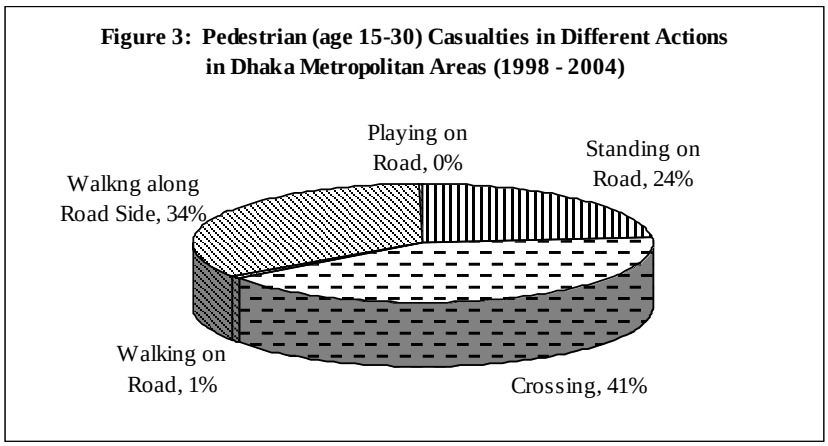


Figure 1: Travel pattern of Garments Workers [Debnath, A.K. (2005)]



Detail analysis of pedestrian accidents as presented in Figure 3, shows that 41 % (392 no.), 34 % (324 no.) and 24 % (224 no.) accidents occurred while they made crossing manoeuvres, walked along the road side and occupied active road space respectively. These huge numbers of pedestrian accidents clearly suggest that physical segregation of pedestrian and vehicular traffic is very urgent.



In another study [Haq F. (2005)] it is also evident that unplanned establishment of garment industries in the core areas of capital city is responsible for the existence of many slum areas and to some extent blamed for unplanned expansion of Dhaka city particularly in the Eastern and Western fringe areas. Further, high concentration of garment industries in CBD areas is creating unhealthy mixed landuse pattern which in tern is breaking the discipline in trip generation and attraction patterns, producing hazardous conflicts between large number of pedestrian commuters and vehicular traffic and in consequence making urban traffic control (UTC) and management particularly traffic signal design and enforcement very difficult.

WORKERS WALKING AND CROSSING PROBLEMS

It is reported by the garment workers that while walking, the main problem is posed by encroachment of footpaths in many descriptions. Besides encroachment problem, overall effectiveness of footpaths is also undermined by presence of uncovered manholes, electric posts, signposts, traffic signals, footbridge landings etc. This poorly sited street furniture prevents full use of the footpaths, impede visibility of road users and thereby make workers movements uncomfortable and hazardous. Eventually, in the absence of functional footpaths, the workers are pushed to walk on the active roads. Moreover, due to foul use of road sides particularly for stacking construction materials, uncontrolled parking and placing garbage bins etc., workers are further compelled to by-pass them by going deep in to the main roads and thereby increasing possibilities of road accidents. On account of inadequate network of city's drainage system, many of the city streets get flooded during the rainy season whenever there are heavy downpours and causes great suffering to the

workers. Another threat to the pedestrian safety is often created by different utility agencies when they dig up roads for laying pipes and cables.

It is also reported that while crossing, in general motorist show little respect to garment workers, voluntarily drivers hardly give away any easy crossing opportunity. Instead they harass them by sounding of horn and forcing them to run away quickly. As such, as an individual finding difficulties in roadway crossing, particularly at the mid-block, often forms group to exert pressure on the moving traffic stream. Moreover, due to the hostile attitude of motorists, often pedestrian especially female workers who are very much neglected by the motorists, cross road without paying any attention to the oncoming vehicles and literally force motorist to slow down their speed. The following Photographs are taken to demonstrate this type of desperate crossing behaviour by female workers. Moreover, hawker's problems of foot bridges discourage them to use the facilities particularly in the afternoon shift. On the other hand, with no generator facility when power failure do occurs, the underpasses become blackout and unusable. Power failure as well as absence of street lighting in many lanes/by-lanes also poses security problems for the night shift female workers.

At Mid-block Locations Desperate Attempts

of Roadway Crossing by Garments Workers

Further, it is evident from the questionnaire survey that due to the absence of continuous functional primary road in the East-West direction, at present there is no affordable public transport system to cater for poor people's walk trips. The workers have to rely on foot and need crisscrossing and meandering through many narrow alleys, local streets, secondary roads, and finally have to cross busy high standard primary road, most of the cases at at-grade level, to reach their workplaces. Interestingly though, the survey results show that in the East-West direction, due to proximity of the slum areas with respect to the job places, the average length of garment workers walk trips is as short as 1 to 2.5 km. Moreover, in consideration of the fact that workers are poorly remunerated and most of them have to spend about 40% of the salary as house rent, it is obvious that modal shift of these inelastic shorter walk trips would be a very difficult by introducing mass transit system particularly when many women workers have shown special reservation about public transport system.

Last but not the least, the garment workers, in particular the female workers suffer the most during the whole rainy seasons when walking through lanes/by-lanes and local streets become very difficult due to submergences problem as well as splashing of water produced by moving traffic.

CONCLUDING REMARKS

Analysis of database shows that there are a total of 2960 enlisted garment industries in and around Dhaka Metropolitan City and about 1,070,754 workers are employed in these industries. 62 % factories are found to be clustered along the primary and secondary roads and all together 72 % workers are working in these industries. Along the main primary roads viz. Airport Road, Begum Rokeya Sharani, Progoti Sharani, Mirpur Road, nearly 47 % garments industries are found to be bunched together and are attracting about 54 % workers. Everyday these industries are generating 200,000, 145,000, 145,000 and 92,000 workers movements respectively. On the other hand 15 % industries are flocked together along the major secondary roads of Dhaka city and about 18% workers are employed in these industries. A total of 146 and 42 industries are

found to be clustered along the main streets of Motijheel and Dilkhusha C/A respectively and are generating nearly 68,000 worker movements in the busy CBD areas.

Questionnaire survey reveals that garments worker are poorly remunerated (89 % get less than Tk. 2000) and by and large they are compelled to live in the fringe areas particularly in the Eastern and Western sides low lying areas as well as in different slum areas of Dhaka City forming mess system. On an average those who live without family spend 40 % of their income as house rent. 88 % workers can not afford to pay travel expenses and are compelled to commute on foot and only 12 % workers are using bus services.

In general O-D lines of garment workers' trips are found to be aligned in the E to W and W to E directions which are directly conflicting with the high speed vehicular traffic of many primary roads of Dhaka city that are oriented in N to S direction. In consequence, huge walk trips generated by the garment industries are seriously interrupting smooth flow of traffic operation, increasing possibilities of pedestrian-vehicular conflicts and thereby affecting level of services (LOS) of primary roads significantly. Moreover, due to foul use of footpath and road side areas by huge vendors activities, stacking construction materials, uncontrolled car parking and placing garbage bins etc., workers are compelled to by-pass them by going deep into the main roads and resulting increasing possibilities of road accidents. Therefore, it is evident that unplanned establishment of these garment industries in multi-storied residential and commercial buildings that are located very near the main roads of CBD areas of the capital city is not only creating unhealthy mixed landuse pattern but also making hazardous conflicts between large number of pedestrians and vehicular movements and in consequence making urban traffic control (UTC) and management very difficult and unmanageable. The following recommendations are proposed to tackle these problems.

Ideally these labour intensive garments industries should not be built in the multi-storied residential or commercial buildings; instead these should be established in an exclusive industrial park or Export Processing Zone (EPZ). Recognizing this issue as well as to eliminate the impact of huge pedestrian traffic and semi-trailer based container movers induced by these industries on the existing fragile city road infrastructures, the Government should take a long term policy for gradual shifting of these industries to outside the CBD areas like leather industries.

Temporarily, the following immediate action plans may be adopted to improve workers walking and crossing safety and side by side to reduce resulting chronic traffic congestion:

- To ensure safe walking facilities, obstruction-free pedestrian friendly wide-footpath is of utmost importance. It would not be an easy task to find a solution to remove the vast number of vendors with their livelihood dependent on various trades and occupations. In this regard, while a steady policy of rehabilitation may be partially an answer, vigilance and preventive actions by the concerned authorities are required to keep the footpath free as far as possible.
- To ensure safe crossing at the junctions, time separated facilities should be given preference over grade-separated facilities [Waresh M.A. (2001)]. Protection should be given by introducing exclusive pedestrian phase in the signal design. Moreover, in consideration of huge pedestrians crossing demands, the all-red period in signal timing along with provision of at-grade diagonal zebra-crossing facility need be introduced. At the mid-block, grade-separated crossing facilities should be provided matching with the workers desired travel path and should be appended with median barrier and footpath picket rails to make these facilities self-enforcing. Even if grade separated facility is not feasible for any reason, these types of safety barriers should be provided to induce orderly pedestrian movements as well as to prevent random pedestrian crossings.
- To minimize the impact of garment industries induced larger sized freight vehicles on road-traffic system, the loading-unloading facilities of garment products should be improved by providing safe parking area in front of the factory buildings and commensurate policy should be put forward to force the owners of the garment industries to implement it accordingly or otherwise in line with the existing truck access control to the CBD areas between 8 am to 8 pm, this restriction policy may be extended to all types of heavy freight vehicles including semi-trailers, covered vans etc.
- In consideration of difficulties in changing modal shift of inelastic short walk trips of garment workers by introducing mass transit system particularly when many women workers have shown special reservation about the mass transport system and most importantly considering the absence of functional primary road in the E-W direction as well as accessibility problems of fringe areas, female friendly bi-cycle can be promoted by integrating it with the existing road-network system and providing safe and secured bike stands at their job places.

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