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Shaping up of urban transport system of a developing metropolis in absence of proper management setup: the case of Dhaka

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Abstract

The development of Dhaka city transport is beset with a number of problems, hindering the expected shaping up of the system leading to the present sufferings of its population from severe congestion and acute traffic related air pollution. The transport problems are characterized by absence of proper mass transit system of any form for over 10 million population, lack of any form of engineered operation of the transport system, phenomenal growth of non-motorized and three wheeler vehicles, very poor maintenance of roadway infrastructures, lack of integration among modes and virtually no clear institutional setup to see through the problems. Earlier researchers claimed that absence of proper management setup manned with educated transport and traffic engineers was the cause of persistent transport problem in a number of developing cities. This paper investigates the shaping up of different sectors of the Dhaka city transport over recent years and their relationship with management issues. An institutional deficiency in the existing Dhaka city transport management setup has been identified in terms of properly educated staff, assigning of tasks among the involved agencies and a workable interrelationship among the agencies. The investigations in this paper revealed significant influence of this deficiency on the traffic operation, infrastructure maintenance, public transport development and control of traffic related air pollutions.

Keywords: Urban transport management; Institutional deficiency; developing metropolis

1. Background

Dhaka is a densely populated metropolitan area of more than 10 million people. The average annual growth rate of Dhaka city's population during the last three decades has been over 7 percent doubling its population each decade. The population of Dhaka city was 9 million in 1996 and it is expected to increase to 19.5 million in the year 2015. As a result of this increasing population, the travel demand is also increasing very rapidly in

the city causing enormous pressure on the existing transport supply; and the inevitable outcome is by any standard Dhaka does not have a reliable transport system. Persistent congestion and delay coupled with alarming air pollution situation (Hossain et al., 2003) have jeopardized the normal living in the city. The problematic transport system is characterized by the absence of proper mass transit system of any form, lack of any form of engineered operation of the transport system, phenomenal growth of non-motorized and three wheeler vehicles, very poor maintenance of roadway infrastructures, lack of integration among modes and virtually no clear institutional setup to see through the problem. The absence of institutional entities and specialized transport civil engineers in the field of modern transport engineering with respect to immediate and short term transport management and long term strategic transport planning has been claimed to be one of the main causes of the persistence of transport and traffic problems in many cities of the developing world (Huzayyin and Osman, 2001). Institutional development efforts have been emphasized (ESCAP 2001) in order to achieve good governance to ensure efficiency, effectiveness, accountability and transparency in service-oriented organizations of cities. Oni (2001) claimed that, it could make or mar the urban environment depending on the interactive measures and degree of responsiveness to transport planning and management in urban development. This paper investigates the shaping up of different sectors of the Dhaka city transport over recent years and their relationship with management issues.

2. Urban transport management issues

Transport management broadly falls under supply management and demand management. It, therefore, includes the various schemes, measures and arrangements designed and adopted by the transport engineer aiming at making full use of urban transport facilities under the conditions of satisfying community needs and preserving the urban environment. The main areas of action are in the domains of traffic management and control and public transport service planning and monitoring as well as demand management. Therefore, commonly identified tasks of the management setup include functional and detailed designs and engineering drawings of infrastructures, operational plan for bus stops and terminals, designs of isolated signals, coordinated signals and area wide signal coordination systems, traffic signals and bus priorities at street intersections, road marking, roadside signs, formulation of parking policies and measures, issuing of traffic safety warrants, formulation and evaluation of public transport fare policies, evaluation of traffic management schemes, conduction of traffic impact analysis, identification of traffic impact for new land development projects, undertaking engineering, economic and financial feasibility studies, undertaking research and development activities. This paper will investigate the impact of the absence of above management activities on the shaping up of the Dhaka city's transport system.

3. Data collection

Data required for the present study on Dhaka city I include existing institutional setup for managing Dhaka city transport, roadway geometry and control characteristics of selected corridors/or intersections, traffic composition, present fare level for various modes, problems of bus, para-transit operation on selected corridors, present bus route in Dhaka city, present bus operators/investors in Dhaka city, bus fleet size, frequency, operation mode, fare and fleet ownership, delay and travel time information on selected corridors, modal choice, user perception regarding public transport, vehicular traffic air pollution situation in recent years, and survey data on existing road pavement and road condition.

4. Existing institutional setup

In Dhaka, three separate bodies such as Rajdhani Unnayan Kartipakha (RAJUK), Dhaka City Corporation (DCC) and Dhaka Metropolitan Traffic Police (DMTP) are thought to be responsible for construction of new transport infrastructures, physical maintenance of road elements and management of traffic operations respectively. But there is no formal accountable interrelationship among these three agencies. RAJUK has a pool of civil engineers to see through the infrastructure related activities; but none of them has specialisation in transport planning and transport facility design. DCC has a traffic engineering division, within its engineering department, consisting of six civil engineers. And, none of them has specialisation in transport and traffic management and operation. DMTP, a wing of Dhaka Metropolitan Police, has been dealing with the enforcement, operation, management and occasionally making short term policy planning (like banning certain vehicle class in certain corridors, banning certain turning movements at locations, turning certain roads into one-way operation). Unfortunately, none of the traffic police personnel has either any engineering background in general or any traffic engineering background in particular. Therefore, apart from the enforcement job (which should have been their sole responsibility), DMTP is unjustifiably overburdened with rest of the responsibilities.

5. Road infrastructure

The quantum of roads in Dhaka available for use stands at 2230 km where more than 900 thousand vehicles ply everyday of which 420 thousand are motorized vehicles. Dhaka city has 436 km of four lane roads, 1408 km of two lane roads, 386 km of lanes/ by lanes and 220km of footpath. Smooth traffic system demands roads and lanes to be constructed on 25% of the city's surface area, but unfortunately for Dhaka city it is only 8% (Hossain et al., 2003). Also, the road network is handicapped by the fact that most of the road spans in N-S direction without adequate connection in the E-W direction as shown in the Figure 1. Dhaka City Corporation is in charge for maintenance and betterment of the roads, while, Rajdhani Unnayan Kartipakha (RAJUK), the capital development authority, undertakes planning and construction of new roads. Most of the four lane roads are median separated. As most part of the city has been developed in unplanned way there is no regular pattern for block/intersection interval. While there are traffic signal establishment for many of the important intersections, there is considerable number of traffic circles/roundabouts as well in the city. Analysis of photographs taken on about 115 km of Dhaka's main road corridors (At the rate of one photo at an acute problematic site of each road km) reveals very poor conditions of the road infrastructures, poor operation and management scenarios. Photo analysis chart in Figure 2 shows the variety of road infrastructure problem including lack of enforcement, parked vehicles on main arterial road, poor road surface, occupied/ partial damaged footpath, road/bus stop blockage, municipal garbage on road, passenger loading/unloading on road, poor bus shade, roadside construction material on the road, water logging in the rainy periods, etc. As the existing pedestrian footpaths are of inadequate quality and mostly occupied for other uses, they do not provide sufficient levels of safety and comfort to encourage walking. Facilities for cyclists, such as bicycle lanes, are non-existent. There are no special transportation considerations for the mobility-impaired such as the elderly and the disabled, as well as those of young children.

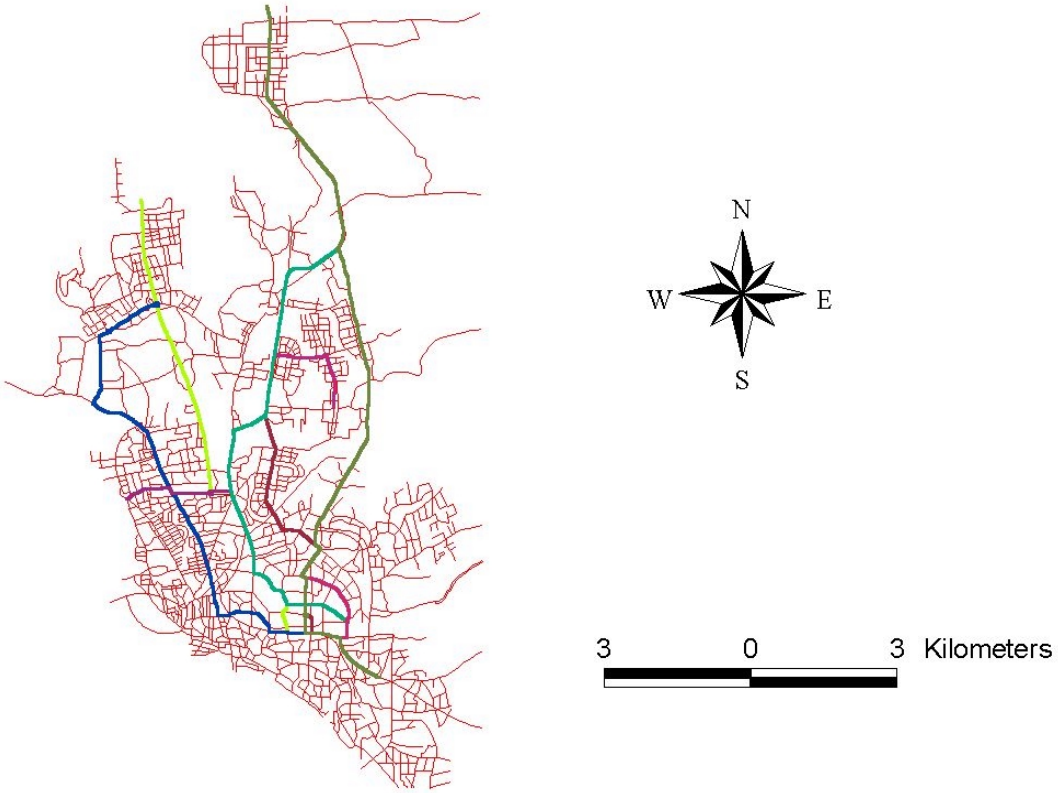

Fig. 1. Main road corridors of Dhaka city (shown as thick line)

6. Traffic operations

Traffic operation in Dhaka city is planned and supervised by Metropolitan Traffic Police. Unfortunately, the organization has no educated traffic engineer or related other manpower to see through this huge task. As a result, traffic operation here is mostly non-engineered, unplanned and erratic. A few examples are poor operation of traffic signals, roundabouts, road network and bus stoppage/terminal, etc.

(i) Traffic Signal

While traffic flow at the traffic signal junctions should be guided by traffic lights, in Dhaka, the same is done by traffic police on duty at the junction. This has made the installation, maintenance and operation of costly traffic light totally meaningless. Also, this manual operation of signal junctions is creating huge congestion problem although apparently the policemen are actively fighting against congestion. In ideal situation the cycle length (i.e. summation of green, red and amber time) should be somewhere in between 1 min. to 2 min. Survey in a number of intersections (Table 1) reveals that policemen maintain a signal cycle time in the range of 6 minutes to 14 minutes in busy hours. This unusually high cycle time may increase average vehicular delay and inflicts immense sufferings to a portion of drivers.

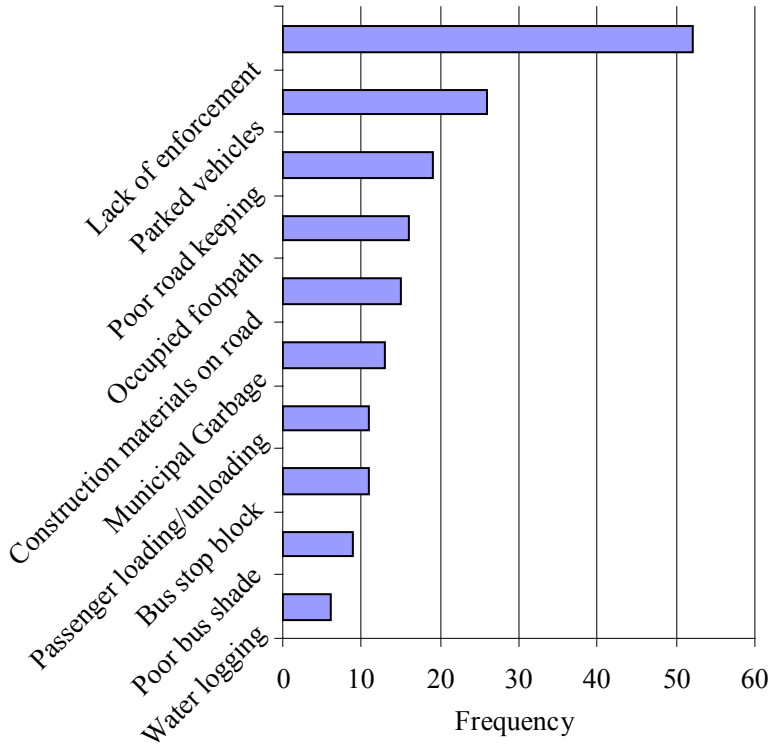

Fig. 2. Photo analysis chart showing main reasons for disruption of normal traffic operation on Dhaka city roads

Table 1
Signal cycle time by light and by traffic policemen

Intersections	Cycle time by light			Average Cycle time by policemen		
	Green	Amber	Red	Green	Amber	Red
Maghbazar	40 s	3 s	35 s	8 min	6 s	6 min
Bangla motor	40 s	3 s	35 s	6 min	5 s	5 min
Dainik Bangla	40 s	3 s	35 s	6 min	4 s	5 min
Purana Paltan	40 s	3 s	35 s	5 min	4 s	4.5 min
Katabon	40 s	3 s	35 s	3 min	5 s	3 min
Sheraton	40 s	3 s	35 s	6.5 min	5 s	5 min

(ii) Roundabouts

From traffic engineering point of view, it is expected that drivers at roundabouts should follow offside priority rule for left hand driving condition of Bangladesh. From field observation it is revealed that both the drivers and traffic policemen on duty are not quite familiar with this operating rule. This has created plenty of confusions among drivers and traffic policemen who are struggling to tackle the situation in so many peculiar ways: sometimes operating as traffic signals, sometimes banning the movement in certain direction, etc. As a result, most of the roundabouts in city are the points of congestion and delay.

(iii) Network operation

Without proper analysis and study, the traffic police often makes changes in the network flow condition, e.g. banning certain turns, imposing one-way movement, banning NMT, etc. even sometimes without prior announcement/circulation of the change among the relevant public. This sort of measurers usually creates confusion, encourages no confidence in the system overall and often ends up with bad results of sufferings.

(iv) Stoppage/terminal conditions

From field observations and photographic analysis (Fig. 2), it is revealed that bus/other transit stoppages and the city bus terminals suffer from poor operation and management. Most of the stoppages are in bad condition, e.g., unauthorized use, blocked by parked vehicle and roadside activities and water logging in rainy season. The basic elements of a stoppage such as route information, schedule information and passenger waiting facilities are missing in most of the stoppages. Buses and other para-transit vehicles most often stand at a place away from the designated bus stoppage. This creates problem of reduction in effective road width and lack of safety and comfort for transit users.

City Corporation owns terminals in Dhaka city. While terminals should be the place for passenger loading and unloading, driver's refreshment and passenger waiting facilities, in Dhaka, the main function of the terminal can be described as rather bus depot. Most of the privately owned buses take shelter in the terminals during idle time and as such it remains overcrowded by the idle bus drivers, helpers and union members. All these along with the poor supervision and maintenance practice have made the terminal area as most unwelcome place for the passengers and on duty drivers.

7. Traffic stream analysis

The traffic stream here is composed of both motorized (MV) and non-motorized vehicles (NMV). The significant portion (about 97%) of non-motorized group is tri-cycle locally known as 'Rickshaw' while small proportion (about 2.5%) of bi-cycle and manually driven push-cart (about 0.5%) are also present in the group. The significant portion of motorized group is composed of locally devised para-transits such as three-wheeled auto-rickshaw locally known as baby-taxi (3 seater) and o (8 seater). The rest of the motorized group is composed of car, mini-bus/truck, regular size buses and trucks.

8. Traffic management scenario

There is a serious lack in transport and traffic management of Dhaka city. Unplanned increase in the number of rickshaws, auto rickshaws, number of bus owners, bus operators, inefficient performance of network and intersections, dual vehicle licensing system (i.e. NMV by DCC and MV by Bangladesh Road Transport Authority, BRTA, an organisation responsible for countrywide motor vehicle registration and issuing of driving license), lack of integration among various modes are a few examples of mismanagement in this sector. The primary reason for this is the lack of institutional development of an accountable authority for the city transport system. Expressing the similar concern, Dhaka Integrated Transport sector study team (1994) has also suggested the formation of Greater Dhaka Traffic Management Authority (GDTMA) and as one of its special division Greater Dhaka Public Transport Authority (GDPTA).

The city public transport system is the worst sufferer of the poor management. Numerous operators, owners, quality variation, fare variation, lack of coordination in time schedule, information gap with user group and poor operational performance are few examples of mismanagement in this sector. Tables 2 to 4 show various bus operators and owner groups in Dhaka city.

Table 2
BRTC* bus fleet (as of March 2002)

Operation	Number of buses		
	Single deck	Double deck	Total
On lease	135	78	213
BRTC operated	83	124	207
Total	218	202	420**

*BRTC (Bangladesh Road transport Corporation)
**18 Double deck buses are on registration process

Table 3
Private limited companies of bus fleets

Owner/Operator/ Company/organisation	Premium	Shapla	Greenline	Nirapod
Type of ownership	Private	Private	Private	Private
Different routes covered	Gulistan-Savar/Gulistan-Narayanganj/Motijheel-Uttra/Fulbaria-Manikganj	Motijheel-Gulshan	Motijheel-Sheorapara-Mirpur12	Motijheel – Uttra
Total number of buses	106	20	10	18
Number of buses according to routes	30+24+32+20	20	10	18
Number of seats per bus	30-32	24	44	45-49
Age of vehicle	2-6 yrs	New	10/11 yrs	2 yrs.
Fare in Taka	30/20/10-25/30	5/10	10/15/20	10-15-20-25/
Waiting facilities	Yes	Yes.	Yes	Yes
Frequency	Minimum 10/10/5/10 minutes normally /or As per demand	5 mins.	15 mins.	10 mins.

From Table 2 to Table 4, it can be observed that five company-shape operators including public sector BRTC and about six hundred small entrepreneurs are operating bus services in Dhaka city with varying degree of service quality and fare. Again, the number of rickshaw and auto rickshaw operators would be numerous. It is very understandable these numerous operators cannot work towards a common goal of good

public transport system rather this aspect has led to the present condition of indiscipline and mismanagement in this sector.

Table 4
Private small number/single bus owner groups

Route	Large bus	Mini-bus	Owner	Frae (Tk/km)	Frequency (min)
Sbad-Gazipur-Sripur	59	135	70-80 individuals	0.50	5
S'bad-Vasantek	--	21	12	0.50	--
Sbad-Balughat	--	11	8	0.50	--
Sbad-Gabtali	--	72	50	0.50	--
Sbad-Mirpur	--	24	15	0.50	--
Sbad-uttara-Tongi	--	77	55	0.50	--
Demra-Uttara-Tongi	--	95	70	0.50	5
Sghat-Kuril-bhalijhuri	105	225	~300	0.65	2-3
Sghat-Gabtali	--	18	13	0.65	5
Total	164	678	598		

Note: For all the routes, the operations are carried out by Owner Association, and manual scheduling is done manually by the Owner Association

9. Modal choice

In order to design a modal choice survey of passengers, a pilot survey with about 100 respondents was performed, from which a number of important findings had been revealed. From the pilot survey result, it was observed that the respondents could give clear prompt details about their main trips only, which are work trips for persons involved with regular work of any sort, education trips for students and shopping trips for others. It was also observed that only those who cannot afford any other mode of transport choose to walk and those who own personal cars normally travel by car. This means that Dhaka city transport system has failed to offer any competitive transport mode for these two groups and does not encourage people to walking who can afford any sort of vehicular trips. Therefore, these two modes had been taken to be associated with fair amount of biasness and hence excluded from the analysis of modal choice behavior. So, present modal choice survey involving about 400 subjects represents modal choice of vehicular trips excluding personal car trips. Figure 3 represents the stack of various vehicular modes as found from the passenger survey. From Fig. 3, it can be observed that bus and rickshaws are equally dominant for main trips of passengers and together they share about 80% of the trips. Rests of the trips were made by three-wheeler and baby-taxi; and, para-transit maxi and newly introduced taxicabs.

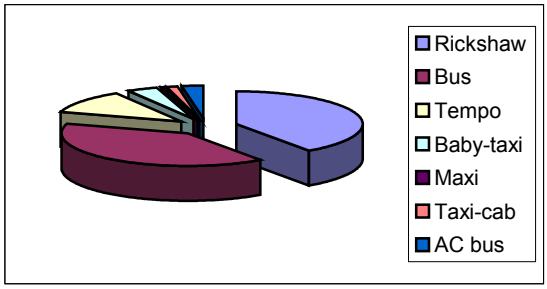

Fig. 3. Modal choice percentages of all vehicular trips

Detailed modal split of work trips according to trip distance ranges has been shown in Fig. 4. The Figure 4 shows that up to a trip distance of around 4 km, rickshaw has been the dominant mode and beyond the distance of 5 km, bus is the dominant mode. Similar scenario can be observed (Fig. 5) from the analysis of education trips. Detailed analysis of shopping trips (Fig. 6) reveals that rickshaw is the primary choice among the shopping trippers. About ninety percent of the shopping trips were made by rickshaws. This indicates a serious deficiency of other public transport modes in catering the need of shopping trips.

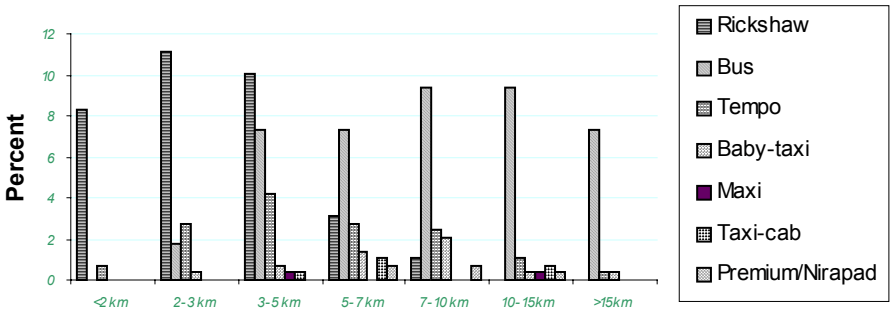

Fig. 4. Modal split according to distance travelled for work trips

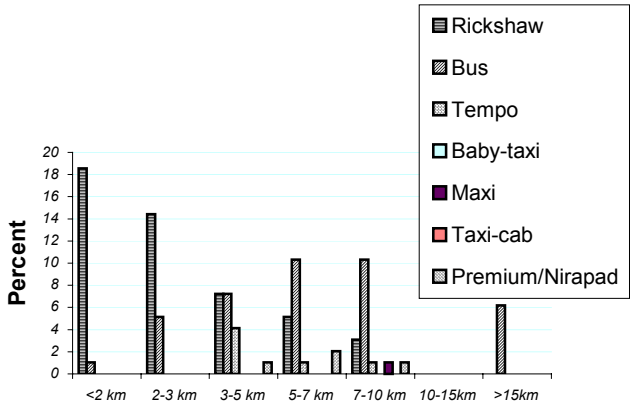

Fig. 5. Modal choices according to distance for education trips

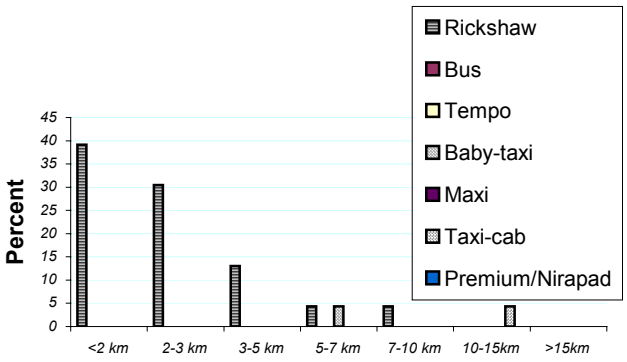

Fig. 6. Modal choices according to distance for shopping trips

10. User perception of the present city transport

In the present study, user perception regarding public transport supply, reliability, safety, information sharing, comfort and bus stop waiting facilities has been investigated through passenger interview survey and the same has been presented in Fig. 7. Regarding public transport supply, Fig. 7 reveals that no respondents felt that the public transport supply was good. Only small portion (about 18%) of respondents opined the supply condition as below average. Majority (about 80%) of the respondents felt that the public transport supply was very poor. Figure 7, showing the user perception regarding the public transport reliability, also reveal that almost all the respondents had viewed the public transport system of Dhaka city as unreliable. Similar perception of the users regarding the safety of public transport system has also been revealed in Fig. 7. While in order to make the public transport system more useful to the mass passengers information dissemination regarding the transit operation and schedule is vital, among the Dhaka city respondents no one is fully informed about mass transit routes and schedules (Fig. 7). About thirty percent of the respondents know very little and majority of about seventy percent respondents had no information regarding the same (Fig. 7). Comfort in the public transport and good waiting facilities in stoppage shade area are very much required for the public transport to be popular. Dhaka city passengers' perception regarding these two was very bleak. Only a few of the respondents (Fig. 7) have opined the public transport as comfortable and waiting facilities in the shade as good. But majority of the respondents had termed them as very poor.

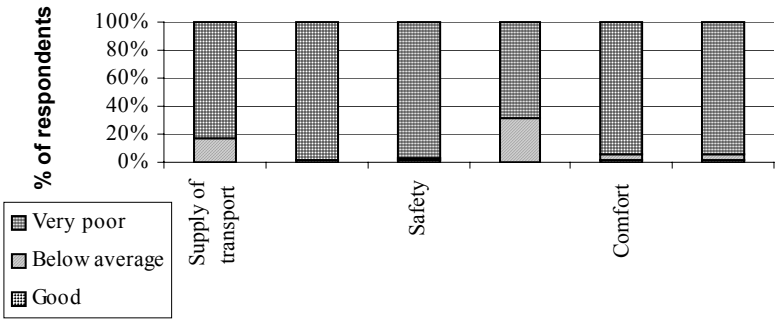

Fig. 7. User perceptions about various aspects of public transport in Dhaka

11. Traffic air pollution

Relatively aged (mostly reconditioned) and poorly maintained motor vehicle fleet coupled with increasing congestion level has been causing increased level of air pollution each year. While a few piecemeal of study regarding the vehicular traffic air pollution have been undertaken by a few agencies, no formal setup regarding the issue has been found in the existing traffic engineering division of DCC. Hence, in absence of proper policy guidelines and enforcement in this regard, the air pollution from road traffic has been found to be increasing as shown in Table 5.

Generally, it could be observed from Table 5 that the concentration of Suspended Particulate Matter (SPM) has increased by 3 to 4 times (from 400 to 1600 $\mu g/m^3$) during the last decade whereas Bangladesh standard value is 400 $\mu g/m^3$. It can also be observed from Table 5 that NOx and SO_2 concentration in air has exceeded standard limit. In a recent study (Begum and Khan 2001) it is claimed that in most busy areas of Dhaka city, CO concentration level is 1.5 to 2 times higher than the limiting standard value of 5000 $\mu g/m^3$. From another study (Alam et. al. 1999), it was also concluded that at more that seventy percent of the sites, the roadside air is severely polluted and rest of the locations are highly polluted. No significant strategic plan to combat the air pollution situation have been put forward through the effective coordination among Department of Environment (DOE), Bangladesh Road Transport Authority (BRTA) and Dhaka City Corporation (DCC); perhaps because of the institutional gap in the respective management setup of DCC.

Table 5
Air pollution in Dhaka city during recent years

Dhaka City Location	Pollutant	1990 DOE study	1996 study	1998 DOE study	2000 study
Mohakhali	NOx($\mu g/m^3$)	4	44	-	325
	SO_2($\mu g/m^3$)	4	58	-	152
	SPM($\mu g/m^3$)	401	1429	1501	-
Science Lab	NOx($\mu g/m^3$)	-	-	-	130
	SO_2($\mu g/m^3$)	-	-	-	146
	SPM($\mu g/m^3$)	-	956	1680	-
Farmgate	NOx($\mu g/m^3$)	-	61	-	144
	SO_2($\mu g/m^3$)	-	24	-	121
	SPM($\mu g/m^3$)	-	1513	1583	2103

Source: Begum and Khan 2001, Alam et. al. 1999 and Begum 1996
Note: Bangladesh standard (Semi-commercial area): NOx($\mu g/m^3$):100; SO_2($\mu g/m^3$): 100; SPM($\mu g/m^3$): 400

12. Conclusions

This paper highlights the poor shaping up of different components of Dhaka city's transport system in the absence of proper management setup. The extent and nature of the problem in the areas like transport planning, road infrastructure management, traffic

operation, public transport development, sector investment, service to the user, safety for the user and sustainable environment friendly transport system emphasizes the need for proper governance in this sector. An authorized institutional management body manned by educated traffic and transport engineer can provide that sort of governance, without which growing metropolis of developing cities would perhaps continue to suffer with an inefficient transport system as the case of Dhaka.

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