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TRAFFIC SAFETY IN DHAKA CITY: KEY ISSUES AND COUNTERMEASURES

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ABSTRACT: The rapid urbanisation process and increase in vehicle ownership in Bangladesh have resulted in enormous environmental pollution from road traffic, traffic congestion and accident problems. This paper highlights the key issues, characteristics and factors concerning the growing and serious accident problems in the urban areas, in particular Dhaka city. Various improvement opportunities, approaches and specific measures of particular relevance are briefly discussed to improve the situation both at present and future conditions. The paper also highlights the potential of road safety audit – a new approach for accident prevention.

KEYWORDS: Road traffic accident, Accident factors and countermeasures, Safety audit.

INTRODUCTION

Rapid rise in population along with increased and versatile land use patterns and increase in vehicle ownership have generated considerable travel demand in the major cities, especially in Dhaka, the Capital city of Bangladesh (Ahsan and Hoque, 1991) and is forecast to continue and gain further momentum in the years ahead. At present, the population of Dhaka city is about 10 million with a growth rate of nearly 8%. Dhaka's urban problems have reached a crisis level including intolerable environmental pollution from road traffic and serious traffic congestion and alarming rise in traffic accidents.

Road traffic accidents have now become a great social concern in Bangladesh and the situation is deteriorating. The annual economic wastage occasioned by traffic accidents is estimated to be in the order of Taka 1050 crore (~ US $ 260 million, as 1% of GDP). Each year, there are at least 1600 police reported fatalities and 3000 injuries on Bangladesh roads. The safety problem is very severe by international standards with some 45 fatalities per 10,000 motor vehicles in Bangladesh compared to 2.0 in the USA and 1.4 in UK, for example (Hoque et al., 1997).

This paper attempts to point out the key issues concerning safety problems related to the urban areas of Bangladesh and Dhaka, in particular. Various road and traffic engineering countermeasures, which offer low-cost alternatives and are worthy of greater attention,

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are summarised. Finally, the paper highlights the potential of road safety audit–a new tool for accident prevention for developing countries.

MOTORISATION TREND AND MODAL CHARACTERISTICS

Motorisation: Motor vehicle ownership has increased steadily from 5.85 vehicles per 10,000 persons in 1971 to 34.6 in 1992, an increase of about 490 percent with a current annual growth rate of almost 8 per cent. It was estimated (IDC, 1996) that in 1996 there were about 200,000-250,000 vehicles in use in Dhaka including 100,000 motor vehicles and some 100,000-150,000 non-motorised vehicles; and the number of motor vehicles is expected to double within the next ten years. However, despite this very large growth in the number of motor vehicles, the country's transport demand is still predominantly met by non-motorised modes, particularly rickshaws, and its level of motorisation is still far below the levels in other Asian countries. The present number of rickshaws in Dhaka is estimated to be in the order of 400,000.

Although motor vehicle registrations has grown considerably, it is still far short of the future demand and will almost certainly continue to outpace road building. Such growths together with other complementary urban hazards have resulted in substantial road traffic safety problems.

Modal Shares: A study of all trips in metropolitan Dhaka (DITS, 1993) revealed the dominance of walk and rickshaw modes. Over 60 per cent of trips involved walking alone. Of the remaining trips, some 11 per cent included a significant walking component. Some 40 per cent or more of non-walk trips involved the use of pedal rickshaws. Only about 10 per cent of trips involved motorised public transport services. In Chittagong, the second metropolitan city and the largest port in Bangladesh, about 50 per cent of this travel is made by rickshaw, 25 per cent by bus and the rest is by other modes (Binnie Partners, 1994).

Equivalent trip studies in medium sized cities (Bogra, Mymensingh and Sylhet) showed rickshaws as the dominant mode, accounting for between 50-60 per cent of the trips, followed by walking (20-40 per cent) and bicycles around 5 per cent (Hoque et al., 1996). It should be noted that much higher percentages of trips are catered for bicycles in medium sized cities than in metropolitan Dhaka (roughly 1 per cent). Thus, in medium sized cities non-motorised transport takes up even larger share (about 90 per cent) of trip than in metropolitan cities (about 80 per cent).

ROAD ACCIDENT CHARACTERISTICS AND FACTORS

Total Accident Statistics: The reported road accident and casualty statistics over the past ten years for Bangladesh have showed significant fluctuations. Such fluctuations usually indicate that the statistics are unreliable (probably masking the actual trends) with

accidents decreasing by some 60 per cent between 1985-86 (3923 vs 1568 accidents) and then peaking in 1992 (4012 accidents) before dropping quickly in 1993 (3134 accidents) (IDC, 1996). In 1994 there were about 3010 reported accidents with 1600 fatalities and 2740 injuries. Metropolitan Dhaka accounted for about 45 per cent of all reported accidents but only 20-25 per cent of the country's road traffic accident fatalities and injuries. In 1996 (DMP, 1996) there were about 1001 reported accidents in Dhaka, with 343 fatalities. Accident data collected nation-wide are very limited with widespread under reporting and incomplete collection of specific details (e.g., exact location, road user movement involved).

Socio-economic Costs of Accidents: Overseas research has shown that countries lose the most economically active years from road accident victims, approximately 70 per cent of the 'years of life' lost due to accidents are 'working years' (Ross Silcock and TRL, 1996). It is argued that compared to the other costs of premature death in developing countries, particularly malaria and infectious diseases, deaths from road accidents appear to be increasing. However, in the absence of relevant data, such estimates could not be determined for Bangladesh situation. A study (DMP, 1996) in Dhaka concluded that the age group from 21 to 35, especially from 26 to 30 are the most vulnerable to accidents. They seem to represent the potential economic force of Bangladesh.

Fatality Rate and Index: The fatality rate, i.e. the number of road traffic accident fatalities per 10,000 motor vehicles, for Bangladesh in 1994 was 45, which was still very high by international standards, as the fatality rate for motorised countries is usually less than 2. The fatality index (deaths divided by total casualties expressed as a percentage) in Bangladesh is very high, nearly 40 which is amongst the highest in developing countries and is in stark contrast to industrialised countries. This signifies probably two important characteristics viz. widespread under reporting of less serious accidents as well as the lower level of emergency medical services available to the accident victims. It is believed that fatality index depends crucially on medical facilities (Ross Silcock and TRL, 1996). In Bangladesh with present level of medical services there is little scope to provide prompt and necessary medical attention to injured people, particularly during the initial hours of an accident.

Some More Accident Characteristics: Following are the important characteristics of traffic accidents reported in Dhaka:

- Pedestrians- the most vulnerable group: In urban areas pedestrians represent upto 70 per cent of road accident fatalities. Current statistics revealed a deteriorating situation in metropolitan Dhaka, with pedestrians as a proportion of road crash deaths increasing from 43 per cent in 1986-87 to 67 per cent in 1991-92 and then a slight drop in 1996 (62%; DMP, 1996). The other major casualty

groups are from baby taxis and rickshaws. Indeed, 70 per cent of fatal accidents were between pedestrian and motorised vehicle. It should be noted that pedestrian fatalities in Asia, Africa, the Caribbean and the Middle East typically represent more than 40 per cent of all road deaths (Downing et al., 1993). Pedestrians, being physically unprotected, are thus considered to be the most vulnerable user group and demand a priority consideration in road safety strategies.

- Over-involvement of trucks, buses and minibuses: Trucks, buses and minibuses are major contributor to road traffic accident fatalities, responsible for about 75% pedestrian fatalities in Dhaka (DMP, 1996). It was found that in almost 90 percent of road deaths in Dhaka a bus, truck or minibus was involved. Yet they accounted for only 4 percent of all vehicles on the road (including rickshaws), and only 11 percent of motor vehicles.
- Motor cycles are much more dangerous than other vehicle types: For motor cycles, there were 0.17 fatalities per million-passenger km, at least five times the rate for rickshaw (Binnie Partners, 1994).
- Accident location: A large proportion of fatalities occur on rural sections of the main highways. Within urban areas, accident frequency is the highest on main road networks. There is evidence of 'clustering' of accidents at a few sites, indicating that the road safety problem may be partially addressed by site-specific treatment.

Accident Contributory Factors: Typically, the principal contributory factors of accidents in Dhaka are (Binnie Partners, 1994):

- Mix of traffic with a variety of vehicle characteristics and speeds.
- Failure to obey mandatory traffic regulations, illegal and inconsiderate driving practices.
- Pedestrian/vehicle conflicts.
- Failure to provide and maintain road signs and markings.
- Failure to enforce traffic law.
- Lack of education of road users.
- Poor detailed design of junctions and road sections.

Haworth (1995) identified a range of road user behaviour problems that contributed to accident risk and poor traffic flow in Dhaka. The prevalent behaviour problems include:

- Failure to give way.
- Lack of lane discipline.
- Counter-clockwise travel at roundabouts.
- Non-wearing of motorcycle helmets.
- Failure to slow down when approaching an intersection.

Furthermore, traffic accident rates in a congested flow, especially rear-end collisions are much higher than in non-congested flows. Traffic congestion, therefore, affects not only the productivity of highway operation but also safety (Iwasaki, 1992).

SYSTEMATIC APPROACH FOR ROAD SAFETY COUNTERMEASURES

Road traffic crashes result from failures in the interaction of humans, vehicles and the road environment - the elements which produce the road traffic system. The combination of these various elements to produce road crashes means that road safety itself has to be tackled in a multi-functional manner in order to break the chains of events that lead to crashes and the eventual injuries of road users. One useful approach is to consider each traffic injury problem as resulting from an interaction between several discrete factors, occurring over distinct phases in time and space. This can be done by dividing all time into three phases: before the injury event, during the event, and after the event. The physical universe can be divided into three factors: the human being (usually the victim), the vehicles and equipment potentially involved in an injury event, and the environment (which consists of everything else). The approach results into a 3x3 matrix as shown in Table 1, also often referred to as the Haddon's matrix (Haddon and Baker, 1981; and Haddon, 1972). This provides a useful framework for the crash analysis and prevention program in the way to formulate effective countermeasures.

Allsop (1990), furthermore, discussed the issue from an implementation point of view considering the measures as part of a road safety management plan. He argued that the essence of road safety management is to develop a strategy for accident prevention and casualty reduction in each urban area as a whole, and follow through the strategy programmes of action that take account of other policies for the area. The process is illustrated in Fig.1 and should help authorities that have statutory responsibility for road safety to fulfil their road safety plans. For putting urban safety management into practice, Allsop (1990) suggested the following ten principles to follow:

- Consider all kinds of road user especially the most vulnerable
- Consider the functions and use of different kinds of road
- Formulate a safety strategy for each urban area as a whole
- Integrate existing accident reduction efforts into the safety strategy
- Relate safety objectives to other objectives for the urban area
- Encourage all professional groups to help to achieve safety objectives
- Guard against adverse effects of other programmes upon safety
- Use the scarce expertise of road safety specialists effectively
- Translate strategy and objectives into local area safety schemes
- Monitor progress towards safety objectives

Table 1. Haddon's Matrix

	Before Crash (Pre-Crash)	In-Crash (Crash)	After Crash (Post-Crash)
Driver (Human)	Training Education	Restraint	Emergency Medical
Vehicle (Vehicle and Equipment)	Primary Safety	Secondary Safety	Salvage
Road (Environment)	Delineation Road Geometry	Roadside Environment	Restoration

(Source: Haddon and Baker, 1981; Haddon, 1972)

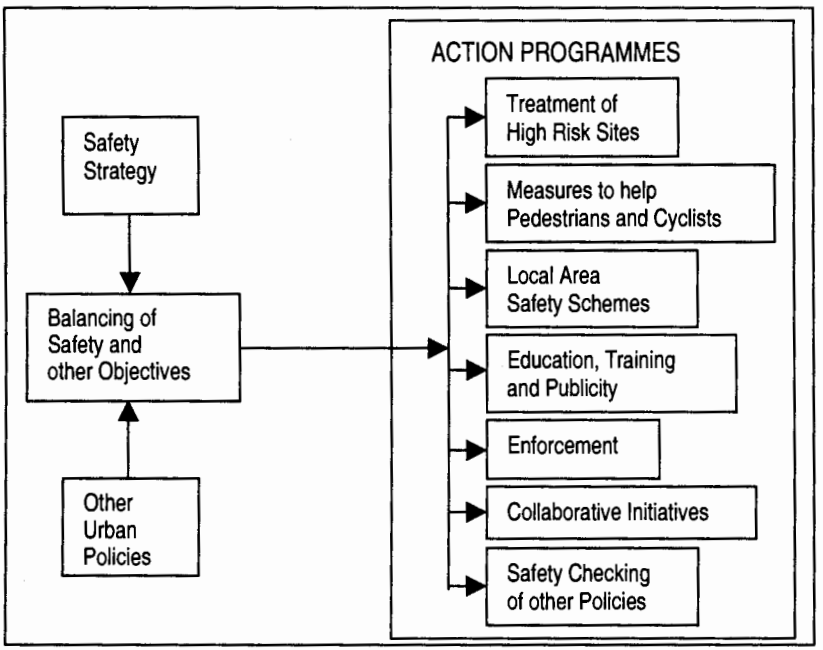

Fig. 1. The Process of urban safety management (Allsop, 1990)

The above process and principles are very relevant and should be vigorously pursued for the management of safety in urban areas of developing countries. It is important that developing countries with limited resources should place initial emphasis on hazardous road location program. Introduction of low-cost engineering improvement schemes at hazardous locations have proved to be very effective in

industrialised countries with First Year Rates of Return were estimated to range from 65 to 950 percent in the UK (Jacobs and Baguley, 1997). Indeed, hazardous road locations extend far beyond the common concept of 'blackspots' to include a wide range of locations and situations (Sabey, 1995). Four investigatory techniques that have been adopted take account of this range:

- *Single sites*: the treatment of specific sites or short lengths of roads at which accidents cluster ('blackspots').
- *Mass action*: the application of known remedies to locations having common accident factors.
- *Route action*: the application of known remedies along lengths of road having above average accident rate.
- *Area wide schemes*: the application of various treatments over wide areas requiring a global approach; a technique particularly aimed at dealing with scattered accidents, usually in urban areas.

SOME CONTEMPORARY ISSUES AND PRIORITY OPTIONS

In Dhaka, similar to urban areas in developing countries, pedestrian-vehicle conflicts are clearly the greatest problem with significant involvement of trucks and buses. There is a severe lack of priority and even attention given to vulnerable road user movements, despite this group of road users dominating travel patterns as well casualty types (Ross Silcock and TRL, 1997). The safety of the vulnerable road users must be sufficiently catered for in the road safety engineering strategies and principles. Vulnerable road users are much more susceptible to accidents when vehicle speeds are high and can even suffer fatal injuries in accidents with motor vehicles at moderate speeds (Mohan, 1991). Thus the most critical and effective measure that should be immediately adopted is reduction of speed. This measure alone will greatly reduce the overall number of road deaths as shown by experience all over the world (the number of fatalities was reduced by 32% in urban areas after a speed limit of 50 km/h was enacted and strictly enforced in Hungary) (Ross Silcock and TRL, 1996).

There is specific need and much scope for road environment improvements aimed at correcting the most common deficiencies through wider application of traffic engineering approaches. It is argued that priorities be placed on the principles like traffic segregation to provide facilities and road space for the most vulnerable users particularly pedestrians and non-motorised vehicles, force correct road user behaviour (self enforcing measures) via channelisation, speed reduction measures, etc. With resource constraints the greater emphasis should be placed on low-cost improvement schemes. Implementation of such measures should take place at hazardous road locations (accident blackspots) identified by systematic accident investigation (rather than in an ad-hoc manner). To promote enhanced

road safety, there should be programs to implement well-known engineering measures, leading to larger and longer lasting effects at less expenses, widely and systematically. Immediate measures that would achieve greater road safety (likely to also improve traffic flow) and would also offer cost-effective results include:

- Appropriate road design guidance.
- Small changes/improvements in road layout and use of roundabouts.
- Treatments of roadway shoulders (provide wide and strong shoulders).
- Strict traffic law enforcement and institutional strengthening.
- Provision of adequate pedestrian facilities (crossings, footways).
- Facilities for non-motorised vehicles and designated truck lanes (traffic segregation).
- Intersection designs/improvements (flaring, channelisation, traffic islands, turning and parking controls).
- Traffic signal improvements (synchronised, demand based timing).
- Installation and upgradation of median barriers and refuge islands.
- Treatments of roadside hazards (trees, ditches, other objects).
- Improvements to narrow and deteriorated bridges, culverts and lanes.
- Control speeding and dangerous overtaking, including traffic calming measures.
- Traffic restraints and flexi work time.
- Installation of delineation devices (e.g., lane markings, guide posts, chevrons).
- Better access controls, cross-sections, sight distances, alignments, one-way streets.
- Improving mass transit system (preferential treatments, bus fleet size, new modes).
- Land use planning and regulation (user friendly road environment, increase short walk trips and reduce commuting).
- Road safety audit – systematic examination of roadway elements for safety.

Different categories of road users and crash types should be explicitly considered as there are specific needs and problems peculiar to each category that can and should be adequately taken into consideration in the engineering road safety solution strategies. A key factor in this regard, of course, is to ascertain the nature of crash occurrence and determine whether particular crash types are exhibiting 'clustering' or non-clustering on the road network. The detection of crash clustering (hazardous road location) is significant in relation to the planning of crash countermeasures. This approach demands priority consideration in the future initiatives.

In the context, some significant progress has been made in most recent years. TRL's MAAP (Micro computer Accident Analysis Package) is being used on Dhaka metropolitan accident data in an effort to identify hazardous road locations. For this purpose, a plan has been introduced by Dhaka Metropolitan Police to develop a comprehensive accident database, which is the central to safety investigation. National Road Safety Council (NRSC) has been formed to consolidate road safety management on a firmer basis. The council has created seven technical working groups to address various safety issues towards developing the National Road Safety Action Plan. Institutional Development Component (IDC) under the Second Road Rehabilitation and Maintenance Project also reviewed the main road safety sectors towards achieving an effective road safety programs (IDC, 1996). The sectors included road safety management, accident data reporting system, traffic legislation and enforcement, engineering and planning, roadway design standards and safety audits, improvements of hazardous locations, vehicle inspection, driver training and testing, road safety education and publicity, medical assistance, motor vehicle insurance, and road safety research. Indeed these are the areas which were specifically identified and discussed for further improvements and co-ordinated actions towards enhancing road safety in Asia/Pacific developing countries (Ross Silcock and TRL, 1996). Increased consideration and sustainability of these initiatives are particularly important in enhancing future road safety in Bangladesh.

Moreover, future actions would require renewed governmental as well as organisational commitments by setting realistic road safety targets. Supports, especially in the form of fund and collaboration from international agencies and specialised institutes would be particularly important in tackling the problems.

NEW APPROACH TO ROAD SAFETY: USE OF ROAD SAFETY AUDIT

The concept of road safety audit as an accident prevention tool is a relatively new and highly cost-effective approach to improving road safety. It is a formal procedure for assessing accident potential and safety performance in the provision of new schemes, and schemes for the improvement and maintenance of existing roads. The method is useful for rural roads as well as urban roads. An essential element of the audit process is that it is carried out independently by qualified auditors, submitting written audit reports through a formal management arrangement. Safety audits are carried out at discrete stages of the road development project. Auditing by its nature is an iterative process of reviewing roadway design elements and in most cases involves the use of checklists that are vital to the procedure, and where safety skills and judgement are paramount. It goes beyond and above the compliance with specified design standards. A detailed review has been given in Hoque (1997).

Road safety audits have been implemented, as a mandatory requirement for various types of schemes, in the UK, Australia and New Zealand, with the UK leading the impetus. The road safety audit technique has been able to contribute significantly to making roads safer by identifying many highway design and operational aspects which would have contributed to the occurrence of road accidents and which would otherwise have been overlooked. Developing countries have been slower to adopt engineering improvements and many roads are substandard. In many new road schemes international design standards are simply adopted from western countries that are generally inappropriate to local conditions. There is widespread disregard of explicit safety considerations in the road planning, design and rehabilitation program. Blackspots (Jacobs and Baguley, 1997) are still being created where many of the accidents and casualties could have been prevented by implementing simple physical measures based on proper safety checks or audits.

Thus a formal program of road safety audit of existing roads in developing countries could be particularly beneficial. Road safety audit is of particular importance in the developing world because countries are still developing their basic national road networks, and unless safety checks are undertaken this will result in unsafe networks in the future. Opportunities exist during road rehabilitation projects. A formal road safety audit process would focus on such explicit safety implications and recommend desirable changes or modifications appropriate to the local safety needs/standards. In addition to modifying the elements, sensible design alternatives (e.g., conversion of cross road intersections into staggered T-junctions, elimination of Y junctions, reduction of accesses, reduction of speeds as roads pass through communities along the road networks, introduction of roundabouts at uncontrolled major/minor junctions) could also be considered to enhance safety. Considerable potential also exists with totally new roads designed to "international" standards to assess how the roads will be used in practice in particular developing countries and to add/modify elements or features necessary to ensure that the roads will operate safely in that operating environment.

Furthermore, co-operation and support of international agencies and specialist institutes through organising the transfer and sharing of expert knowledge are of vital importance to the establishment of safety audit procedures in developing countries. There are good examples of such successful collaborative efforts to set up the audit process in some countries (viz. Fiji, Nepal, and PNG). Such external co-operation and support should be systematically strengthened.

CONCLUSIONS

The paper has reviewed the road accident situation in the urban areas of developing countries with a particular reference to Dhaka, the Capital city of Bangladesh. Clearly the current statistics demonstrate that road accidents have become a very serious problem. Key problem characteristics are summarised in the paper and the need for engineering approaches to improving greater safety is emphasised. For planning effective countermeasures a systematic approach is also outlined. Selected roads and traffic engineering measures and the ways in which their effective implementation could take place are discussed. It is also important that road safety audits should be systematically implemented for preventing road accidents and resulting casualties in Bangladesh.

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