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ROAD SAFETY RESEARCH NEEDS AND THE ROLE OF ACCIDENT RESEARCH CENTRE (ARC)

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Abstract: The context and the value of road safety research in mitigating the man-made epidemic of road traffic accidents and injuries are discussed in this paper. Accident Research Centre (ARC) was established at Bangladesh University of Engineering and Technology (BUET) under the top priority programs of the Government of Bangladesh to carry out scientific studies and research regarding the causes of accidents on roads, railways and waterways and commensurate remedial measures. Activities, achievements and future outlook of ARC are also discussed.

1. INTRODUCTION

Road traffic accidents are a 'global tragedy' with ever-rising trend and represent a major cause of premature deaths and disabilities worldwide. Road trauma has now been recognized as one of the significant diseases of industrial societies and is an increasing public health and economic issue in developing countries. Accidents are particularly prevalent in low and middle income countries- around 88 percent of the world's deaths occur in developing countries (Mackay, 2003). More than half of the world's traffic fatalities occur in the Asian-Pacific region although only one in five motorized vehicles are registered here. It is estimated that by 2020 about two-thirds of the world's traffic fatalities might be in the Asian-Pacific region. The economic costs of road crashes, which range from 1 percent to 3 percent of GDP in Asia, have a disproportionate impact on lower income groups, thus contributing to the persistence of poverty. Most of the injured are vulnerable road users such as pedestrians, motorcyclists and bicyclists (WHO, 2005). These facts demand that there is indeed an urgent need to develop an appropriate and co-operative response to this man-made epidemic by implementing strategic programs that will effectively address such a major growing issue of road traffic accidents and injuries. An effective and integrated research program is fundamentally important and is seen as the basis of development and subsequent evaluation of a comprehensive road safety strategy.

This paper briefly discusses needs, benefits and a framework and requirements of road accident research to aid policy decision making for safety improvements. The paper also highlights the activities, achievements and future outlook of the newly established Accident Research Centre (ARC) at Bangladesh University of Engineering and Technology (BUET).

2. GLOBAL MENACE OF ROAD TRAFFIC ACCIDENTS

According to the World report on road traffic injury prevention (WHO, 2004), worldwide, an estimated 1.2 million people are killed in road accidents each year and as many as 50 million are injured. About 15 percent of global road fatalities were children (0-14) of which 97 percent occurred in low-income and middle-income countries. For every death, there are far greater numbers of injuries- four persons with severe/permanent disabilities, ten persons requiring hospital admission, and thirty persons requiring emergency room treatment. Projections indicate that these figures will increase by about 65 percent over the next 20 years unless there is new commitment to prevention. Road traffic deaths are predicted to increase by 83 percent in low and middle income countries and to decrease by 27 percent in high income countries. Sustained declining trends of road fatalities in the developed countries have been attributed to concerted efforts in many sectors including effective coordination, community involvement, well researched road safety initiatives, road safety good practices and improved targeting of resources. In developing countries like Bangladesh major considerations of such approaches are required with due urgency and commitment. Essentially, in order to be most successful, road safety policies and actions should invoke local research based outcomes and for that it is necessary to carry out country specific research to identify effective measures.

3. OVERVIEW OF ROAD ACCIDENT CHARACTERISTICS IN BANGLADESH

According to official statistics, there were at least 3200 fatalities and 2400 injuries in 3783 reported accidents in Bangladesh in 2006. It is estimated that the actual fatalities could well be 10000-12000 each year and many more sustain disabling injuries. In economic terms, road accidents in Bangladesh costing community in the order of Tk. 5000 crore (US \$ 850 million) which is nearly 2 percent of GDP. The number of fatalities has been increasing from 1009 in 1982 to 3184 in 2006, nearly 3 times in 24 years period showing an increasing trend in recent years. The statistics revealed that Bangladesh has one of the highest fatality rates in road accidents. About 70 percent of road accident fatalities occurred in rural areas including rural sections of national highways. Also it has been observed from the studies that up to 62 percent of urban road accident deaths are pedestrians alone and in Dhaka city, they represented nearly 70 percent. Almost 80 percent of fatalities are vulnerable road users e.g. pedestrians, bicyclists and motorcyclists (Hoque, 2006).

These figures clearly demonstrate that the road safety is a serious issue as it affects each and every one of us, whether drivers, travelers or consumers and thus demands urgent attention to improve road safety in Bangladesh. There remains much scope for improving road safety and for that co-operative research and interventions need to be implemented with due urgency.

4. THE CONTEXT OF ROAD SAFETY RESEARCH

Road traffic safety professionals can only prevent accidents and injuries if they understand what causes them. Traditionally this understanding achieved through systematic investigation and scientific research on road traffic accident which results from failure in the interaction of human, the vehicle and the road environment- the three elements which produce the road traffic system. Importantly, accident remedial and preventive measures should by and large be implemented based on local research on road safety issues in a specific country of concern. However, with a few notable exceptions, relatively little research had been undertaken in many developing countries, Bangladesh in particular. Road safety research is needed to clarify the current situation in terms of priorities and problem areas, as research provides the framework of knowledge against which policy decisions can be taken and countermeasures devised. This is usually best carried out by specialist researchers in universities or road research institutes, but can also be done by others with an interest in road safety. Much research has been undertaken internationally in road safety and many of the findings of such research can be of value to researchers and practitioners in all countries. Due to the complex nature of road accidents and the many different sectors involved in the operation of road safety, local research is required to provide a scientific and objective approach to reducing the suffering and losses caused by road accidents. Indeed, the real road safety research progress can be achieved through closer interaction between research and implementation- research to research, research to implementation, implementation to implementation and implementation to research (Elsenaar, 2007).

5. NEEDS AND BENEFITS OF ROAD SAFETY RESEARCH

Road traffic accidents result from failures in the interaction of humans, vehicles and the road environment- three elements which produce the road traffic system. The combination of these various elements to produce road accidents means that the road safety itself has to be tackled in a multi-functional manner in order to break the chains of events that lead to accidents and the eventual injuries of road users. An integrated, multi-disciplinary approach is required to reduce road accidents and consequent injuries which may come through road safety research.

Road safety research is the scientific and objective study of road and traffic systems with the aim of reducing the suffering and losses due to road accidents. It has three main objectives (ADB, 1996):

- Greater understanding of the situation, issues and the identification of problem areas;
- Development of countermeasures for problem areas; and
- The evaluation of the effectiveness of any remedial action undertaken.

With the deteriorated road safety situation in Bangladesh, the need for road safety research has become stronger not only on humanitarian grounds but also on an economic basis.

Road safety research produces many benefits (ADB, 1996):

- **Problem Assessment:** Road safety research objectively evaluates the data available and appraises the relative situation with respect to accident trends, high-risk road user groups, etc., while also identifying any data deficiencies.
- **Development of Countermeasures:** A good accident data system serves as a research aid to enable problem areas to be identified, and remedies devised and tested in a scientific manner.
- **Evaluation:** Road safety countermeasures and programs need to be evaluated to determine their effectiveness, particularly in relation to cost.

- **Scientific Approach:** Effective road safety research provides the framework against which informed decisions can be made and every developing country should have some local research activity on road safety issues to aid decision making.

6. REQUIREMENTS AND STAGES OF ROAD SAFETY RESEARCH

▪ Sectors of Research Activity

Typical sectors of research activity and their aims are usually as follows (ADB, 1996):

- Accident Data: to develop and apply accident analysis in order to improve the background knowledge that shapes decisions relating to road safety and traffic engineering;
- Road Users: to develop and apply human performance characteristics and behavior patterns in different traffic situations in order to improve the background knowledge that shape decisions concerning vehicles and traffic environment, and measures relating to road users, particularly drivers, pedestrians, and cyclists;
- Roads: to develop and apply methods that will facilitate the achievement of the desired standard in the planning, design, construction, and operation of roads; and
- Vehicles: to develop and apply methods for studying vehicles and vehicle components in different traffic situations, in order to improve the background knowledge that shapes codes concerning vehicles, vehicle components, and the traffic environment.
- Economic, social and health consequences of road traffic accidents and injuries.
- Monitoring and evaluation of road safety programs, policies and actions.

▪ Staffing and Funding

A road safety research unit ideally needs several members interacting to ensure a critical mass working together and maximizing the research's potential impact on road safety policy. Training needs should be covered by university courses, short in-house courses, and overseas training. Funding is synonymous with political support and is required to ensure appropriate staffing and resources are available for road safety research. Funding must also be consistent and reliable to allow research adequate development time.

▪ Dissemination and Application

Road safety research is not an end in itself and findings need to be shared, discussed, and applied in order for the full benefits to be realized. Research findings can be disseminated through seminars and training courses, and through international conferences. Research findings should be integratable into transport policy, which requires a close working relationship with the traffic police and road engineers.

▪ Stages of Development

In order to develop an effective road safety research capability, a country needs to proceed through a number of stages. The activities involved in the development of road safety research are typically as follows:

- Identify previous research conducted.
- Target priority areas identified and ensure reliable, accurate and comprehensive accident database accident database.
- NRSC/lead road safety agency to guide research and promote dissemination and application of findings.
- Effectiveness of road safety remedial measures evaluated by road safety researchers.
- Establish links with other road safety research institutes in other countries.
- Solicit private sector commissioned road safety research.
- Establish a road safety research center with full time researchers. Road safety research will eventually need to be undertaken by specially trained professionals.

▪ Priority Requirements For Bangladesh

With respect to Bangladesh situation, some aspects of systematic approach in accident research and investigation for improving road safety nationally could essentially involve the following:

- Detailed systematic accident data collection, recording and computerized database development with emphasis on objective information relating to accidents casualties and environment.
- A detailed and sophisticated analysis of accidents with emphasis on sub categorizing accidents into location, type, severity, user group etc. Analytical approach should invoke 'accident type/location' technique in ascertaining incidents of the side clustering of accidents.
- Development of procedures for identification of "hazardous road location"/ "accident black spots" as the treatment of those locations has been found to be highly cost-effective.
- Understanding and systematic application of proven and effective engineering countermeasures accompanied by proper evaluation studies of their effects.

7. TRAFFIC ACCIDENT RESEARCH METHODOLOGY

Traffic accident research methods can be broadly categorised under three major headings: theoretical, empirical, and simulation. However, by far the largest amount of accident research has been attributed to the second category of approach i.e. empirical analysis of accidents. Such empirical research generally involves the use of sets of data obtained in the form of observations or counts. The specific approach, however, depends on the type of analysis and the study objectives. In general, two broad divisions exist in an accident analysis (Hoque, 1987), namely: (i) detailed technical investigations of accident events, and (ii) general surveys of system wide accident patterns.

An example of accident studies in the general category is the analysis of trend information. Trend analysis is generally oriented towards providing information on accident data in a more or less non-technical form (e.g. describing accident numbers in terms of per unit of population or registered vehicles). An example of accident studies in the technical category is the analysis of accidents using a collision diagram that determines the patterns of accident types and gives clues to the reasons for accidents, and thus directs towards appropriate remedial measures. The research methodology at the Accident Research Centre (ARC), BUET essentially invokes such approach known as the “accident type/location” technique (Andreassend, 1982).

8. ACCIDENT RESEARCH CENTRE (ARC) AND ITS ROLE

Accident Research Centre (ARC), a centre first of its kind, was established under the top priority programs of the Government of the People’s Republic of Bangladesh to carry out scientific studies and research regarding the causes of accidents on roads, railways and waterways and commensurate remedial measures. ARC conducts appropriate training programs and workshops to develop qualified human resources for professional capacity building and also for creating mass awareness on road safety. In addition, ARC is expected to play major role to develop pragmatic, cost-effective scientific solutions and bring about significant improvements in the capability of the professionals and workers in the field of transportation to a meaningful level of expertise for accident prevention and injury control and thereby contribute to the safer road environment for all users and operators. ARC is also exploring the possible scopes for exchanging knowledge and technologies through collaboration with an extensive number of renowned overseas institutions, organizations and universities etc. at local, regional and international levels. The establishment of ARC at BUET is seen particularly significant in the context of the UN youth declaration for road safety which calls upon university administrators to promote and develop courses and programs on road safety and to conduct and publish more research on road traffic injury prevention. The recent activities of ARC are highlighted below.

8.1 Road Safety Research and Investigations

ARC conducts road safety research and investigation, which are useful in documenting the accident problem characteristics and would provide the means to develop and evaluate effective countermeasures. Some major areas of ARC’s research and investigation include:

- Road traffic accident data collection, accident database development and updating
- Identification of hazardous road locations (HRL) and accident black-spots analysis in Bangladesh
- Investigation of major fatal accidents and accidents during festivals
- Metropolitan street accident characteristics and safety improvements
- Involvement of pedestrians and children in road traffic accidents and injuries
- Understanding heavy vehicle drivers’ behavior and their attitudes
- Observational studies of Hazardous Road Locations (HRL)
- Accident spot investigation and in-depth analysis
- Recording and analyzing of inland water transport accidents and identification of the remedial measures
- Investigation of the incidence of over-speeding in relation to roadway safety
- Development of road safety education materials for children and drivers
- Emergency care and rescue of accident victims using GIS technology
- Heavy vehicles involvement in road traffic accidents
- Involvement of drivers in accidents and their characteristics
- Effects of vehicular defects on road traffic accidents

- Road safety hazards associated with bridges and culverts
- Estimates and analysis of costs(social and monetary) of accidents
- Route/site specific detailed analysis: Dhaka-Aricha highway corridor and the Jamuna multipurpose bridge and its approaches

8.2 Road Safety Training and Awareness Programs

ARC has already developed and organized a number of training programs to strengthen professional and institutional capacity in road safety management to promote safety conscious behavior and mass awareness. Some major areas of ARC's road safety training and awareness programs include:

- Training for professionals and road safety practitioners
- Training for students, Cadets and Scouts
- Training for heavy vehicle drivers (buses and trucks)
- International Conference on Road Safety in Developing Countries
- National and regional workshops, seminars, policy discussion meetings and rallies
- Observation of UN First Global Road Safety Week and the World Health Day with the theme "Road Safety is No Accident"
- Established a co-operative linkage and networking with various departments, institutions and organizations of Bangladesh in promoting road safety
- Preparation of road safety materials, booklets, posters, leaflets, banners for mass awareness among the policy makers, professionals, members of the civic society, NGO workers, transport operators and owners and the general public.

The Centre has also initiated professional exchange programs with similar overseas organizations and institutions for exchanging, updating and sharing of knowledge and experience on matters related to traffic accident and safety.

8.3 ARC's Publications:

Major Publications of the Accident Research Centre include the following:

- Proceedings of the International Conference on Road Safety in Developing Countries
- Key Road Safety Facts
- Drivers Booklet (in Bengali)
- Road Safety Messages
- Brochure on Accident Research Centre
- Brochure over Pedestrian Safety
- ARC News Letter
- The Dhaka Declaration on Road Safety
- Recommendations for Safety Improvements in Bangladesh

8.4 Research Dissemination and Sharing of Knowledge

Accident Research Centre has organized a series of events to provide a platform to share and transfer of knowledge and experiences in road safety developments and good practices. Some of those events include the following:

- The International Conference on Road Safety in Developing Countries (August 2006)
- National Workshop on Organizational Roles and Responsibilities of Road Safety
- National Workshop and Training Course on Road Safety Audit
- The Observance of UN First Global Road Safety Week
- Workshop on Road Safety in Bangladesh: Constraints and the Way Forward.

8.5 Strategic Vision of ARC

The Centre is Committed to Safer Transportation. In the light of achieving this goal, ARC is conducting various researches and training activities which include accident research and investigation, safety training and development of countermeasures and collaborative linkages. Through the wider expansion of research works,

eventually the centre would turn into a National Accident Research Centre and hopefully a Centre of Excellence for the advancement in safety research and technology.

The following future activities of Accident Research Centre (ARC) are particularly envisaged:

- Develop training courses for different target groups of professionals for developing the institutional capacity of different organisations of Bangladesh
- Offer Certificate courses, Diplomas, Masters and Ph.D degrees in different areas of Transport Safety, Technology, Injury Prevention & Control and other relevant areas of research.
- To conduct advanced research on technological, behavioural and educational safety improvement opportunities and their cost effectiveness and support the policy makers through providing recommendations.
- Disseminate and share the knowledge and translate them into safety policies and practices.
- Conduct regular meeting and exchange forums in the form of conferences, workshops, seminars of policy implications in collaboration with local, regional, and international agencies.

9. CONCLUDING REMARKS

Because road accidents are a national problem, achieving safety on our roads depends greatly on the commitment and efforts of the government, communities, organizations and individuals throughout Bangladesh. An improved understanding of the occurrence of road traffic accidents is a necessary prerequisite to the development and application of cost effective solutions to the accident and injury problem. Road safety research provides such understanding and knowledge of the problem characteristics solutions options. Accident research needs, benefits and requirements are briefly discussed in the paper with particular reference to the establishment and the role of Accident Research Centre in Bangladesh.

REFERENCES

1. Andreassend, D. C., 1982. *A Technique to Resolve Road Accident Problems*. Ph.D. Thesis (Unpublished), Dept. of Civil and Mining Engineering, The University of Wollongong.
2. Asian Development Bank (ADB) (1996). *Road Safety Guidelines for the Asian and Pacific Region*. ADB, Manila.
3. Elsenar, P., 2007. *Concluding Presentation in the 14th Road Safety Conference on Four Continents (RS4C)*, Bangkok, Thailand.
4. Hoque, M. M., 2006. *Road Safety in Bangladesh: The Contemporary Issues and Priorities*. Proceedings published on International Conference on Road Safety in Developing Countries, BUET, Dhaka, Bangladesh.
5. Hoque, M. M., 1987. *Accident in road classes and their long term changes in Melbourne*. Ph.D. Thesis (Unpublished), Dept. of Civil Engg, Monash University, Melbourne.
6. Mackay, M., 2003. UN Technical Briefing, "*Global Road Safety Crisis*", May 29.
7. World Health Organization, 2005. *The Road Ahead*, the WHO newsletter on road safety, issue 04.
8. World Health Organization, 2004. *World Report on Road Traffic Injury Prevention*. Geneva.