ADB

Road Safety Guidelines

for the Asian and Pacific Region

Asian Development Bank

ROAD SAFETY GUIDELINES

for the Asian and Pacific Region

Guidelines for Decision Makers on Road Safety Policy

Asian Development Bank

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ACRONYMS

AASHTO	-	Association of American State Highways and Transportation Officials
ADB	-	Asian Development Bank
BAC	-	blood alcohol concentration
CARS	-	Conference on Asian Road Safety
CITA	-	Comite International Del Inspectorate Technique Automobile
DEE	-	disaggregated effectiveness evaluation
DRE	-	divisional road engineers
DRSC	-	divisional road safety committee
DSA	-	Driving Standards Agency (United Kingdom)
EC	-	European Community
FNTC	-	Fiji National Training Council
GDP	-	gross domestic product
GNP	-	gross national product
HGV	-	heavy goods vehicle
IIT	-	Indian Institute of Technology
Lao PDR	-	Lao People's Democratic Republic
JICA	-	Japan International Cooperation Agency
MAAP	-	Microcomputer Accident Analysis Package
MoE	-	Ministry of Education
MoT	-	Ministry of Transport
NAASRA	-	National Association of Australian State Road Authorities
NGO	-	nongovernment organization
NMV	-	nonmotorized vehicle
NRSC	-	National Road Safety Council
OC	-	officials' committee
ODA	-	Overseas Development Administration (United Kingdom)
OECD	-	Organisation for Economic Co-operation and Development
PAU	-	police accident unit
PDMCs	-	Pacific developing member countries (of ADB)
PMO	-	prime minister's office
PRC	-	People's Republic of China
PRSC	-	provisional road safety committee
PSV	-	public service vehicle
PWD	-	public works department
RAP	-	route action plan
REAAA	-	Road Engineering Association of Asia and Australasia
RETA	-	regional technical assistance
RoSPA	-	Royal Society for the Prevention of Accidents (United Kingdom)
RSE	-	road safety education
RSU	-	Road Safety Unit (Fiji)
RTA	-	road traffic accident
RTSA	-	Road Traffic Safety Association (Republic of Korea)
SATCC	-	Southern Africa Transport and Communications Commission
TAC	-	Transport Accident Corporation (Australia)
TM	-	traffic management
TPIP	-	third party insurance premiums
TRL	-	Transport Research Laboratory (United Kingdom)
UK	-	United Kingdom
UN/ESCAP	-	United Nations Economic and Social Commission for Asia and the Pacific
US	-	United States
VASCAR	-	Visual Average Speed Computer and Recorder
VRU	-	vulnerable road user
WHO	-	World Health Organization

MEASUREMENTS

km	-	kilometer
km/h	-	kilometer per hour
m	-	meter
mg	-	milligram
ml	-	milliliter
mm	-	millimeter
mph	-	mile per hour

CONVERSIONS

1 mile	=	1.6 km
1 mph	=	1.6 km/h
1 yard	=	0.91 m

1 UK pound = US$1.6

ROAD SAFETY GUIDELINES

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EXECUTIVE SUMMARY

Asian Development Bank

1 INTRODUCTION

This Road Safety Guidelines for the Asian and Pacific Region has been developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB). The purpose of the Guidelines is to provide a source of reference and guidance to the region's senior decision makers with responsibility for road safety. The Executive Summary provides an overview of the problems and actions that need to be taken in each sector to address road safety issues effectively in the Asian and Pacific region. This publication has been designed as a series of self-contained documents that can be extracted for discussion and distribution.

2 TRENDS AND PROSPECTS

Although only a small proportion of the world's total motor vehicle fleet and total network is in the Asian and Pacific region, 235,000 road deaths occur annually, which is almost half of the 500,000 road deaths that occur annually worldwide. The number of people injured or crippled through road accidents in the region is difficult to quantify because of underreporting, but it is certainly of the order of 3 million to 4 million each year. Road accident deaths are commonly the second largest cause of deaths for the core age groups (ages 5-44 years) in many countries and the problem is now considered by the World Health Organization (WHO) to be of epidemic proportions. Road accidents cost countries between 1 percent and 3 percent of annual gross domestic product (GDP). Annual losses due to road accidents are now a serious economic drain and problem for many developing countries. In developing countries of the region alone, such losses total at least US$20 billion a year and much of these costs are incurred as foreign exchange losses because vehicles, medicines, and spare parts are often imported. These recurring annual losses (which are greater than the total annual lending to the region by the World Bank and ADB combined) undoubtedly inhibit the social and economic development of the region.

Plate 1: Bicycle versus truck in Hanoi, Viet Nam.

Many countries are experiencing annual vehicle fleet growth rates of about 16 percent or 17 percent; for example, People's Republic of China (PRC) (18 percent), India (17 percent), Malaysia (15 percent), and Viet Nam (18 percent). This is equivalent to the doubling of motorized vehicle fleets in five years, trebling in eight years, and quadrupling in 12 years. This factor, allied to the high proportion of two- and three-wheeled motorized vehicles and the relatively young age of the majority of the population, contributes to the serious road safety prob-

Plate 2: Road safety education in school.

lems being experienced in much of the region. Whereas the number of deaths and injuries have been reducing steadily in developed countries, the number of deaths in Asian and Pacific countries is rising at alarming rates. Between 1981 and 1993, the number of road accident deaths increased in the region by 95 percent, whereas total population increased by only 24 percent. This means that there was a significant increase in personal risk of death in a road accident.

Vulnerable road users (VRUs) (pedestrians, motorcyclists, and nonmotorized vehicles [NMVs]) are particularly at risk and in many countries of the region, they constitute the highest proportion of those killed or injured. They require particular attention in the developing of countermeasures and improvements.

For the last 10-year period (1984-1993), official police statistics show that more than 2 million people were killed and more than 17 million were injured or disabled in road accidents in the region. Many of these casualties will have received crippling injuries that will handicap them for the rest of their lives, imposing ongoing financial burdens on their families and their communities. So far, the problem has been largely unrecognized within the individual countries. Insufficient efforts and attention are given to the improvement of road safety in the region, even though road accidents impose a heavy burden on the medical and hospital resources of many countries. What is even more worrying is that a significant amount of underreporting occurs in many countries and many casualties are not included in official statistics. Thus the scale of the problem is even worse than the "official" statistics show.

Opportunities and scope exist for avoiding future problems by incorporating procedures, controls, and improvements in many sectors related to road safety. Failure to take action will condemn millions of people in the region to unnecessary death or injury. The necessary information to take action is available in this document and should be used to improve safety in the region.

3 COORDINATED ROAD SAFETY PLANS AND INTERVENTIONS

Experience in both the more industrialized countries and developing countries has demonstrated that the most effective way of reducing accidents is by adopting an integrated approach; that is, by safety action plans that are coordinated within and across all the different sectors (or government departments) that can influence Asian and Pacific countries. They are at different stages of development with respect to road safety awareness and activity, so different interventions need to be undertaken depending upon the particular circumstances within each country. Three distinct stages can be identified in the development of safety within a country. The types of activities and interventions possible and necessary at each stage are outlined below:

Stage 1: Raising Awareness

In most cases there will be a need to improve the national road accident database and the importance of this must be stressed to police authorities. The database should be capable of identifying the scale and nature of safety problems so that appropriate information about recent trends, road users at risk, hazardous locations, etc., can be imparted to those concerned, particularly to organizations in a position to make improvements.

Stage 2: Prioritized Road Safety Action Plans

During this stage the relevant authorities will need to develop an overall strategy identifying the most urgent remedial actions required

Plate 3: Police spot checks on drinking and driving.

and strengthening the key organizations that need to be involved. This will inevitably require special funding for the implementation of demonstration and pilot projects. External technical assistance is also likely to be needed (if specialist expertise is lacking within a country) and training for relevant personnel. At this stage, partial funding can often be obtained via overseas aid or through the international development banks.

The timescale for this important stage should be about three years and the main focus should be on strengthening relevant organizations with road safety responsibilities, implementation of the most urgent improvements, and the development of a five-year program. Specific interventions that can be implemented in each sector of road safety are presented in the Road Safety Guidelines and have been summarized in the following sections.

Stage 3: Five-year Road Safety Programs

This stage should aim to consolidate the activities already initiated in the earlier stages by the implementation of a realistic five-year program via a series of one-year plans. The significant investment required for this stage is normally met by the government of the country. Experience from the more industrialized countries indicates that improving safety can be enhanced by setting casualty reduction targets and ensuring that relevant authorities are accountable for achieving them. However, developing countries should take care when setting such targets. They should not blindly adopt targets similar to those stated in the industrialized countries, where the road network may well be developed and vehicle ownership levels stabilizing as they approach saturation level. Setting realistic targets in developing countries is often more complex because of the rapid motorization being experienced in these countries that itself will tend to result in increasing numbers of deaths and injuries each year. Consequently, developing countries are advised to use targets related to numbers of lives saved from different interventions, rather than targets related to reductions in total deaths or casualties. Reductions in total deaths or casualties are unlikely to occur during periods of very rapid motorization in developing countries.

It is strongly recommended that all safety action plans are properly monitored to ensure institutional impact and that developmental objectives are achieved as well as cost-effective implementation of specific countermeasures. Published evaluations are valuable in providing information about relative effectiveness of schemes and aiding decisions about the types of schemes to be implemented.

Priority actions that should be considered by all countries include:

1. initiate an independent review of road safety and organize a national seminar to present and discuss the findings;
2. establish a national road safety council (NRSC) with adequate technical and financial resources to coordinate road safety nationwide and develop a road safety action plan; and
3. include a road safety component in all relevant road improvement projects and also explore whether any unutilized loan funds on existing projects could be redirected to safety.

4 ROAD SAFETY SECTORS

The specific actions and interventions that can be undertaken in each sector of road safety are summarized in the following pages.

4.1

COORDINATION AND MANAGEMENT OF ROAD SAFETY

Road safety is a multidimensional social problem involving many government agencies, so the state must play a leading role in initiating, organizing, and coordinating the national assault on road safety problems in a country. The practical development of road safety capability at a national level has to take into account at least five important aspects as follows:

- definition of responsibility: this means designating a member of the government (prime minister's office [PMO] or ministerial task force) to be responsible for overall road safety policy;
- assigning the task to initiate and coordinate the state's actions. Establish a multidisciplinary team led by a high-level civil servant or high-caliber executive director from the private sector;
- setting up a permanent group to steer the actions (e.g., a national road safety council [NRSC] or an officials' committee);
- planning and assigning adequate technical and financial resources for the NRSC to carry out its work; and
- evaluation of the outcomes of actions.

All activities of the ministries involved in road safety (e.g., health, transport, police, and education) must be complementary and coordination also has to be developed with regional and local organizations so that road safety work is undertaken at all levels.

PRIORITY ACTIONS NEEDED

1. Designate the prime minister's office or a ministerial task force to be directly responsible for road safety policy issues and to oversee development of a road safety strategy and action plan.
2. Establish a multidisciplinary NRSC or a similar body with various subcommittees and a full-time secretariat with adequate technical and financial resources to develop and coordinate road safety activities effectively.
3. Identify high-risk target groups for publicity and education from analysis of accident data.

Strong political, financial, and technical support is needed for those delegated to initiate and coordinate road safety on behalf of the state. Such coordination is best done by a multidisciplinary national road safety council supported by a secretariat of road safety specialists led by a senior government official or high-caliber executive director.

EXECUTIVE SUMMARY

4.2

ROAD ACCIDENT DATA SYSTEMS

An accident database is needed for accurate assessment of the road safety situation. In order to be useful, the data need to cover more than deaths and should include data on casualties and the circumstances of the accident. This will help organizations that are able to contribute to safety improvement to devise and implement appropriate measures designed to combat specific problems.

The main processes involved in producing an accident database include an accident **reporting and recording** system, a **storage and retrieval** system, an **analysis** system, and an effective **dissemination** system.

Traffic police are the most ideally placed to record and manage accident data. Police do, however, need to be motivated and convinced of the usefulness of devoting the considerable effort required to collect this data and they also need to have adequate resources in terms of staffing, training, and computer systems. The data collected for all recorded accidents need to answer the following questions:

- **where** accidents occur;
- **when** accidents occur;
- **who** was involved;
- **what** was the result of the collision;
- **what** were the environmental conditions; and
- **how** did the collision occur.

Having introduced an effective database system, it is important to ensure that the data is utilized as effectively and widely as possible. Police annual accident statistics reports should be circulated widely and national decision makers should use the data. They should also be made readily accessible to relevant organizations for designing appropriate countermeasures, producing plans, monitoring effectiveness, and carrying out research.

PRIORITY ACTIONS NEEDED

1. Review police accident report forms to ensure that they are easy to complete, used nationwide, and include sufficient information to meet the needs of all potential accident data users.

2. Introduce an easy-to-use computerized data storage and analysis system that provides an understanding of the scale and characteristics of the problem, and permits appropriate countermeasures to be devised for high-risk target groups.

3. Ensure accident data statistics and analyses are distributed to those able to affect road safety and that they are used in designing and monitoring countermeasures.

An effective computer-based accident data system using a standard police data collection form nationwide is one of the most important prerequisites for a country that hopes to improve its road safety problem. It permits the characteristics and nature of the problem to be defined and appropriate countermeasures to be devised.

ROAD SAFETY FUNDING AND THE ROLE OF THE INSURANCE INDUSTRY

Funding of road safety is primarily the responsibility of the central government, supported as necessary by regional or provincial governments. However, the private sector and especially the insurance industry can and should play an important role in tackling road safety. But with a few notable exceptions, it does not yet do so in developing countries.

The insurance industry role is too often limited to the postaccident stage and, while vast sums are spent on accident claim compensation, little thought or financing is directed at road accident prevention. Increased motorization and the associated rise in accident claims require the active involvement of the insurance industry as it bears the majority of the costs of road accidents, and should assume greater responsibility for financing and directly promoting road safety.

The insurance industry can participate both via funding and by sharing its business and marketing skills to assist government in tackling a country's road safety problems.

Insurance companies in many countries, such as Australia, Canada, Finland, and other European countries, have found that there are significant advantages from investing in road safety, as the benefit in terms of reduced claims (because of reduced numbers of accidents) often outweighs the amount invested. The industry also benefits from an improved public perception of being seen as a socially responsible industry.

Other private sector organizations, especially fuel companies and organizations with large vehicle fleets and many drivers, can also help and profit by investing in road safety. Their involvement should be actively sought and encouraged by government.

PRIORITY ACTIONS NEEDED

1. Government should actively seek and encourage the private sector (e.g., fuel companies, transport operators, and especially the motor insurance industry) involvement in funding relevant road safety activities.

2. Legislate a mandatory requirement of third party motor insurance on all drivers, with, say, 5-10 percent of premium as a levy for road safety activities.

3. Motor vehicle insurance regulations should be enforced in order to achieve a high rate of coverage and maximize insurance contribution to road safety.

Opportunities do exist for governments to draw the insurance industry and other private sector interests into the battle to improve road safety by establishing voluntary or compulsory levies. Investment in road accident prevention can reduce outlays in accident insurance claim compensation and is seen as a good business decision by those already active in this area.

4.4

SAFE PLANNING AND DESIGN OF ROADS

Road networks in most developing countries are still being expanded and/or rehabilitated, and opportunities therefore exist to incorporate safety practices (at marginal cost) during the planning and design stages.

Many components of the design process can influence the level of road safety and some of the more important of these are discussed in this section. Simply adopting international design standards from developed countries will not necessarily result in levels of safety that are achieved in such countries because these standards are generally accompanied by effective enforcement, driver training, and publicity. These may not be operating as efficiently in developing countries and, in any case, the traffic conditions and types of traffic using the roads will be different.

More emphasis, therefore, needs to be placed on examining how to make the road network operate safely in the particular operating environment and traffic conditions that exist in each country.

- In **rural road rehabilitation** schemes, opportunities should be taken to minimize direct major road access, keep traffic speed relatively low when such roads pass through small communities, and eliminate Y-junctions.
- **New roads** may require the inclusion of additional safety features such as cycle lanes.
- **Urban areas** may require design of road networks to establish a road hierarchy, and the reduction of through traffic and speeds where pedestrian and cyclist activity exists.
- **On all roads**, greater emphasis needs to be given to the safety of the large proportion of vulnerable road users that normally exist in developing countries.

The Asian Development Bank (ADB), World Bank, and other development aid agencies have found that many potential safety problems can be avoided by safety checking of schemes during the planning and design stage (the safety audit process).

PRIORITY ACTIONS NEEDED

1. Require all proposed new and rehabilitation road schemes to be checked from a safety perspective during the design stage.
2. Review existing design standards, access control, and development control to ensure safety is given high priority, particularly for vulnerable road users in urban and rural areas.
3. Check that towns and cities have localized zoning, and that the existing road network is classified into a road hierarchy.

Developing countries need to adopt more safety-conscious design procedures when planning land use or improving their road networks. Safety audit (or safety checking procedures) should also be adopted to ensure that road networks are designed to be safer, particularly for pedestrians, nonmotorized vehicles, and motorcyclists.

EXECUTIVE SUMMARY

4.5

IMPROVEMENT OF HAZARDOUS LOCATIONS

The safety benefits that can be derived from identifying hazardous locations through the careful analysis of accident data, studying sites, and then designing appropriate remedial measures have proven to be particularly high. The benefits achieved by low-cost remedial measures can be many times the cost of their implementation.

The effectiveness of this approach can be maximized by a planned program of remedial measures based on accident reduction targets for highway authorities. The authorities will, of course, need to allocate a specific annual safety budget for their plans, or at least ensure adequate funding is set aside within the maintenance budget.

The four main strategies are: single site or black spot programs, mass action plans, route action plans, and area-wide schemes.

The stages of the hazardous location improvement process are as follows:

- a good accident database;
- agreeing a local hazardous location improvement program;
- accident analysis to identify accident black spots;
- design of remedial measures;
- implementing the measures; and
- monitoring the effectiveness of remedial measures.

Remedial measures can include better signs, road markings, pedestrian facilities, fencing, guardrails, junction modifications, and improvements to visibility. Traffic calming through various speed reduction measures has proven particularly effective where vulnerable road users are at risk.

PRIORITY ACTIONS NEEDED

1. All road authorities must establish and train a small team to monitor the operational safety and efficiency of their road network.

2. Identify and improve the most hazardous locations on the major inter-urban road networks according to annual targets.

3. Identify and improve the most hazardous locations on the road networks of each of the major cities and towns according to relevant annual targets, focusing on speed reduction near schools, and in residential and other areas where there are high numbers of pedestrians and cyclists.

Improvement of known hazardous locations is one of the most cost-effective investments that can be made in the transport sector and should be a high priority for every government.

ROAD SAFETY EDUCATION OF CHILDREN

On average, 20 percent of all people killed in traffic accidents in developing countries are aged under 15. This is twice as high as in the developed world.

- Human error plays a large part in road accidents, being a contributory factor in about 95 percent of accidents.
- Teaching safety skills to children can provide lifelong benefits to society.

Roads in developing countries are often more unsafe than roads in industrial countries and the traffic safety problems faced by children will often be greater in the developing world. Absence of traffic education can leave children exposed to unnecessary risk. Since the traffic circumstances and problems faced by such children are very different, it is inappropriate to simply use teaching materials from developed countries. Local materials need to be developed. Although these may be based on principles and materials from developed countries, they will need to be adapted to reflect the needs, problems, and circumstances of relevance to local children.

In addition, an incremental approach is needed to improve road safety education. Road safety provision should not rely on only occasional, isolated talks by visiting speakers but should include regular practical training. Essential components in developing and improving this sector are as follows:

- inclusion of road safety in the school curriculum appropriate to each age group;
- development and production of classroom materials;
- production of a teachers' guide and dissemination to all teachers;
- inclusion of road safety in teacher training courses; and
- coordination of activity and clearly defined responsibilities.

PRIORITY ACTIONS NEEDED

1. Review current extent of road safety education in school curriculum and assess adequacy and practicality of lessons and materials.

2. Develop road safety education pilot projects in high-risk areas, especially around roads being rehabilitated where the road accidents are likely to increase.

3. Strengthen road safety education in national curriculum with on-road practical lessons.

Children need to be made more aware of road safety and should be taught survival skills appropriate to their age and needs. Teaching of road safety in schools is best done by teachers who have themselves been trained on road safety issues and who can provide such instruction on a regular basis to their students.

4.7

DRIVER TRAINING AND TESTING

Recent studies in the United Kingdom (UK) and United States (US) have shown that in about 95 percent of recorded accidents, driver error was a contributory factor in some form or other. It is, therefore, vital that the human factor is addressed in tackling the problems of road safety. Fundamental to this is an efficient driver testing and training regime. This regime must not only be efficient and cost-effective, but just as important, it must have public confidence. Regrettably, at the moment, it must be said that the systems in some countries are obviously failing on all three counts.

It is readily appreciated that driver testing and training are only a small part of a whole series of initiatives necessary to solve the road safety problem. However, these sectors must make an important contribution to any initiative aimed at reducing road casualties and long-term reductions in accident statistics. It is essential that all road users are made more aware of the heavy responsibilities inherent in the possession of a driving license.

Novice drivers, especially those in the 17-21 age group, have a disproportionate number of accidents. By training all new drivers in skills for life, there are immeasurable long-term economic and social benefits arising from a more responsible attitude to driving.

Driver testing and training procedures are inadequate in many countries in the Asian and Pacific region and, with the rapid pace of motorization, urgent remedial measures are required to improve the situation. The state has a responsibility to ensure that only safe, competent drivers are allowed on roads.

The majority of driver training is used only to prepare a candidate for the driving test and therefore the standard of the driving test will determine the extent and quality of driver training. In order to improve driver training, the quality of driving instructors must also be improved and monitored and, in each country, a recommended syllabus for learner drivers should be introduced.

PRIORITY ACTIONS NEEDED

1. Ensure that the driving test examines the driver's judgment, decision making, and ability to drive safely on public roads in normal traffic conditions with stricter tests for drivers of large commercial vehicles.

2. Provide adequate training and staffing for driving examiners and ensure they are taught to drive all vehicles to the highest standards.

3 Organize training courses for professional driving instructors, develop a standardized driver training curriculum, and established a registration system, driving instructors, and driving schools.

Effective driver testing is the best way to ensure that only safe, competent drivers are awarded a driver's license. Good control and registration of driving schools and driving instructors is also highly beneficial in ensuring learners are given competent instruction.

ROAD SAFETY PUBLICITY AND CAMPAIGNS

Mass media has a profound effect on the daily lives, health, and well-being of people, and effective publicity can influence road user behavior and raise awareness of road safety issues. Well-planned publicity can influence both short-term behavior and long-term attitudes. For instance, publicity might deter drunk-driving because of the risk of being caught by police, but may also influence the long-term way a society thinks about and accepts the need to deter such unsocial behavior.

Publicity has the potential for being highly cost-effective in that it can address the safety of large numbers of people using media and materials. However, it can also lead to wasted resources if it is not handled in a manner that is carefully planned. Publicity campaigns and selection of target groups should be based on analysis of road accident data. In the absence of detailed data, awareness-raising campaigns can be undertaken to highlight the worsening situation.

Suitable publicity should accompany, or prepare for, the following: new legislation, new standards, enforcement initiatives, new safety products, and new highway features. Such publicity should be appropriate to local conditions and should focus on a single concise message.

Where possible, the publicity should be part of a wider marketing strategy aimed at raising awareness and influencing behavior.

PRIORITY ACTIONS NEEDED

1. Road accident data must be analyzed to identify the nature and characteristics of the problem, and the road user group to be targeted.

2. Publicity and campaigns should focus on a single concise message, and the media materials and images used must be appropriate to local conditions and the target groups.

3. Publicity campaigns should, where possible, be coordinated with engineering, legislation, and enforcement and should be evaluated by conducting before and after surveys.

Road safety publicity is an indispensable part of any nation's road safety strategy and is most successful if used in conjunction with engineering, legislation, or enforcement.

4.9

VEHICLE SAFETY STANDARDS

Without vehicle construction regulations governing safety standards, for systems such as braking, lighting, and signaling, there can be little control over the general safety of the country's vehicle fleet. For public service vehicles (PSVs), standards of comfort, access, and additional safety requirements are also needed. For heavy goods vehicles (HGVs), standards of size, gross vehicle weight, and maximum axle loads are necessary to ensure the safety of all road users and to minimize damage to the environment. Imported used vehicles must always be checked on arrival in a country to ensure they comply with national safety standards. Statutory testing is required to ensure that at regular intervals, vehicles meet a minimum acceptable standard of safety. The most important items that should be inspected are as follows:

- braking system;
- steering;
- tires; and
- lights.

While there is no international fixed agreement on the age of first testing of vehicles, it is recommended that light vehicles in developing countries are tested after three or four years and then annually, whereas high utilization vehicles such as HGVs, PSVs, and taxis should be tested after one year, and then annually with inspections every six months after 10 years of age. These are recommendations for minimum testing frequencies. In order of priority, the components necessary for an effective vehicle roadworthiness testing system are as follows:

- a legal framework;
- a coordinating and managing authority;
- trained and qualified staff;
- adequate testing facilities and equipment; and
- an enforcement and backup operation.

PRIORITY ACTIONS NEEDED

1. Vehicle defects most likely to contribute to road accidents and casualties should be targeted in routine and roadside vehicle inspections.

2. Checklists, assessment forms, increased controls, and training programs should be used to encourage uniform testing standards and procedures between stations and inspectors and to minimize corruption.

3. Random roadside inspection checking should be introduced involving the police and vehicle inspectors day and night to encourage compliance with safety standards.

Vehicle safety standards are necessary to ensure unsafe vehicles are not imported and to develop a safety culture among vehicle operators, owners, and users. They must be backed by adequate roadside checks in order that the overall standard of vehicles is gradually raised. The end result should then be a reduction in the contribution of vehicle defects to road accidents.

TRAFFIC LEGISLATION

Traffic legislation regulates the use of public roads and is applicable to the circulation of people, animals, and vehicles on the public highway and related activities. Where possible within the legislative system, the primary legislation should provide the basic features and framework, and the details should be specified within secondary legislation (i.e., through ministerial regulations). This allows flexibility for periodic revision without disturbing the primary enactment. Legislation provides the framework to promote and, where necessary, to enforce safer road user behavior.

Legislation specific to road safety includes as follows:

- driver licensing (criteria for license holders and driving test content);
- vehicle registration and testing (roadworthiness requirements and testing, and registration);
- control of traffic (speed limits, traffic signals, signs and markings, drink-driving, and pedestrians); and
- road authority.

Fixed penalty and penalty point systems should be considered wherever feasible as these have been found to be effective in reducing administration and influencing driver behavior in many industrialized countries. However, they may not always be as effective in the developing world. Areas of legislation directly relevant to road safety should be identified and all traffic laws reviewed and consolidated.

Drinking and driving is a proven cause of accidents. Enforcement of prescribed limit legislation has led to reductions of associated deaths and injuries in many countries. It is recommended that similar legislation prohibiting driving while under the influence of drink or drugs be devised that specifies a quantitative upper limit.

PRIORITY ACTIONS NEEDED

1. Review existing legislation and prosecution patterns to identify areas needing to be revised, and weaknesses in current legal system regarding citations and prosecutions.

2. Where it does not already exist, develop and introduce urgently legislation on drunk-driving limits and enforcement, speed zones and speed enforcement, seat belt and motorcycle safety helmet wearing, and compulsory third party motor insurance.

3. Where it does not already exist, develop and introduce urgently legislation on a national road safety council (NSRC) or similar to oversee coordination and improvement of road safety.

Traffic legislation provides the framework for traffic police and other enforcement agencies to ensure compliance with driving rules and regulations. Existing legislation should be reviewed, updated, and consolidated wherever possible. Legislation on drunk-driving, seat belt and safety helmet wearing, and speed zones where not already existing, should be introduced as a matter of urgency.

4.11

TRAFFIC POLICE AND LAW ENFORCEMENT

Traffic law enforcement is needed to encourage safer road use and an orderly traffic flow.

Most traffic police forces in the Asian and the Pacific region are characterized by insufficient training, minimal enforcement equipment or vehicles, and a high turnover in staff. Lack of mobility often results in a preoccupation with traffic control at junctions and inadequate attention has been given to the use of accident data in identifying enforcement priorities and targeting moving violations. Although staffing levels are often high, the lack of trained and experienced officers reduces substantially the potential effectiveness of such traffic police personnel.

Training is needed in many areas, including traffic management, accident investigation, highway patrolling, motorcycle riding and car driving, and management skills. Traffic police must be trained in both the technical tasks of policing and in how to set an example for the general public. Where possible, a career structure should be available in traffic policing to allow officers to specialize and make maximum use of their additional training. Control systems should be established to allow for the empowerment of junior level police officers while minimizing potential for abuse of power.

Modern enforcement equipment such as alcohol testing devices and radar speed detectors should be acquired. Traffic police personnel should be trained in their use and in related tactics and enforcement strategies.

PRIORITY ACTIONS NEEDED:

1. Traffic policing should be based on analysis of accident data and targeted to the roads and locations where accidents occur most frequently, and on the associated unsafe driver behaviors and moving offenses.

2. Traffic police training should be expanded and improved to create a specialist traffic police force skilled in use of modern enforcement equipment, tactics, and strategies, and with the ability to conduct targeted and effective enforcement campaigns.

3. Efficiency and activity indicators should be adopted to monitor performance, including the frequency of use and prosecutions resulting from modern enforcement equipment, such as alcohol testing devices and radar speed meters.

Traffic police must focus their attention on preventing road accidents. This is best done by having a well-trained, efficient organization that is adequately equipped with modern equipment and vehicles, and by concentrating on moving offenses and preventing unsafe driver behavior.

4.12

EMERGENCY ASSISTANCE TO ROAD ACCIDENT VICTIMS

Although there is great diversity in application, there is general agreement on the principles of an effective emergency medical service. The essential functions of such a service are as follows:

- the provision of first aid and medical care to the casualties at the roadside;
- the transport of the casualty to a hospital; and
- the subsequent provision of more definitive treatment.

The typical components of an ambulance service in a developed country are as follows:

- a notification and communication system;
- central control and coordination of operations;
- effective rescue and medical aid at the scene; and
- transport to a hospital and the provision of definitive care in an emergency department.

In many countries, the absence of organized ambulance systems may mean that accident victims must rely on being transported to a hospital by the first available vehicle passing the site (often called scoop and run). In such locations, efforts should be made to educate the public in the basic four or five actions that can be taken to preserve life, and the need to transport the victim to the nearest medical facility as quickly as possible.

To ensure accident victims get the best emergency medical treatment practically possible, there should be a review of the local situation to provide information on the available resources and current usage patterns; i.e., how casualties arrive at the hospital and how long a time at the scene and in transit. With data from a study of crashes and injuries, and transport to hospitals, short- and longer-term plans can then be made for the development of a system suited to local situations.

PRIORITY ACTIONS NEEDED

1. Provide basic first aid information on treatment of accident victims (how to stop bleeding, choking, etc.) to all drivers (e.g., at the back of the highway code and through targeted publicity campaigns).

2. Train police, fire, and any other emergency service personnel in basic first aid.

3. Develop local and regional trauma plans based on study of postaccident assistance and consequences for road traffic accident casualties.

The key principle is to provide initial stabilization of the injured party during the “golden hour” (i.e., the first hour after injury). The general driving public should be made aware of simple actions that can be taken to preserve life.

4.13

ROAD SAFETY RESEARCH

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. Accurate and comprehensive accident data is required to provide a base comparison for identifying problems, evaluating any changes, and assessing the effectiveness of any countermeasures adopted. Consequently, improving the accident database is frequently one of the first priorities when seeking to establish a road safety research program.

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. 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.

Efforts should be made to identify the factors involved in road accidents and to monitor effectiveness of any countermeasures implemented. Of particular importance is the development and monitoring of low-cost engineering countermeasures so that immediate improvements can be made at known hazardous locations.

PRIORITY ACTIONS NEEDED

1. Identify and prepare a consolidated list of all road safety research undertaken in the country and the researchers and institutes involved.

2. Target future research at accepted priority areas or in improving the accident data system if accident data is inadequate to provide an accurate baseline assessment of the road safety situation.

3. Coordinate research with the national road safety council (NRSC) and the lead road safety agency in the country to ensure road safety research is relevant and findings can be applied.

Road safety research has proven beneficial in documenting the road accident problem and has provided the means to develop and evaluate countermeasures. It has contributed greatly to the accident reduction in industrialized countries.

4.14

ROAD ACCIDENT COSTING

With the high growth of road accidents throughout the developing world, it is essential that adequate sums of money are spent in dealing with the problem. In the absence of an estimate of accident-related economic issues, it is difficult to identify the sums of money that should be invested each year on road safety counter-measures. The first need for accident cost valuations, therefore, is at the level of national resource planning to ensure that road safety is given adequate priority in terms of investment in its improvement.

A second need for road accident cost figures is to ensure that the best use is made of any investment and that the best (and most appropriate) safety improvements are introduced in terms of the benefits they might generate in relation to their cost.

Various methods exist for costing road accidents but the method currently recommended for use in the developing world is the gross output or human capital approach. The method takes into account the loss of current resources such as vehicle damage, medical treatment, police and administration costs, and damage to street furniture. It also attempts to cost the loss of future resources by considering the loss to society of a person's output when that person is killed or injured.

In using the gross output method, a sum is usually included to reflect pain, grief, and suffering of the accident victim and to those who care for the victim.

Accidents are usually costed by degree of severity so that separate values are determined for fatal, serious, slight, and damage-only accidents. The national cost of road accidents is then determined by multiplying the costs by accident severity by the number of those accidents taking place each year.

Once the total extent of the human casualty toll and economic costs of road accidents is known, the road safety situation will be better appreciated by politicians and decision makers and the case made for increased road safety investment. Road accident costs can then begin to be used to justify safety measures, and be considered along with construction and maintenance costs in the cost benefit analysis of road improvement projects.

PRIORITY ACTIONS NEEDED

1. Until local estimates are available, assume 1-2 percent of national gross domestic product (GDP) is lost annually through road accidents.

2. Prepare interim local estimates of the costs of road accidents by severity using the approach recommended by the Transport Research Laboratory (TRL) of the United Kingdom (UK).

3. Set in motion a research project at a university or economic research institute to prepare accurate valuations of road accident costs by severity using the gross output method.

An estimate of the total national cost of road accidents will help Governments realize the heavy economic losses (typically between 1 percent and 2 percent of gross domestic product [GDP]) being incurred annually). This will encourage them to invest in road safety improvements to reduce these losses and to see expenditure on road safety as an investment and not as a cost.

Road Safety Guidelines

for the Asian and Pacific Region

1

INTRODUCTION AND BACKGROUND

Asian Development Bank

1.1 INTRODUCTION AND BACKGROUND

This *Road Safety Guidelines for the Asian and Pacific Region* has been developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

In addition to these guidelines, the project reviewed road safety in the developing countries of the Asian and Pacific region, and a number of technical notes and reports were prepared documenting various aspects of road safety in the region. Among these is a companion volume, *Vulnerable Road Users in the Asian and Pacific Region*, which focuses on the problems, approaches, and facilities faced by the most vulnerable users of roads in the region. Copies are available from the ADB.

These guidelines are based on the practices found to have been most effective in developed and developing countries and on the extensive practical experience of a large number of professionals with direct experience of working on road safety issues in such countries.

It is intended that this publication will be available in Chinese and Russian, as well as in English, and that they will be distributed widely throughout the Asian and Pacific region. Additional copies of this publication are available from the ADB.

1.2 Scope

This document was devised to help countries in the region overcome some of the deficiencies and impediments preventing effectiveness of road safety. Guidance is given on the types of interventions and countermeasures that can be implemented in each of the 14 major sectors affecting road safety, and also on how these different interventions can be coordinated within national road safety action plans and programs to bring about road safety improvement.

It is intended to promote comprehensive coordinated approaches to road safety and to encourage networking and sharing of information.

1.3 Aim

The general aim of these guidelines is to encourage the development and implementation of initiatives in all the major sectors affecting road safety. The specific objectives are as follows:

1) to provide a single comprehensive source of reference and guidance for senior government officials in developing countries of the Asian and Pacific region on the kinds of actions and interventions that can and need to be taken in each of the different sectors affecting road safety;

2) to provide, in an easily accessible format that can be updated easily, information for policymakers so that senior government officials can discuss these issues more easily with government ministers and other senior politicians;

3) to bring together in a single document the practical experience of specialists from the developing and developed world who have been active in road safety over many years and who have particular knowledge or experience of road safety in the Asian and Pacific region; and

4) to improve significantly the capability of developing countries in the Asian and Pacific region to tackle their growing road safety problems.

1.4 The Need for Guidance and Advice

Since almost all countries in the developing world suffer from a lack of financial resources, it is essential that the limited resources that are available should not be wasted. Road accidents contribute to high economic losses annually in the Asian and Pacific region and action is necessary to try to reduce these losses. Unfortunately, many countries also suffer from the absence of adequate technical resources and expertise to ensure that road safety issues are tackled effectively.

Often, too few trained professionals are available. There are often gaps in knowledge and they may not always be familiar with recent developments and techniques that can affect road safety. Consequently, there was felt to be an urgent need to amalgamate and distill the collective knowledge and experience of the industrialized countries and of those developing countries that had tackled such issues. This document attempts to do this.

This document is complementary to the United Nations Economic and Social Commission for Asia and the Pacific (UN/ESCAP) *Guidelines on Action Plans and Programs* (published by UN/ESCAP). The two sets of guidelines should assist developing countries in addressing their road safety problems more effectively.

1.5 Potential Users

This publication is intended for use by senior government officials at director general or permanent secretary level in sectors that can have an in• uence on road safety in a country. The document can also act as a basic source of reference for senior politicians, aid agency officials, and other decision makers so that they are at least familiar with the key issues, elements, and opportunities relating to the improvement of road safety.

1.6 Structure and Content

The document has been designed for ease of use by different interest groups. It consists of an Executive Summary and four chapters followed by a number of appendices. The arrangement is as follows:

a) *Executive Summary*

The Executive Summary gives senior decision makers an overview of the most important issues in each sector of road safety and the priority actions that can be taken as first steps to commencing useful activity. Each sector is summarized in a one-page format. Apart from summarizing the contents of the guidelines, it simply provides a short section on each sector of road safety and suggests three priority actions that could be undertaken in order to strengthen road safety activities in that sector. Road safety can be improved only through a multidisciplinary and comprehensive approach. Activities need to be undertaken in each sector that can affect or influence road safety. Implementation of the three priority actions in each sector would at least initiate some activity and strengthen the ability of each country to begin to address its safety problems.

b) *Chapter 1*

This provides a brief introduction and discusses the volume's scope, main aims, potential users, and structure. It also offers guidance on the use of the volume.

c) *Chapter 2*

This chapter summarizes the scale of road safety problems in the Asian and Pacific region, discusses the motorization and growth in vehicle fleets, and illustrates recent trends in road accidents in the region. It also discusses the socioeconomic cost of road accidents, showing that the problem has now become more acute, and argues for urgent action to be taken.

d) *Chapter 3*

Chapter 3 discusses how road safety action plans and interventions can be designed for maximum impact. It argues for coordinated action, discusses the stages of road safety development in a country, and illustrates the kind of action and intervention that can be taken in this process. These range from raising awareness to developing prioritized road safety action plans and eventually developing three- or five-year road safety programs. This chapter also discusses road safety goals and targets that can be based on casualty reduction or, less directly, on desired changes in road user behavior (e.g., wearing of seat belts). Advice is also provided on how road safety initiatives can be financed. It also argues for improved monitoring and evaluation to ensure that maximum impact occurs both in terms of accident reduc-

tions and institutional strengthening when such action plans and programs are implemented.

e) Chapter 4

Chapter 4 has been designed as 14 self-contained sector guidelines, covering all important aspects of road safety. The format enables individual sector guidelines to be circulated as needed by relevant users.

The first page of each sector summarizes the key points and priority actions relating to that sector.

The remaining 8-10 pages describe, in more detail, what needs to be done to develop effective road safety activity in that sector. The sector guidelines included in Chapter 4 are as follows:

4.1 Coordination and Management of Road Safety
4.2 Road Accident Data Systems
4.3 Road Safety Funding and the Role of the Insurance Industry
4.4 Safe Planning and Design of Roads;
4.5 Improvement of Hazardous Locations
4.6 Road Safety Education of Children
4.7 Driver Training and Testing
4.8 Road Safety Publicity and Campaigns
4.9 Vehicle Safety Standards
4.10 Traffic Legislation
4.11 Traffic Police and Law Enforcement
4.12 Emergency Assistance to Road Accident Victims
4.13 Road Safety Research
4.14 Road Accident Costing

The references at the end of each sector provide guidance on the most important documents for those wishing to explore that sector in more depth.

f) Appendices

This section provides additional information. Appendix A includes a list of useful documents worth acquiring by all readers, while Appendix B includes international contacts and organizations active in road safety, to encourage formation of a network of road safety professionals for the Asian and Pacific region. Appendix C provides a small case study of a recent successful Road Safety Action Plan in Fiji and demonstrates the monitoring system used in ensuring effective implementation. Appendix D provides some statistics for the main countries in the Asian and Pacific region to allow some preliminary cross-country comparisons.

1.7 Sources of Further Information And Networking

A deliberate effort has been made within the appendices to provide a list of the key publications considered to be most important for road safety professionals in the Asian and Pacific region.

In addition, sector-specific references are provided within each technical sector in Chapter 4. Appendices B and C also provide the telephone/fax numbers, E-mail addresses, and postal addresses for many organizations from whom additional information can be acquired.

1.8 Guidance on the Use of the Document

The document has been deliberately written as a number of freestanding sections that are internally cross-referenced.

The *Guidelines* has been designed to be held within a ring binder file so that relevant sections can be extracted by senior government officials for discussion with politicians and others as appropriate.

1.9 Limitations of the *Guidelines*

This is the first serious attempt to provide a general road safety reference covering all sectors of safety in developing countries. While it obviously cannot meet the comprehensive needs of all countries in the Asian and Pacific region because of their diversity, it does hopefully address common issues and problems that can be found in all the countries.

Attempting to cover in a single document the wide mix of countries at different stages of motorization and with different road safety problems is obviously difficult. The Asian and Pacific region contains some of the largest and smallest (in terms of population) countries, some countries with fast economic growth, and

others at the bottom of the development scale. It contains highly industrialized city states such as Singapore, and countries such as Nepal, where more than half of its districts do not even have roads suitable for motorized vehicles.

Consequently, it is not feasible to provide detailed guidance for all situations. However, the project team has attempted to provide a basic overview of what needs to be done in each sector and has provided guidance, references, and contacts for readers interested in exploring particular topics in more detail.

The knowledge, views, and opinions of many safety practitioners both within the Asian and Pacific countries and from outside were solicited to ensure that the guidelines were as practical and relevant as possible to the needs of the region.

Any credit for this document should be shared by all those who contributed to and commented on it.

Errors and limitations are the responsibilities of the authors alone and it is the intention that these will be rectified when this document is updated in a few years.

Road Safety Guidelines

for the Asian and Pacific Region

2

ROAD SAFETY TRENDS IN THE ASIAN AND PACIFIC REGION

Asian Development Bank

2

SAFETY TRENDS IN THE ASIAN AND PACIFIC REGION

The rapid increases in motor vehicle ownership in the Asian and Pacific region in recent years in combination with the relatively young age of the populations and the wide mix of vehicle types have resulted in a significant worsening of road safety problems.

Present vehicle fleets result in 235,000 persons being killed and 3 million to 4 million being injured or crippled each year. In the last 10 years alone (1984-1993), official statistics show that this has resulted in more than 2 million deaths and more than 17 million people being injured or crippled. Road accidents already cost the developing countries of the Asian and Pacific region about US$20 billion each year and this will continue year after year. These losses undoubtedly inhibit the economic and social development of the region.

The rapid rate of increase in motorized vehicle fleets (15 percent to 17 percent annually in many countries) will result in a doubling of vehicles in only five years and trebling every eight years. This will cause even more problems and, according to present trends, there could well be 450,000 deaths and 7 million to 8 million injured or crippled each year within the next decade unless appropriate action is taken. What is even more worrying is that a considerable amount of underreporting occurs in most countries of the region so the true figures could be even higher.

Road accident death rates in Asian and Pacific developing countries are already between 20 times and 70 times as high as equivalent rates in the industrialized countries. In addition, the fatality index (percentage who die out of total casualties) is high. This is almost certainly partly due to inaccuracies and omissions in data, but may also be due to absence of adequate medical care and treatment of those injured in road accidents.

PRIORITY ACTIONS NEEDED

1. Agreement on data items to be collected for inclusion on the United Nations Economic and Social Commission for Asia and the Pacific (UN/ESCAP) database, which is to be made available (perhaps via Internet) to all.

2. Designation of a lead agency within each country to ensure national accident data is as complete and accurate as possible and is widely disseminated within the country and sent on to ESCAP for inclusion in the regional database.

3. Regular comparison and dissemination of accident and death rates and ranking to encourage countries to take action.

There is now a serious and growing road safety problem in the Asian and Pacific region that needs urgent attention from all concerned. Unless effective action is taken, casualties could rise to 450,000 deaths and between 7 million and 8 million injured or crippled each year within the next 10 years.

2.1 SCALE OF THE ROAD SAFETY PROBLEMS

The rapid increase in vehicle ownership in the Asian and Pacific region in recent years has placed considerable pressures on the road network, and on its traffic control devices, many of which were never designed for the traffic flows now using them, and on drivers and pedestrians using existing facilities. In the 10 years between 1984 and 1993, the number of people killed annually has increased by almost 60 percent and there are now more than 235,000 road accident-related deaths each year in the region. It is estimated that, in addition, at least 3 million to 4 million are injured in road accidents each year.

Official statistics show that during the 10-year period 1984-1993, more than 2 million people were killed and more than 17 million injured in road accidents in the region. Many of these casualties will have received crippling injuries that may handicap them for the rest of their lives and will impose a financial burden on their families and on their communities.

Traffic accidents account for more deaths in the Asian and Pacific region than the common notifiable diseases often considered to be a major problem in developing countries. Whereas the road accident situation is slowly improving in the high-income industrialized countries of the region (e.g., Australia, Japan, and New Zealand), most developing countries in the region face a worsening situation. As infectious diseases are increasingly brought under control, road deaths and injuries have, in recent years, risen in importance. In Thailand, for example, more years of potential life are now lost through road accidents than through tuberculosis and malaria combined. Road accidents are the second highest cause of premature death among the core segments of the population (5-44 years of age) in many developing countries.

What is even more worrying is that there is much evidence that road accidents are underreported, so the official statistics used here underestimate the situation. The problem is almost certainly much more urgent and serious than even the following analyses of trends would suggest, as these are based on official police statistics. The following sections present comparative analyses of current trends and statistics for the region that are presented in Appendix D.

2.2 Motorization and Growth in Vehicle Fleets

During the last decade, the rate of increase of gross domestic product (GDP) of Asian developing countries has consistently been double the global average. Tourism into and within the region has grown rapidly in recent decades and the urban populations of the Asian and Pacific region have almost trebled between 1960 and 1990.

This economic growth, increasing disposable income, and increasing urbanization is creating greater demand for transport and the number of vehicles on the region's road system is growing rapidly. Many countries have experienced annual growth rates of about 16 percent or 17 percent; e.g., People's Republic of China (PRC) (18 percent), India (17 percent); Malaysia (15 percent), and Viet Nam (18 percent). This is equivalent to doubling vehicle fleets in five years and trebling in eight years. This factor, allied to the high proportion of two- and three-wheeled motorized vehicles and the relatively young age of the majority of the population, all contribute to the region's serious road safety problems.

If the trends in growth of vehicles continue, this will have severe consequences for the region. As the following paragraphs indicate, urgent action will need to be taken if the present systems are not to be swamped by a deluge of

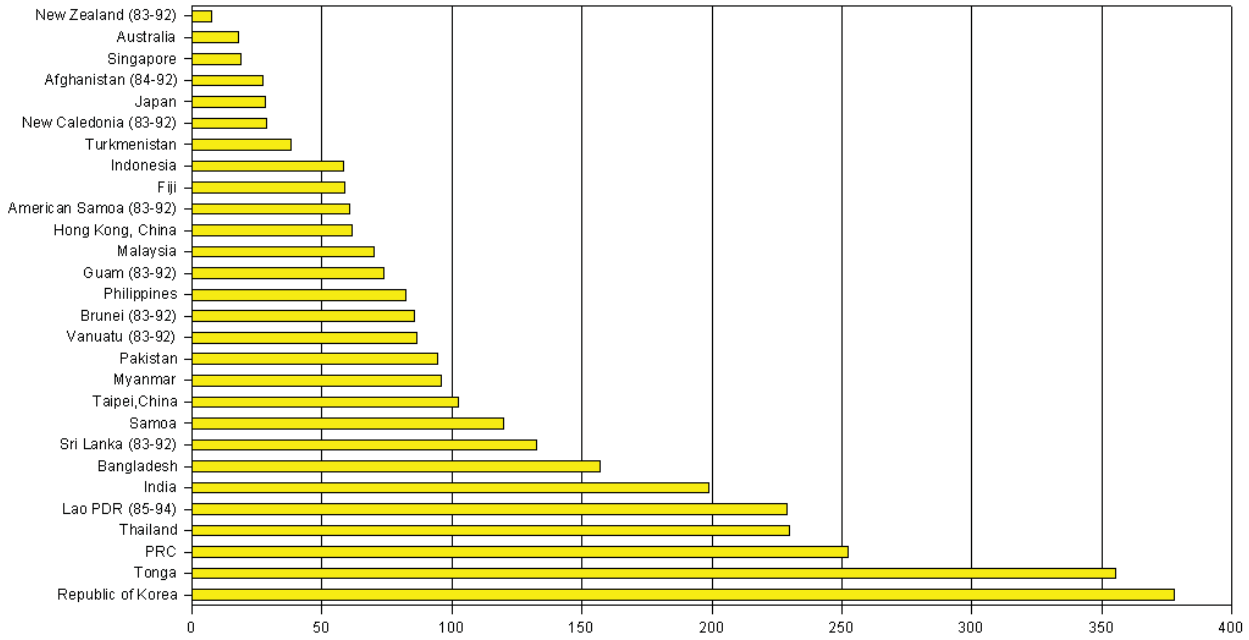
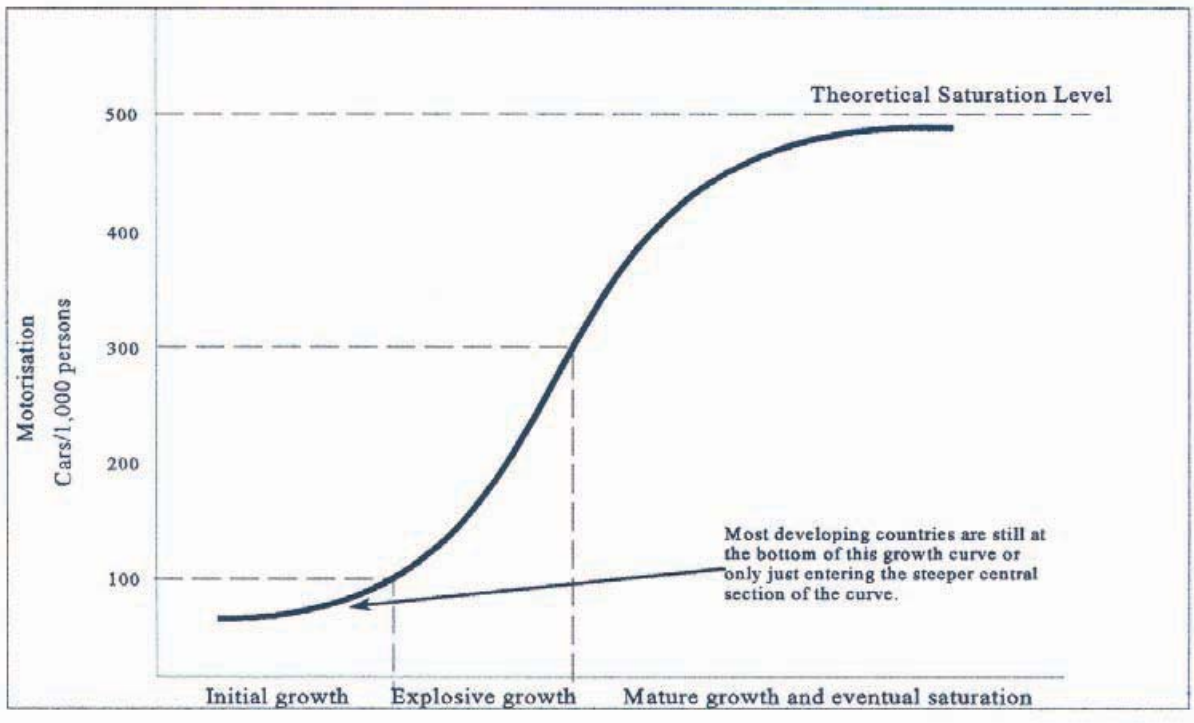


Figure 2.1

Source: RETA project data.



Source: RETA project data.

Figure 2.1 (top): Percentage change in motorized vehicle fleet 1984-93.

Figure 2.2: Generalized vehicle ownership growth curve.

vehicles in future. Recent changes in motorized vehicle fleets are shown in Figures 2.1 and 2.4. It can be seen that PRC, India, Republic of Korea, and Thailand have all substantially increased the size of their motorized vehicle fleets in recent years. In the Republic of Korea, for example, the vehicle fleet has increased eightfold in only 12 years and most of this growth has arisen out of increased demand for private vehicles.

The freedom, benefits, and convenience offered by ownership of a private vehicle is such that most individuals aspire to owning one as soon as they can afford it. In developed

countries this has resulted in large increases in the ownership of cars as the economic conditions of the people improved. In developing countries, private motorization encompasses motorcycles as well as cars, as these are often the first affordable motorized vehicles that are accessible to people in the developing world.

Thus, private vehicle ownership in the developed world consists almost exclusively of cars while it encompasses a much wider range of motorized vehicles in developing countries. The consequences of this difference are discussed in the following four paragraphs.

The current private vehicle ownership level of many countries in the region is still low in comparison to the industrialized countries. In these more motorized countries it has been found that the shape of the private vehicle ownership curve over time approximates an S curve (Figure 2.2).

In the early years (at the tail of the curve), the vehicle ownership growth is slow and steady but this is followed by a period of rapid expansion or "explosive" growth (i.e., the steep part of the curve), before growth slows down again towards the top of the curve as it approaches theoretical saturation level (i.e., when it is assumed that all who want vehicles will have acquired them).

At that stage, the rate of increase is expected to drop until it just keeps pace with the number of new drivers, since all existing demand will already have been met.

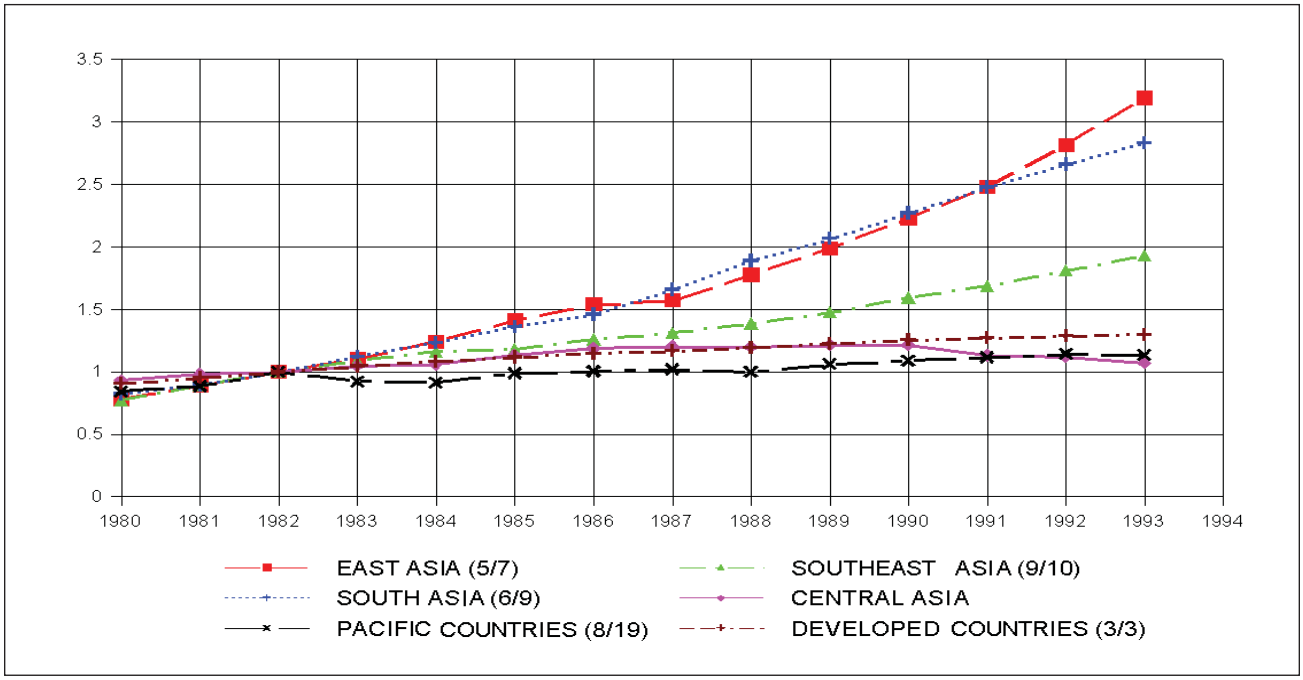
It has been found in the more motorized countries that vehicle ownership growth rates do not begin to level out until ownership levels of about 500 vehicles per 1,000 population or higher are achieved. Consequently, the experiences of the more motorized countries would suggest that, despite the rapid increases already being experienced in the region, many countries are still at the bottom of the growth curve and have yet to enter the very steep "explosive" growth part of the vehicle ownership curve. If motorization continues as it has in all other industrialized countries, then growth in ownership is certain to continue to levels of at least 500 vehicles per 1,000 population. Many countries (for example, Australia and the United States) already have ownership levels of well above this theoretical limit.

While the number of motor vehicles per 1,000 persons has surpassed 600 in many industrialized countries and is also high in Taipei,China (779), the next highest motorization level in the region is 344 in Malaysia. Three other countries have relatively high motorization levels: Thailand (225), Singapore (207), and the Republic of Korea (184). Fiji has 121 motor vehicles for every 1,000 persons and all other countries have motorization levels lower than 85. Afghanistan and Bangladesh have low rates at only three, while the PRC has yet even to register one motor vehicle per 1,000 people.

At present (because of their high numbers of motorcycles), only Malaysia and Taipei,China appear to have passed through the

Figure 2.3: Proportional increases in vehicles per person for Asian and Pacific subregions using 1982 as the base year.

Source: RETA project data.



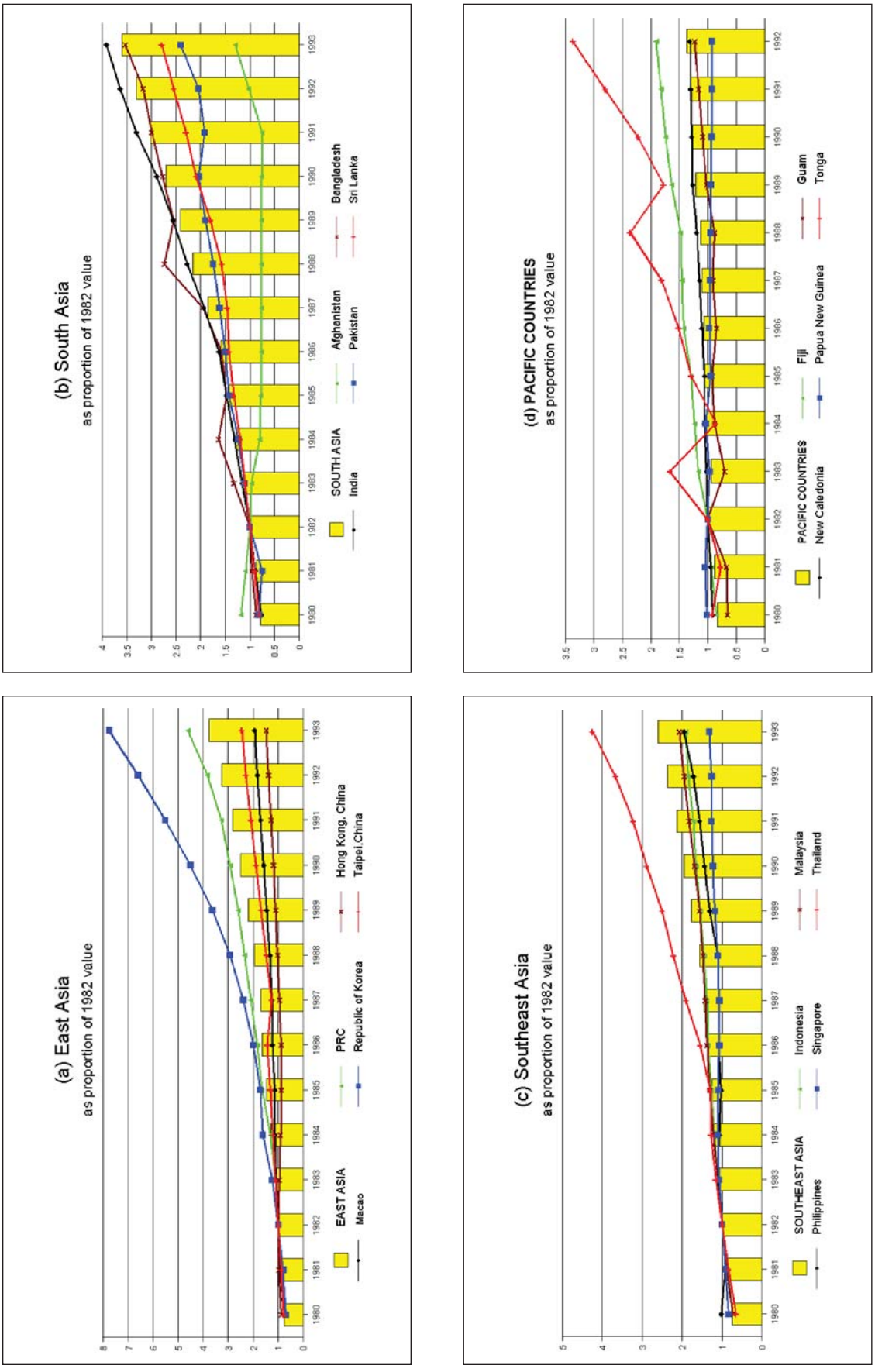


Figure 2.4: Proportional increase in vehicles in the Asian and Pacific region using 1982 as the base year (e.g., value 1).

Source: RETA project data.

explosive vehicle growth phase, while a few more countries (Fiji, Republic of Korea, Singapore, and Thailand) have entered this rapid vehicle fleet growth period. Most developing countries are still well below 100 motor vehicles per 1,000 population and can be expected to have their vehicle population grow at current levels for several more years before beginning the much steeper increases of the explosive stage of growth.

The initial acquisition of a motorcycle in many cases will be followed by its eventual replacement with a private car once incomes rise, so the general trend of the vehicle growth S curve is likely to be repeated in the developing world and may even be steeper, since motorization is occurring at a much faster pace in developing countries.

Figure 2.3 shows the proportional increase in vehicles per capita for the Asian and Pacific subregions using 1982 as a base year. Data for five out of the seven **East Asian** countries shows that the number of vehicles per person increased by more than three times between 1982 and 1993. The numbers of vehicles per capita in **South Asia** increased by more than 2.5 times between 1982 and 1993. **Southeast Asia** has also seen large increases in vehicle ownership. The number of vehicles per capita in the three **developed** countries in the region increased only 1.3 times. However, this was mostly in Japan, with Australia and New Zealand experiencing relatively small increases.

More dramatic increases in motorization become apparent by looking in isolation at individual countries within subregions. Figures 2.4(a) to 2.4(d), show the gross number of motor vehicles as a proportion of the number in 1982. Generalization simply by area can be a little misleading because of the massive intercountry differences in geographical or population size.

Figure 2.4(a) shows that the number of vehicles in **East Asia** has risen almost fourfold between 1982 and 1993. There have been significant variations between the individual countries involved. The vehicle fleet in the Republic of Korea has increased almost eightfold and Taipei,China's fleet has increased by more than four times its 1982 level. On the other hand, Hong Kong, China's vehicle fleet has remained relatively stable in comparison, increasing by only 48 percent over this period.

In **South Asia** the total number of vehicles in the six countries from which data are available (Figure 2.4[b]) is dominated by the number of vehicles in India, which constitute about 84 percent of the total vehicles in the six countries in 1993. A further 11 percent are in Pakistan. India dictates the trends in this subregion (an overall increase of more than 3.5 times). Afghanistan, Maldives, Pakistan, and Sri Lanka have all experienced a rise in vehicle ownership below that of the South Asia figure as a whole. The number of vehicles in Bangladesh has increased by more than 3.5 times.

Compared with the other subregions of the Asian and Pacific region, **Southeast Asia** shows a modest rise in the number of motor vehicles. Figure 2.4(c) shows that growth varies from 1.3 times (Singapore) to 4.3 times (Thailand). In a number of countries, vehicle fleets have doubled over the 1980s. The only country with explosive increases in the number of motor vehicles is Thailand. It could be that in Southeast Asia, the relatively modest rise in vehicle ownership in the 1980s follows an earlier explosion in the number of vehicles (especially motorcycles).

Much of the data for the **Pacific** area are erratic and may well be unreliable (see Figure 2.4[d]). It is highly improbable that vehicle numbers would fluctuate to the degree they appear to be doing in some Pacific countries. It is more likely that the political upheavals in the subregion during the late 1980s led to inadequate recording of the number of motor vehicles, causing erratic fluctuations in what might otherwise be a straight line. The actual numbers involved in Tonga are small (7,364 vehicles in 1991) compared with the larger islands (102,000 in Guam, 87,800 in Fiji, and 75,000 in New Caledonia in 1992). Fiji, Guam, and New Caledonia dictate the overall trend due to the size of their vehicle fleets, as can be seen from the graph. The overall increase in the number of vehicles is, however, more modest in this subregion than in the others.

As mentioned above in relation to vehicles per capita, trends in the **developed** countries of the region are heavily influenced by the high numbers of vehicles in Japan. In terms of vehicle fleet, Japan has experienced a 44 percent increase between 1982 and 1994, whereas Australia and New Zealand had increases of 25 percent and 10 percent, respectively.

The S-shaped motorization curve described earlier is based on developed countries' experience where two- and three-wheeled motor

vehicles did not play an important role. In many parts of the Asian and Pacific region, two- and three-wheeled motor vehicles dominate the motor vehicle populations and the vehicle growth rate. **With motorcycles a much more affordable vehicle type, motorization levels may well increase at even higher rates than found in the developed world.**

More than 70 percent of the motor vehicles in the most motorized country of the region, Taipei,China, are motorcycles. Apart from the Philippines, two- and three-wheeled motor vehicles account for at least half of all motor vehicles in South Asia and Southeast Asia, and in India, Indonesia, Thailand, and Viet Nam, they represent two thirds of all motor vehicles.

Two- and three-wheeled motor vehicles appear so far to have grown at a relatively constant rate in line with the total motor vehicle fleet (perhaps again because they have previously dominated the motor vehicle fleet), except for Bangladesh where they more than doubled their motor vehicle fleet share (28 percent to 59 percent) between 1991 and 1994.

Motorcycles are the most vulnerable motorized vehicle type for several reasons, including the lack of protective covering, younger riding age, minimal (if any) training requirements, minimal testing procedures, and relaxed vehicle inspection procedures. These factors may all contribute to increasing the road traffic accident casualty rates in the region.

Virtually all countries throughout the world have, over the last 20 years or so, experienced increases in vehicle ownership, but **developed countries**, by investing in road safety countermeasures, have managed to reduce the numbers of road accidents. Regrettably, developing countries appear to be less willing or able to spend the sums of money required to reduce road accident deaths and injuries and the situation continues to deteriorate in such countries.

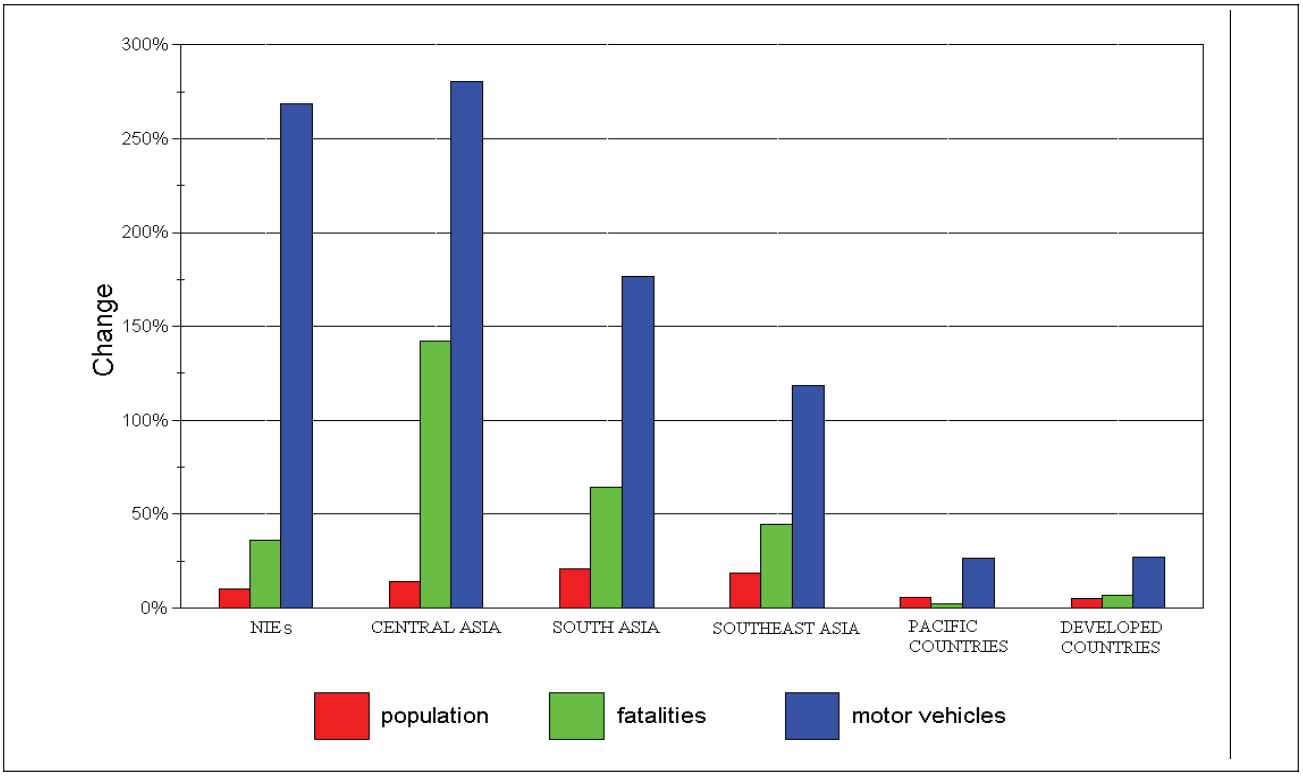
While vehicle growth has outstripped fatality growth overall, vehicle growth in most of the developing countries of the region have yet to begin the sharp incline predicted by the S curve.

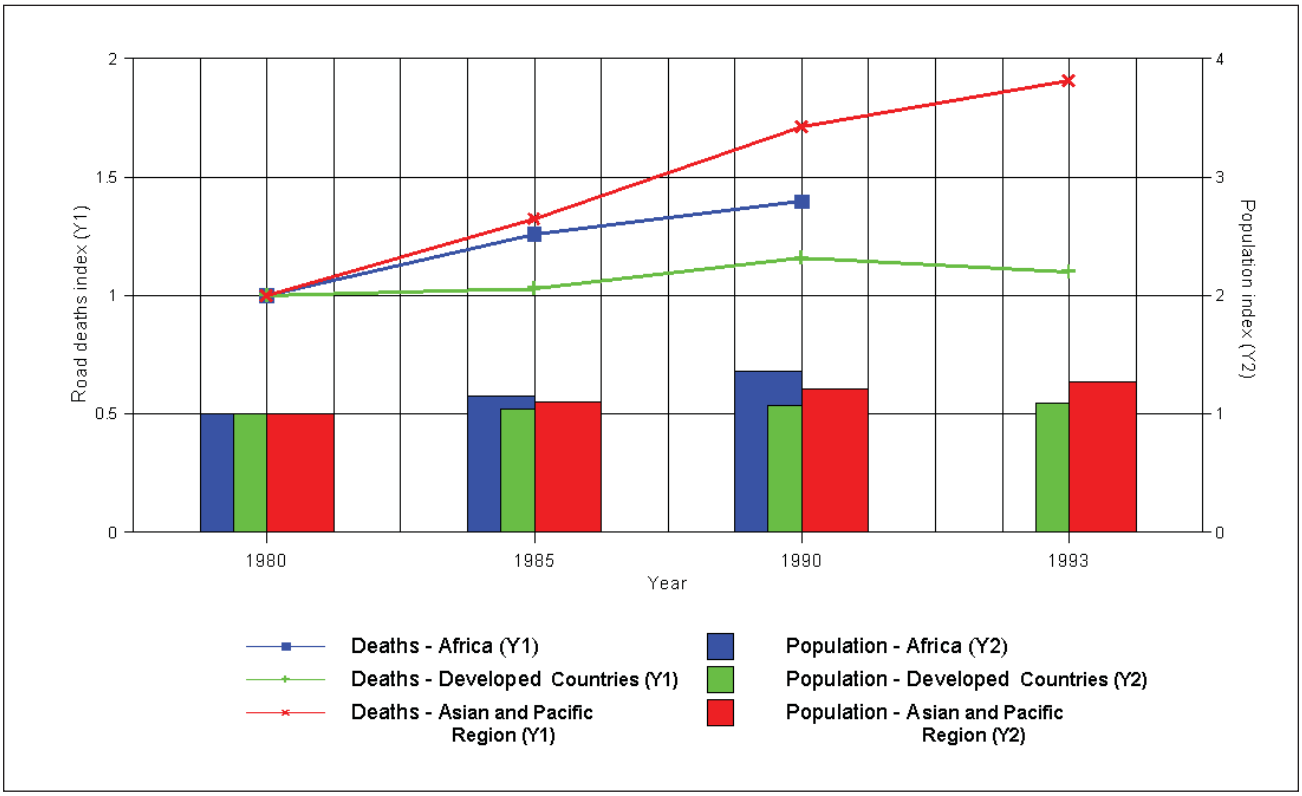
When the boom in motorization occurs, road traffic accident deaths can be expected to rise dramatically. However, while deaths have been shown to have increased significantly, the frequent fluctuations in the data from many Asian and Pacific developing countries indicate data weaknesses that can mask the actual road accident trends.

It should be noted that apart from the Pacific countries, all developing countries of the Asian and Pacific region have experienced much higher growth in road deaths than population, which implies a **significant worsening of the personal risk involved** and increasing

Figure 2.5: Changes in population, road fatalities, and motor vehicles in the Asian and Pacific region, 1984-93.

Source: RETA project data.





Source: RETA project data.

Figure 2.6: Road accident deaths and population, as a proportion of those in 1980.

importance of road accidents as a public health concern (see Figure 2.5).

Existing vehicle fleet growth at 15 percent to 18 percent per year is already causing considerable traffic congestion and road safety problems, and stretching the resources of the agencies with responsibilities for keeping road networks operating efficiently and safely. Future increases in the explosive stage of development will place even more strain upon road networks and organizations unless procedures and systems, such as access control and improved traffic engineering, are established now before the problem becomes unmanageable. This requires urgent action to be taken in the region.

2.3 Recent Trends in Traffic Accidents

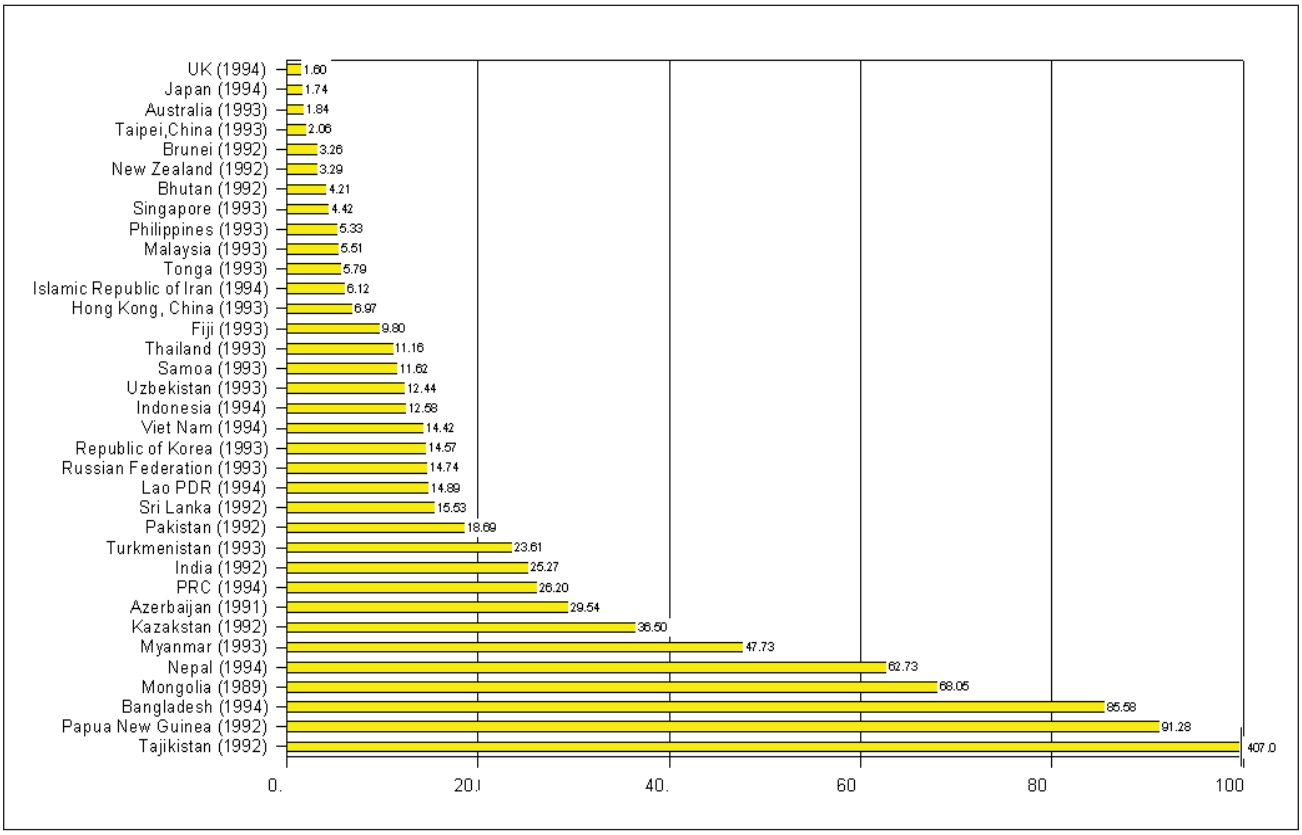
a) *Trends in road accident fatalities and population*

Figure 2.6 shows the changes in the gross number of road deaths over time for Asian and Pacific countries, African countries, and industrialized countries. Proportional changes in population are also displayed, for comparison. The number of deaths in the Asian and Pacific region have been factored to take account of differences in definition of death due to a road accident. European Union standardized 30-day death factors were used to create a common base.

Figure 2.6 shows that by far the largest increase in the number of deaths (89 percent) is in the Asian and Pacific region, with African countries and industrialized countries exhibiting a figure of 15 percent and minus 5 percent, respectively. In terms of population growth, however, the increase for the Asian and Pacific region (24 percent) lies between that for African countries (41 percent) and developed countries (5 percent). Given these figures, the most likely explanation for the rise in the number of deaths and injuries from road accidents in the Asian and Pacific region is due to the massive increase in the numbers and usage of motorized vehicles.

b) *Road accident fatalities and vehicles*

Figure 2.7 shows the number of deaths per 10,000 vehicles for the latest available year (mostly 1992/1993) for many countries in the UN/ESCAP region. It can be seen that Australia; Japan; and Taipei,China have death



Source: RETA project data.

Figure 2.7: Fatalities/ 10,000 vehicles.

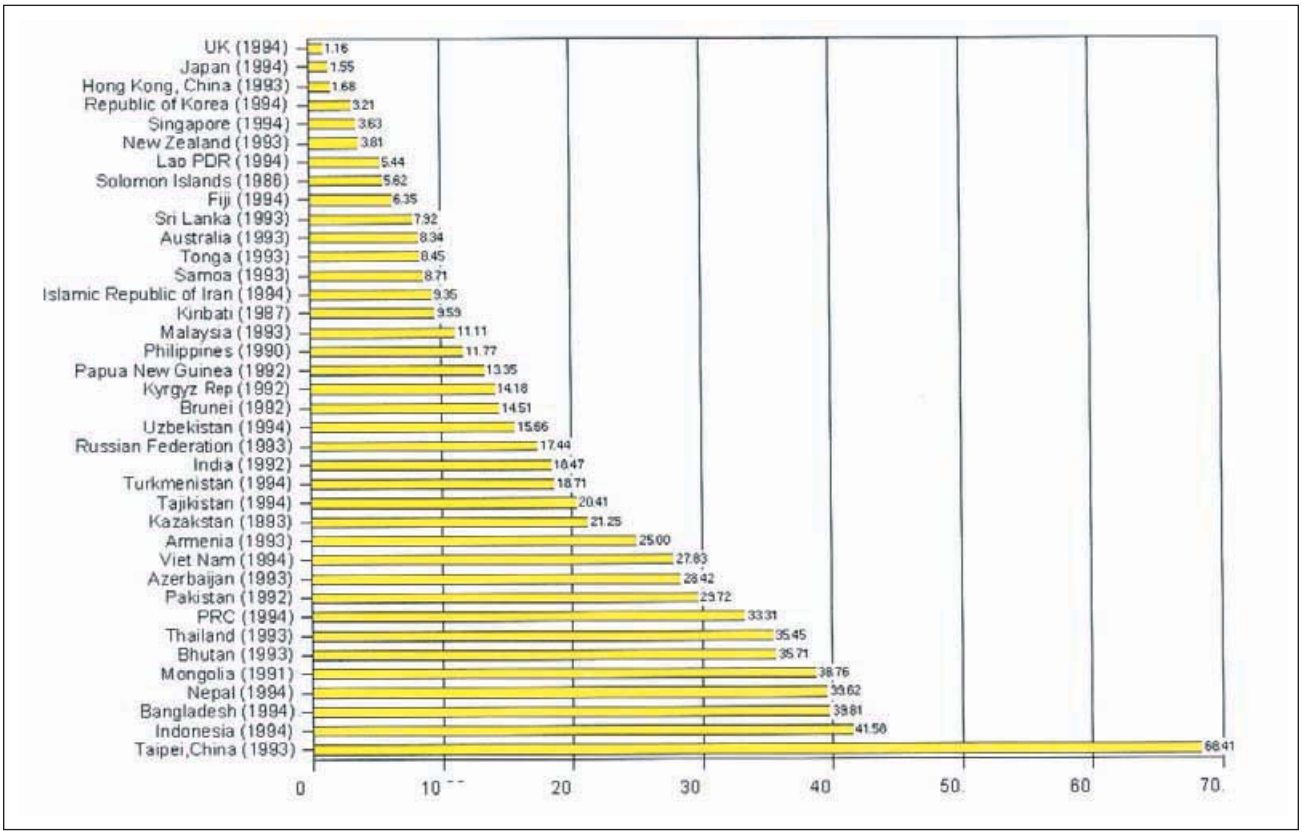
rates that are characteristic of those generally found in the industrialized countries. This is usually about two road accident deaths per 10,000 licensed vehicles. By contrast, it can be seen that many developing countries in the Asian and Pacific region have high death rates, typically between 20 and 70 deaths per 10,000 motor vehicles. The death rate for Tajikistan appears to be so high as to be implausible, probably resulting from data deficiencies. For this country, it is likely that the vehicle licensing records are incomplete and that there are, in fact, many more vehicles in this country than official statistics suggest.

This single indicator (annual deaths per 10,000 vehicles) highlights the severity of the road accident problem in many countries in the Asian and Pacific region. Even in emerging, newly industrialized countries, such as the Republic of Korea and Thailand, there are between 11 and 15 deaths per 10,000 vehicles; i.e., about eight times higher than in the developed countries of the region. If Japan had a comparable death rate to, say, the Republic of Korea, the number of people killed on Japan's roads per year would be 116,000, as opposed to the 13,800 "standard 30-day deaths" that occurred in 1994.

c) *Fatality index*

Many Asian and Pacific countries have an extremely high fatality index (i.e., deaths divided by total casualties [including deaths] expressed as a percentage). This is in stark contrast to industrialized countries, which are typically characterized by low indices of the order of 1 percent to 2 percent. Thus, in Figure 2.8, it can be seen that Japan has an index of 1.6 whereas many developing countries in the region have indices between 20 and 42, indicating that the relative risk of death if involved in a road accident is 13 to 27 times higher in these countries (data are for latest year available).

A number of factors can help to explain this variability. The fatality index depends crucially on accurate reporting of deaths and injuries, but can also be influenced by medical facilities. Unless prompt medical attention can be given to injured people at the roadside, their condition will deteriorate. Thus sufficient numbers of ambulances, hospitals, doctors, and hospital beds are required to keep the index low. In an earlier regression analysis, the Transport Research Laboratory (TRL) of the United Kingdom found a significant relationship between fatality index and the number of doctors per capita.



Source: RETA project data.

Figure 2.8: Fatality index (deaths divided by total casualties expressed as a percentage).

Similar analyses were carried out using available data from Asian and Pacific countries. The fatality index was regressed against three medical indicators; doctors per 1,000 population, nurses per 1,000 population, and hospital beds per 1,000 population. The results of these analyses clearly show that the quality of medical facilities and attention available to victims of road accidents makes a big difference to the likelihood of survival for those people injured in a road accident.

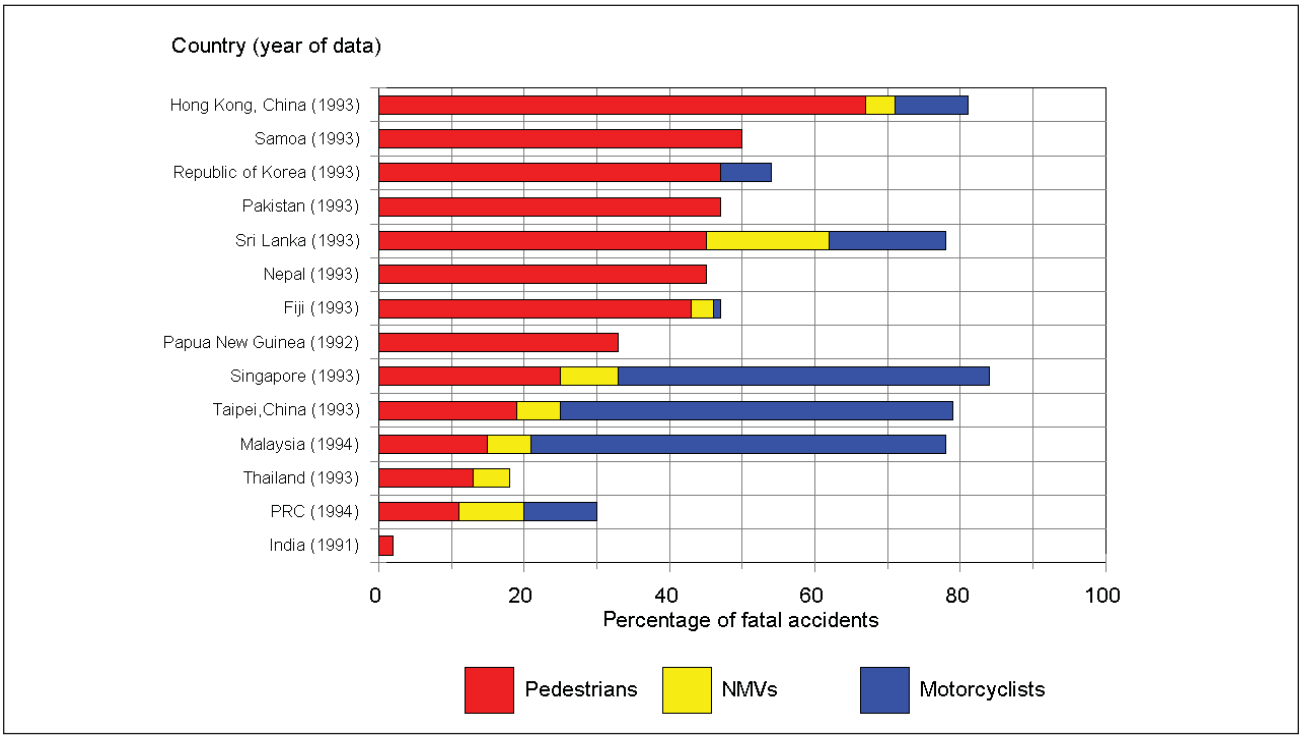
In addition to differences in medical facilities, it is also possible that there are qualitative differences in the nature of road accidents between countries. For example, pickups and open-topped lorries are used as public service vehicles in many Asian and Pacific countries. Accidents involving such vehicles are likely to cause serious injury to greater numbers of people. Road traffic accidents involving multiple casualties compound the problem of limited medical resources.

Finally, it is important to note that the underreporting of road accidents artificially inflates a country's fatality index. Most fatalities get reported to the relevant authorities because of the seriousness of their nature. Underreporting tends to act at the level of less serious accidents where injuries are slight. In such accidents there is less need to involve the police or other official agency, since any compensation often can be negotiated privately. The outcome of this is to increase artificially the proportion of casualties that die and therefore the fatality index. In some countries where underreporting is particularly high, it is possible that a high fatality index could be more due to underreporting than lack of medical facilities. However, it is clear that emergency medical services and other interventions could do much to reduce the very high fatality indices in the region.

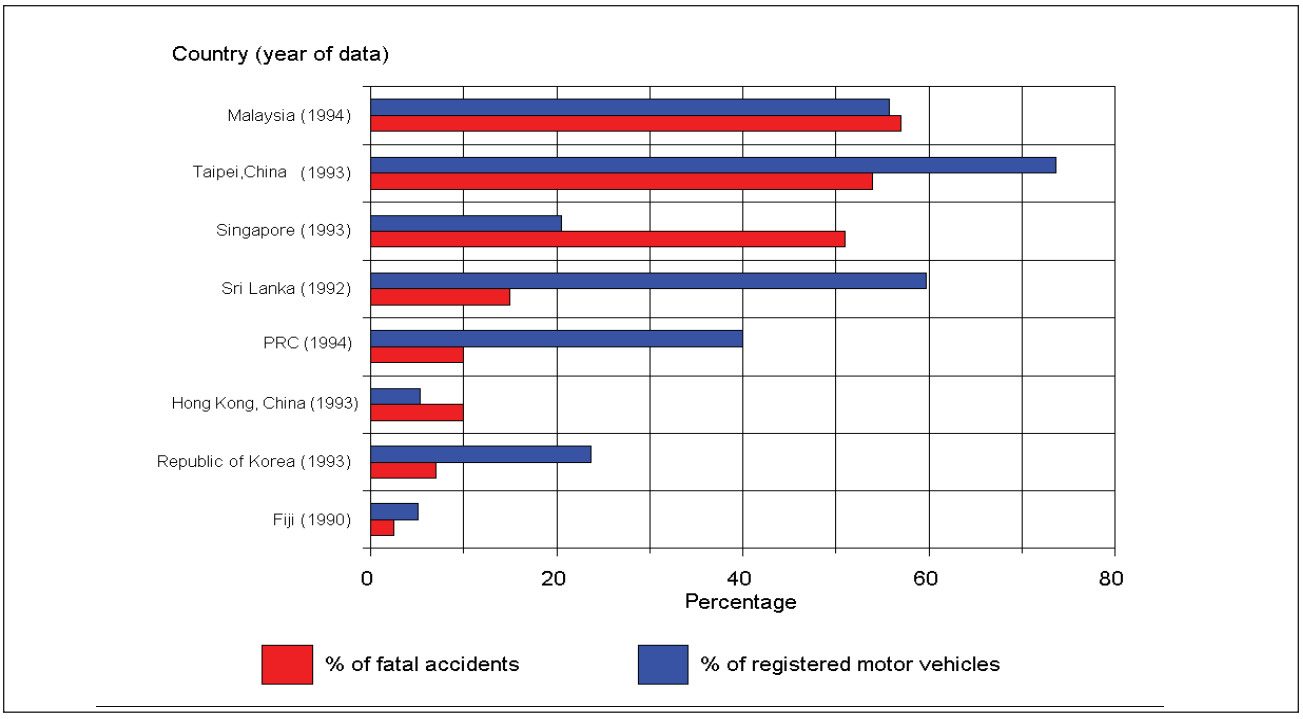
2.4 Vulnerable Road Users

Pedestrians, users of nonmotorized vehicles (NMVs), and motorcyclists, because of their much greater numbers and absence of adequate facilities, often appear much more frequently among casualties in developing countries than in developed ones.

Available accident data for the region show that pedestrians and motorcyclists are involved in a high proportion of fatal accidents. Figure 2.9 shows that more than two thirds of all fatal accidents in Hong Kong, China involve



Source: RETA project data.



Source: RETA project data.

Figure 2.9 (top): Percentage of fatal accidents involving road users

Figure 2.10: Motorcycle share in vehicle fleet and involvement in fatal accidents.

pedestrians, while in Malaysia; Singapore; and Taipei,China more than half of all fatal accidents involve motorcyclists.

The reported national accident statistics involving NMV users were generally low. However, the scale of the problem in the PRC is such that about 70 percent of the total traffic accidents in a city like Beijing involve cyclists. This, of course, must be related to the NMV users' share in the traffic flow. In Shanghai, NMVs comprise about 87 percent of all vehicular traffic (excluding pedestrians).

Figure 2.10 shows the motorcycle share in the motorized vehicle fleet in relation to the

percentage of fatal accidents involving motorcyclists in selected countries. Those countries where the lower bar (percentage of fatal accidents) is at a higher level than the upper one (percentage share of the vehicle fleet) have a proportionately more dangerous situation for motorcyclists, notably Hong Kong, China; Malaysia; and Singapore — three of the newly booming economies. Hong Kong, China, however, has a low proportion of these vehicle users.

It would appear that motorcyclists are the most vulnerable road users in some of the more developed of these countries. In countries further behind on the development scale, pedestrians generally and, under some circumstances, NMV users appear to be at high risk of accident involvement and particularly at high risk of being killed.

2.5 Socioeconomic Costs of Road Accidents

Deaths and serious injuries as a result of traffic accidents represent a considerable waste of a nation's resources and cause anguish and grief to family and friends of those killed or maimed. Even if the emotional consequences of traffic accidents are ignored, the cost to the community in purely economic terms is high. Each year, apart from more than 235,000 people killed in the Asian and Pacific region, about 1 million people are reported injured in road accidents. Taking into account underreporting, it is estimated that at least 3 million to 4 million are injured each year in road accidents. It is, therefore, necessary to include an estimate of the productive loss to the country of someone killed or crippled. The more seriously injured can remain in hospital for days, or in some cases, for months and some may require medical treatment for the rest of their lives because of the seriousness of the injuries. Thus the use of some hospital beds and highly skilled medical staff can be attributed to the cost of traffic accidents. In addition, the costs incurred by police at accident sites and insurance processing costs should be added to the other, more visible costs of accidents such as vehicle repair costs.

TRL research has shown that the number of working years lost as a result of road accidents is higher than is lost from other causes of premature death. About 70 percent of the "years of life" lost due to road accidents are working years, hence developing countries lose the most economically active and productive years from such persons. Comparison with the other costs of premature death in developing countries, particularly malaria and infectious diseases, indicates that deaths from road accidents seem to be increasing. The economic losses involved can often be a major drain upon the economy of a country, particularly a developing country that needs to import medical supplies and vehicle parts. In such cases, much of the losses are often sustained as foreign exchange losses.

Research in a number of countries indicates that such losses are normally in the range of 1 percent to 3 percent of a country's GDP. Even if the lower end of this range (i.e., 1 percent of GDP) is assumed in estimating the economic losses due to road accidents in the Asian and Pacific region, this still results in high losses annually.

If this percentage is applied to the region's developing countries, road accidents can be seen to be costing such countries in excess of US$20 billion per year. Recurring losses of this magnitude (greater annually than the total lending to these countries by the World Bank and ADB combined!) should be of urgent concern to senior government officials in the region as they inhibit economic and social development.

2.6 The Need for Action

Road accident deaths have been climbing steadily during the last decade and experience from other countries indicates that in the early years of motorization, road accidents typically rise in line with the number of vehicles. The Asian and Pacific region is still generally in the early stages of motorization. The rapid rises in vehicle fleet that are occurring and will continue to occur in future years as these countries reach the explosive stage of vehicle growth, will undoubtedly lead to major problems. There is, therefore, little doubt that the numbers of persons killed or injured on the roads in future years will rise substantially and will continue to increase unless effective action is taken urgently to address this growing and serious problem.

It has to be recognized that there are many serious problems confronting the region. The major constraints inhibiting the improvement

of road safety are as follows:

1) fragmentation of responsibility for safety issues;
2) general absence of accurate information on the scale, nature, and characteristics of the problem;
3) inadequate action to coordinate and implement safety countermeasures in all sectors that require improvement;
4) inadequate efforts being made to improve known hazardous locations or to have more safety-conscious planning and design of road schemes; and
5) inadequate technical and financial resources available for action.

Despite these problems, it also has to be recognized that there are factors in the Asian and Pacific region that are conducive to the improvement of safety. The various problems and difficulties cited above should not be seen as insurmountable obstacles in the development of effective plans, countermeasures, and interventions. Even where the problem itself cannot be eliminated, mechanisms can be devised to circumvent or to improve such deficiencies. In some respects, despite the problems cited above, the timing for investment in road safety in the region is just right as there are a number of helpful undercurrents and factors at play that are now conducive to success in this field. The main reasons why the time is right to stimulate activity include the following:

1) there is increasing recognition that road accidents are already a serious problem. The annual toll of more than 235,000 deaths and estimated 3 million to 4 million injuries per year is causing serious social and financial problems for the region;
2) on present trends the annual deaths from road accidents will rise to more than 450,000 per year within a decade with millions more being injured or crippled each year. It is now recognized that urgent action is needed to avoid this;
3) there is increasing recognition by aid agencies that there is a serious problem confronting developing countries, that action needs to be taken, and financial and technical assistance needs to be provided for such action;
4) there is increasing recognition of the economic losses being sustained. Annual losses in excess of US$20 billion per year (which exceed the total World Bank and ADB annual lending in the region) substantially inhibit the economic and social development of the region;
5) the current early stage of development of many of the road and transport sectors in many countries offers significant opportunities to avoid many problems and difficulties that have had to be faced and overcome in other more motorized countries. Adoption of safety-conscious planning and design approaches in roads, and introduction of effective countermeasures will add only marginally to the cost at planning and design stage but would be prohibitively expensive if they were added later as remedial measures; and
6) opportunities and scope exist for avoiding future problems by incorporating procedures, controls, and improvements now in many sectors while the systems are still in a state of incomplete development.

All the preceding points are encouraging factors indicating that, if the road safety sector can be stimulated in the right way and the right institutional climates created for it, countries can gain the benefits of improved road safety on their networks.

Chapter 3 shows how coordinated road safety action plans can be devised to allow a more effective and coordinated application of the various interventions in different sectors. Chapter 4 provides guidance and information on the types of policies and interventions that can be implemented in each of the different sectors that affect road safety. This guidance is intended to provide a source of knowledge and experience gained from around the world so that all countries in the Asian and Pacific region can apply the methods and techniques that have been found to be successful in other countries.

The necessary information to take action is available in this document. Failure to take action will condemn millions of fellow citizens in the Asian and Pacific region to unnecessary death or crippling injuries and greatly inhibit the social and economic development of the region.

Many of these deaths and injuries are avoidable simply by implementing the practical measures and policies advocated in this publication.

Road Safety Guidelines

for the Asian and Pacific Region

3

ROAD SAFETY ACTION PLANS AND PROGRAMS

Asian Development Bank

3

ROAD SAFETY ACTION PLANS AND PROGRAMS

Experience in industrialized and developing countries demonstrates that road safety improvements can be achieved only by working on all sectors affecting road safety, and that this is best done within a comprehensive coordinated road safety plan.

Asian and Pacific countries are all at different stages of development with respect to road safety awareness and activity. To be effective, therefore, road safety interventions need to be undertaken in three distinct stages, as follows:

stage 1: raising awareness;
stage 2: prioritized road safety action plans; and
stage 3: five-year road safety programs.

There are benefits to setting casualty reduction targets. However, developing countries should not just blindly adopt targets similar to those aimed for in the industrialized countries. The setting of realistic and achievable casualty reduction targets in developing countries is more complex because of their stages of development in terms of their level of motorization or vehicle ownership. Consequently, developing countries are advised to adopt targets related to "numbers of lives saved" from different interventions rather than targets connected with total death or casualty reduction, since such casualty reductions are unlikely to occur during periods of rapid motorization. It is also beneficial to establish behavioral and other noncasualty targets (such as the percentage wearing seat belts or kilometers of footpaths constructed).

Appropriate targets and performance indicators should be established and all plans and programs monitored to ensure effectiveness.

PRIORITY ACTIONS NEEDED

1. Initiate an independent review of road safety and organize a national seminar to present and discuss findings and to raise awareness of safety issues.

2. Establish a national road safety council (NRSC) with adequate technical and financial resources to coordinate road safety activity nationwide and to develop a road safety action plan.

3. Include a road safety component in relevant new Asian Development Bank (ADB) or World Bank projects and explore whether any unutilized loan funds on existing projects can be redirected to road safety.

Road safety activity can be developed in a country by implementing road safety action plans and programs with interventions in all key sectors. Appropriate targets and performance indicators should be established and all plans and programs monitored to ensure effectiveness.

3.1 THE NEED FOR COORDINATED ACTION

Effectiveness of road safety activities in any one sector is often dependent upon complementary supportive activity being carried out in related sectors. Absence of such complementary activity can diminish effectiveness. Conversely, coordination across several related sectors can result in substantial synergy occurring, where the effect is multiplied. Interventions will, therefore, be required in each road safety sector to ensure that all sectors are contributing effectively towards the overall improvement of safety. Chapter 4, which contains a series of individual sector guidelines, offers guidance on the sorts of actions and interventions that should be considered within each sector.

Given the wide range of sectors that can influence road safety it is essential that activities are coordinated and harmonized to achieve the maximum effect.

Effective coordination and decision making are integral parts of managing and implementing national road safety action plans and interventions. Appropriate mechanisms need to be set in place to achieve this. The various options available and the functions needed at the different administrative levels are discussed in more depth in Sector Guidelines 4.1.

Before action plans can be devised and implemented effectively, appropriate conditions must exist or be induced within a country. Countries of the Asian and Pacific region are at different stages of development with respect to safety activities and interventions, and have different strengths and weaknesses. Irrespective of these differences, most countries go through a number of stages before effective activity is undertaken in all sectors by relevant organizations. The following sections discuss the different stages and activities involved in most developing countries' efforts to tackle road safety problems. These stages are as follows:

1) raising awareness;
2) priority action plans; and
3) five-year road safety programs

Each of these is briefly discussed below.

3.2 Raising Awareness

a) *Typical situation at stage 1*

At the earliest stages of safety development, little or no safety awareness may exist and efforts will first need to be made to enhance the awareness of key decision makers as to the scale and nature of the problem and the activity that is necessary to alleviate it. Typically in such a country, accident data may not be regularly collected but, even if it is collected, it is likely that the data system will need extensive improvement. Not much will be known about trends or road users at greatest risk and even the main organizations with road safety responsibilities may not be clearly identifiable. General interest by the government will usually be low and it will be only a few individuals (often medical personnel) who are interested in trying to bring the problem to the public attention.

Typically, there will be no special police accident data unit to analyze or disseminate accident data and even if one exists, the data will be little used other than to provide overall administrative statistics for use within the po-

lice force. Accident data will often be incomplete or grossly inaccurate and there will be few, if any, professionals actively working to improve road safety through remedial measures.

b) *Action required at stage 1*

The primary focus of activity in such circumstances is to raise awareness among the decision makers in the country concerned and to demonstrate to them that road safety is a growing and urgent problem. This will require definition of the scale and characteristics of the problem, the bringing together of key parties that may be able to contribute towards solving the problem, and convincing those responsible for resource allocation that sufficient funds need to be made available to tackle road safety issues. The two main tasks that need to be undertaken at this stage are as follows:

1) carry out an independent review of road safety activities and, in particular, quantify the scale, nature, and characteristics of the problem to identify deficiencies and weaknesses (in terms of road safety) in the sectors and organizations related to road safety; and
2) organize a national road safety seminar involving all senior personnel from key government and nongovernment agencies with responsibilities or interest in road safety. Each of the main six or seven agencies should present a short (ten-minute) paper on road safety problems, what needs to be done **in their particular area of responsibility** in order to tackle the problem, and what is preventing them from taking the necessary action. This one-day national seminar should result in agreement among the key agencies on the actions needed to tackle the problem. An interim inter-agency working group should also be established by drawing from the senior staff in six or seven of the key agencies represented at the seminar. This should function as the safety coordinating mechanism until a more formal national road safety council can be established.

Plate 1:
National road safety seminar, Samoa.

The time needed for completion of these activities can be as little as two or three months. The technical assistance of an independent specialist road safety advisor may be needed to carry out the independent assessment of road safety activities and the road safety situation. The national road safety seminar should be organized to take place shortly after the completion of the review of road safety so that the results can be presented at the seminar to all participants.

The 10 to 15 agencies with road safety responsibilities or interests should be invited to send a senior representative to the one-day seminar. Participants at the seminar should be drawn both from the public sector (ministries and central and local government organizations) and the private sector (large commercial companies, insurance industry, transport operator organizations, and motor traders association, etc.). Representative organizations such as Chamber of Commerce, Lions Club, Rotary Club, and media representatives should also be invited to participate in the seminar.

c) *Financing stage 1 activities*

There are a number of sources of funding to cover the costs involved and these costs are of two different types.

1) ***Technical Assistance Costs.*** These can often be financed by development banks such as the ADB or World Bank, which can often finance short-term technical assistance from their own funds or from trust funds. The purpose of such technical assistance is to review road safety

activities and to identify areas in need of improvement. Technical assistance is also often available from bilateral agencies such as the United Kingdom's (UK's) Overseas Development Administration (ODA), the Japan International Cooperation Agency (JICA), and other bilateral aid agencies that are sometimes willing to provide an expert for a short period to review road safety activities. All of these types of assistance tend to be on a **grant** basis.

It is, however, also possible for governments to use funds from existing development bank project loans in order to carry out such reviews of safety. Both the major development banks (ADB and World Bank) actively encourage reviews of safety so that better understanding of the problems and needs can be achieved. Countries should seek such assistance during discussions with ADB and World Bank project officers visiting the country, or by following up relevant specialists at the institutions (see Appendix B).

2) ***Implementation Costs***. The only real implementation costs involved in this preliminary safety awareness raising activity are in organizing and carrying out the one-day national road safety seminar. Costs involved tend to be minor and can often be financed by sponsorship from the larger motor manufacturing companies, the fuel companies such as Shell or Mobil, or other commercial concerns such as banks and insurance companies who see involvement in sponsorship of road safety as part of their social obligations and good public relations.

The main purpose of these activities is to raise overall public awareness of road safety as an issue through press and media coverage of the national seminar, raising awareness, and awakening interest among major players who can influence road safety. It should also raise commitment among government agencies, which can take action to improve the situation. By consciously encouraging press coverage and providing articles, information, and statistics to coincide with the national seminar it is possible to build up a great deal of public awareness and media interest before the seminar is conducted.

It is particularly important to make some estimation of the annual losses to the economy resulting from road accidents. In the absence of more detailed information on costings, it is possible to assume and publicize that road accidents cost the country **at least 1 percent** of the annual gross domestic product. This figure stated in US dollars or local currency provides at least a **minimum** figure for general publication, discussion, and focus, and provides a good hook to attract press and media coverage.

3.3 Prioritized Road Safety Action Plans

a) *Typical situation at stage 2*

Typical conditions that exist when a country is ready for the next stage of development in road safety are that the government will probably have received some technical assistance to review road safety activities and will have organized a national road safety seminar. The interim road safety working group may already be coordinating activities from time to time and obtaining periodic sponsorship for road safety initiatives, publicity campaigns, and materials. Individual ministries with road safety responsibilities may be starting to address the problem and beginning to take action that will improve road safety.

In particular, the ministries that deal with external funding agencies should by now have taken the opportunity to request assistance from bilateral aid agencies and multilateral development banks.

This would be to finance some or all of the proposed road safety improvements in order to rectify the deficiencies and weaknesses identified by the road safety review undertaken during stage one.

b) *Action required at stage 2*

The main purpose of this stage is to:

1) develop an overall strategy for the improvement of road safety in the country;
2) identify the most urgent improvements for inclusion within a priority action plan;
3) commence implementation of a priority action plan so that the basic systems and procedures can be established to enable more effective activity in road safety; and

4) strengthen the key organizations and individuals who need to be involved in improving road safety in the longer term.

The primary emphasis during this stage should be towards strengthening the key organizations, systems, and procedures so that once the priority action plan has been implemented, local organizations will be able to tackle the road safety problems of the country more effectively.

Typical activities that will need to be undertaken during this phase include the development of a strategy and implementation of a prioritized action plan.

This usually includes improvement of the accident data system, the establishment of a national road safety council or some other coordinating mechanism, and implementation of demonstration projects in other important sectors. This is done to provide training to individuals involved in the key agencies and to establish procedures and practices conducive to the improvement of road safety in the country.

Apart from the opportunities to participate in training through demonstration projects, a small multidisciplinary group of four or five senior individuals drawn from government agencies with the greatest responsibilities for road safety should make a two- to three-week overseas study tour, visiting countries that have demonstrated success in tackling road safety problems.

The prioritized action plan should ensure that basic systems are operating to at least a minimum level in all the most important areas by the end of the action plan period. Implementation of the plans can be undertaken in anything from 12 months to three years depending on the size and scope of the action plan, the size of the country, and the nature of the problems to be addressed. Generally, the intention is to develop a downstream five-year program while implementing the most urgent improvements needed to strengthen the key institutions and agencies.

Wherever possible, a timescale of around three years should be allowed for the action plan in order to develop and implement all the main improvements needed. The actual resources required to carry out the action plan will again depend upon the plan's nature, the scope of work, and the size of country. External specialist road safety advisory input of anything from 25 to about 50 person-months is typically required in implementing action plans.

In addition to the technical input, financial provision also has to be made for the actual physical cost of the individual interventions implemented as part of the action plan. An amount of US$3 million to US$5 million should be available for demonstration and pilot projects. Some of this will be financed by the government itself and other parts may be eligible for finance from road safety components within aid-funded loans. In addition to the resources, which may be available from external funding, a government will have to cover the cost of its own staff and specialists who will work as counterparts with the specialist external consultants and will participate in the implementation.

c) *Financing stage two activities*

Two different types of activity need to be financed under this phase. The first is financing of the **technical assistance** that might be required in order to provide the specialist road safety advice and assistance at key stages. The second type is related to **implementation cost** of the priority action plan, including funding of the training costs for local specialists. These costs are most commonly financed through a road safety component within an aid-funded project[2]. Such components typically include funds for technical assistance, for equipment, infrastructure improvements (such as improvement of accident black spots), and training (both domestically and overseas) of key personnel.

It is highly desirable that some funds be included within the action plan to permit implementation of the "demonstration" projects and other countermeasures during the period of the consultancy project. This helps in training the local personnel and in building up the capability locally to tackle the problems rather than execution of a study with implementation to be carried out in a subsequent phase (after the consultants have departed).

Governments interested in implementing prioritized action plans and developing road safety should be aware that international development banks are keen to provide loan funding for the improvement of road safety, as they have recognized the importance and urgency of the problem. In addition, bilateral agencies providing assistance to a country can also of-

ten be keen to assist countries in tackling road safety issues. Thus the international funding community is both aware and willing to provide loans, or other funding, for road safety interventions. However, a request must be received from the borrowing country or recipient country for road safety assistance before the ADB or W orld Bank can consider providing funding within existing or proposed projects.

The allocation of funds for prioritized action plans can take some time due to the bureaucratic processes involved. Therefore, requests should be made as quickly as possi ble so that ongoing or future aid-funded projects can provide funding for safety measures. In some cases, where funds have been underspent on previous or existing projects, aid agencies are often willing to allow some of the funds to be reallocated for use on road safety. Where such funds are available, governments should seek aid agency approval for the reallocation of these funds for safety initiatives.

By the end of the priority action plan, local professionals should have the capability to tackle the road safety problems facing the country. Government ministries should be investing in road safety as part of their normal cycle of budgets in each sector, and they should have a greater appreciation of the losses being sustained by the country as a result of road accidents.

3.4 Five-year Road Safety Programs

a) *Typical situation at stage 3*

By this stage, the government should have received technical assistance and implemented a priority action plan and an improved accident data system should be in place with suitably trained local staff operating it. Analyses of black spots, locations, and characteristics of road accident groups most at risk should be being conducted regularly. An NRSC with several subcommittees should be providing policy guidance and some financial support to safety committees in municipalities and provinces. Road engineers and highway authorities should be skilled in basic accident black spot improvement work and in undertaking black spot im-

Figure 1: Extract from five-year Road Safety Action Plan, Fiji.

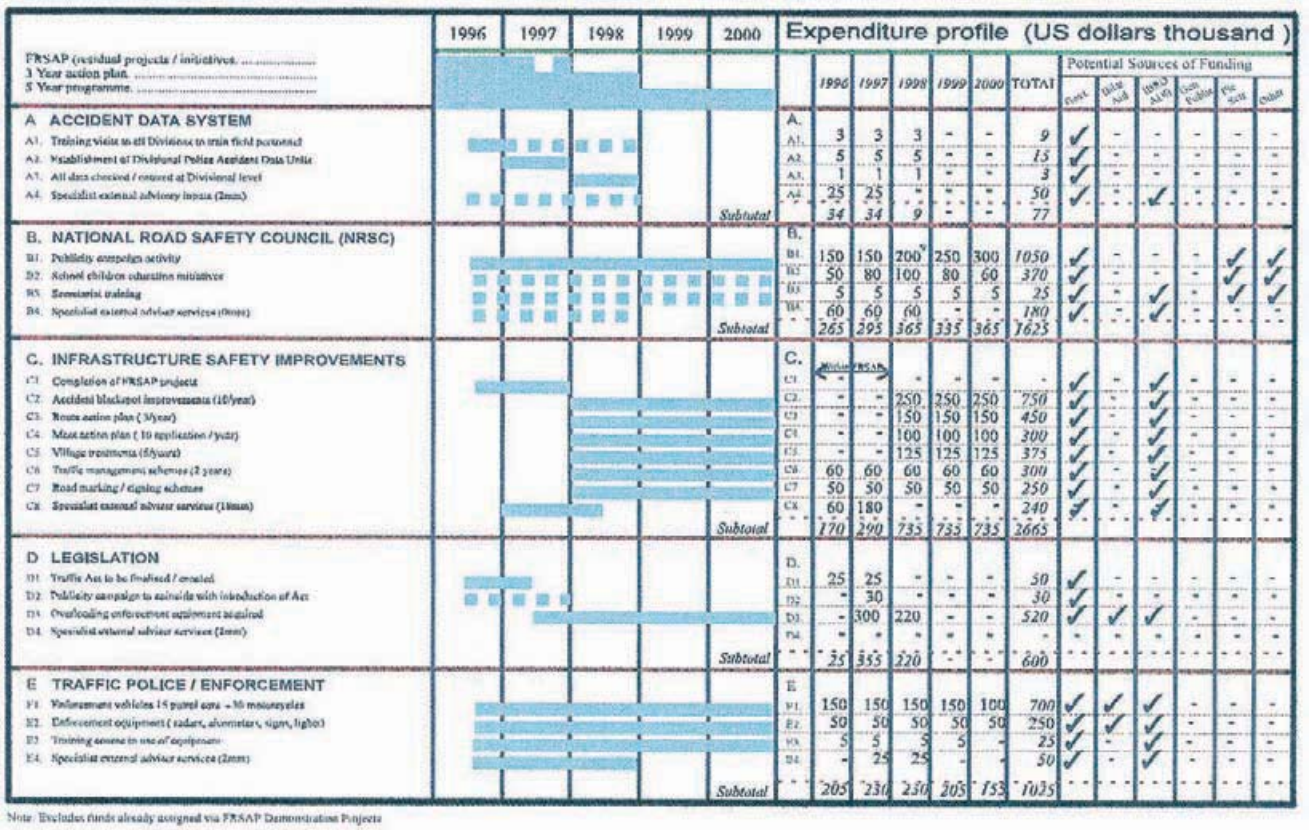


Figure 1: Extract from 5-year Road Safety Action Plan, Fiji

provement programs on national and provincial roads. Efforts may already be underway through the NRSC to, for example, improve driving tests and vehicle inspection, and to develop children's traffic education programs.

There may also be a core of interested professionals specializing in various aspects of safety and keen to tackle the problem, but lacking resources to do so. The country , having already implemented a priority action plan, will have a number of government and non-government organizations involved and active in improving safety , creating a conducive atmosphere in which to formulate and implement a series of five-year road safety programs.

b) *Action required at stage 3*

The main purpose of this stage would be to consolidate the activities initiated during the priority action plan and to develop new activities and interventions that will enable the annual toll of road accident related deaths and injuries to be reduced. The first five-year plan should be seen largely as an extension and consolidation of the activities initiated in the previous priority action plan but subsequent five-year programs will be building on each previous five-year program. Actual implementation is normally undertaken by way of annual national road safety plans and these are prepared each year to guide and focus the activities of the various agencies towards achievable targets within the following year, but operating within the context and framework of the overall five-year program.

c) *Financing stage 3 activities*

By this stage, it becomes necessary for significant investment to be made in road safety , and most of this will have to be made by the government of the country concerned and not through external aid funding. Normally , some items selected from the program (for example, infrastructure improvements for a one-off safety program of marking and sign improvements on the national network) can be incorporated into aid-funded projects, but in the majority of cases, actual funding will have to be built into government annual budgeting and five-year national programs.

Government by now should be aware of the annual losses to the economy and willing to see expenditure on safety as an **investment** that will, in the longer term, reduce such economic and social losses. Some countries even devote a fixed proportion of annual gross national product (GNP) towards the reduction of road accidents. For example, until recently , Japan used to devote about 0.6 percent of its annual GNP towards the improvement of road safety , in the knowledge that road accidents were costing the economy around 1.3 percent of annual GNP (i.e., Japan was investing about half of its estimated annual losses in efforts to try to improve road safety).

The kind of efforts that are required at this stage are a continuation of the activities of earlier periods, but in each case increasing the quality or quantity of activity aimed at improving road safety. The types of interventions likely to be needed are outlined in Chapter 4 of these guidelines. This covers all sectors from coordination and administration through to road safety research.

Within the five-year period, one-year safety plans are usually produced in the form of a document that is published and widely circulated so that all agencies have a clear focus on what needs to be done and targets to be achieved during the upcoming year . The resources required to establish the necessary procedures, systems, and practices so that the road safety problem can be reduced can vary from US$15 million to US$20 million in a small country to anything from US$50 million up to several hundred million US dollars in a large country.

Most of the investment in a five-year action program needs to be undertaken by the country itself in recognition that **expenditure on road safety is an investment, not a cost.**

Unfortunately, road safety is a continuous and continuing problem. Completion of the first five-year program does not mean the end of the problem or that the problem has been solved. It will be necessary to develop a second and probably even a third five-year program to continue reducing the numbers and severity of road accidents. This may cost millions of US dollars but conversely will "save" (via reduced losses of productivity and less use of medical facilities) many more millions of dollars.

3.5 Road Safety Goals and Targets

Road safety strategies and plans should set realistic targets. In most industrialized count-

ries these have been expressed in terms of a reduction in the numbers of accidents and casualties expected. These targets must be capable of being understood and accepted by those responsible for road safety. The effectiveness of the plan must be regularly monitored and reported upon. A national road safety plan should, therefore, consist of a program of measures based on a careful analysis of the problem. This requires assembly of factual data on the road safety situation, identification of the problem areas, investigation of the true causes of accidents, and the development of appropriate countermeasures. Ranking of such measures should be based on the estimation of their cost effectiveness in saving lives or serious injuries.

Implementation of safety plans requires a clear identification of responsibilities between the different departments of the central government. One way of achieving this that has proved effective in a number of countries is to publish challenging but achievable casualty reduction targets, first at the national level and later disaggregated to the regions. It is important, however, to ensure that appropriate targets are set in developing countries, as is explained in the following four paragraphs. In addition to action at central level, decentralized action is essential. This must involve government organizations and activities at local level. Entities involved will not only be those with statutory responsibilities, such as the police and local authorities, but a wide range of organizations such as automobile clubs, private sector companies, the insurance industry, and others that can be instrumental in explaining and promoting road safety action plans and providing feedback.

Expensive items, such as police equipment and infrastructure improvements, have to be clearly targeted and tightly controlled to make sure that the country is getting the best value for money. Continuous monitoring and periodic evaluation is also important to verify that the projected benefits are actually occurring. Training, study tours, twinning with other countries or organizations, and improved data and research need to be closely linked to increased road safety programs and safety funding so that data and appropriate skills are applied to the problem.

It is important to note that developing countries should not blindly set casualty reduction targets of the type typically being set in industrialized countries. These tend to be statements such as, "Reduction in 1993 number of deaths by 30 percent by the year 2000." Most industrialized countries are now at the mature stage of motorization and, in many cases, approaching or even exceeding theoretical saturation levels (see Section 2.2 and Figure 2.2 in Chapter 2). Consequently, their vehicle fleets are now stabilized, or at worst, are growing slowly and accident levels too have stabilized. Therefore, they can, with reasonable confidence, set targets for casualty reductions of 30 percent or more within 6 to 15 years and many (e.g., Australia, Denmark, Netherlands, New Zealand, and UK) have now done so.

Many developing countries are still approaching or just entering the explosive growth phase of motorization. Thus, private vehicle fleets will increase substantially in future years. During early stages of motorization, rapid increases in vehicle fleets inevitably result in accompanying increases in numbers of road accident deaths or injuries due to the populations' greater exposure to risk. Adopting a target such as "30 percent reduction on 1995 level deaths by 2000" may in reality require a reduction of 80 percent or more in the likely numbers of deaths that will occur by the year 2000, since actual deaths may rise by an additional 50 percent between 1995 and 2000 as a result of the previously mentioned increasing risk exposure.

Since it is politically difficult to use "road deaths will rise by only 40 percent by the year 2000" as a target, it may be better for developing countries to use targets related to the "lives or injuries saved" by various interventions. For example, introduction of seat belts and strict enforcement may result in the saving of xx lives, even though the actual numbers of total deaths may increase over the intervening period because of the rapid motorization. In this way, politicians can still set death and casualty **reduction targets** without getting into trouble with unachievable targets. This also helps focus political will towards specific interventions.

It is also important to establish behavior-related and other targets such as "percentage of drivers wearing seat belts to increase by xx percent," "kilometers of pedestrian footpaths increased by yy percent," or "number of pedestrian crossing facilities increased by zz percent," all by a set date.

These kinds of targets ensure that the types of behavior modification and increased safety facilities needed to reduce accidents or casualties are actually gradually occurring as the program is being implemented.

The development of effective safety policies and action plans suitable for a developing country and based on a well-thought-out program of road safety measures and targets is a complex task. It requires a level of expertise that may not be readily available in every developing country at this stage. Consequently, the road safety councils or other agencies may need some assistance. The development banks and bilateral aid agencies are often willing to assist countries in financing the necessary investment and related technical assistance needed for developing and implementing such action plans and programs.

3.6 Financing Road Safety Initiatives

Implementing a comprehensive and effective road safety policy and action plan is dependent on obtaining adequate funding. Although public budgets are often limited, road safety is a highly cost-effective activity involving the saving of human lives and reduction of economic losses. Therefore, a sharp increase in funding is often justified to finance a well-prioritized action plan based on cost benefit analyses. Each country needs to decide how best to finance its particular safety action plans at a level in accordance with its needs.

Comprehensive road safety programs require substantial funding and one leading safety specialist[1] suggests that potential sources of funding (which are not mutually exclusive) could include the following:

1) **budgets** of government departments and agencies are normally the main source of funding for all actions under their control, including safety actions, which cannot be fully separated from other functions. This also applies to provincial and local governments;
2) **road user charges** are sometimes directly allocated to road agencies for road management and investment. Charges for vehicle import and purchase, fuel, and road tolls are often considered to include an element of general government revenue and an element of user charge for road use. Charges for vehicle registration, driver licenses, and vehicle testing often recover all or part of the cost of these services, and may also raise additional revenue;
3) **roads funds** are one type of mechanism for allocating road user charges to road spending. These are established in a number of countries, often with the initial support of the ADB or the World Bank, to help stabilize the flow of funds to the road sector. They generally rely on user charges such as levies on fuel, tolls, vehicle taxes, or other sources that are related to the service provided, and incorporate increased accountability regarding priorities in road spending.
4) **road safety funds** have a similar function, but provide a pool of funds specifically for road safety actions that may be undertaken by a number of different agencies. Revenue is raised from levies on traffic sources (e.g., vehicles or gasoline) and expenditure, and priorities regarding safety are agreed with safety interest groups inside and outside government. This potentially ensures a priority to safety, which is independent of the concerns of individual ministries, and gives greater impetus to interministerial coordination of safety programs. Some countries (e.g., Botswana) use a levy on vehicle registrations to provide additional financing for road safety within a number of departments;
5) **private sector contributions** to road safety include sponsorship of media articles or road safety campaigns by motor vehicle dealers, oil companies, commercial firms, and transport fleet operators as part of their public relations;
6) **motor vehicle insurance** of road safety has been found, in many countries, to be particularly appropriate, and involving it in the decision making process can also be beneficial. Focusing on **accident prevention** rather than **repair** is cost-effective for the insurers and for the rest of society. Significant benefits can accrue for both parties through investment of insurance-related monies to reduce the number of accidents. Considerable incomes are being achieved from small levies on motor insurance in the State

of Victoria in Australia, and Finland. Fees corresponding to US$21 per vehicle in Victoria and US$3.6 per vehicle in Finland result in US$56.65 million and US$8 million, respectively in these two countries. The levy is 10 percent in Victoria and 1 percent in Finland. Developing countries should consider imposing a levy of about 10 percent on third party insurance. This is discussed further in Sector Guideline 4.3;

7) **enforcement fines** provide extra income in a number of countries (due to the increased enforcement on speeding and drunk-driving) to be allocated to road safety. This can be used to purchase additional enforcement equipment and to finance other road safety initiatives that will help in the overall reduction of road accidents; and

8) **development banks** are increasingly willing to assist developing countries in tackling road safety problems. Opportunities should be taken, therefore, to take advantage of these sources of funds by including road safety components when such agencies are carrying out aid-funded projects in the developing countries of the region. For example, development banks can often assist in all three of the stated stages of road safety development.

During the initial stage of **raising awareness**, they can provide technical assistance to carry out the initial review of road safety to identify the major areas in need of improvement. In **stage 2** , they can often assist in the development of a strategy and five-year action plan and the implementation of a prioritized action plan. This would include the technical assistance required plus the cost of improvements that can be implemented as part of the action plan. In **stage 3**, aid agencies can assist in financing selected parts of the five-year program of activities. This could range from investment in infrastructure to improving the road safety aspects of road markings, road signs, or highway safety in general, to investment in other sectors, such as ambulance systems or equipment and training for traffic police services. Since development loans have to be repaid, these costs are ultimately borne by the governments concerned.

Road safety activities are highly cost-effective and **provide a higher rate of return than any other investment in transport**. Despite this, the current level of funding for road safety activities in most developing countries is far too low. Different sources of road safety funding may need to be applied for in order to get adequate funds to tackle the problem.

Table 1 shows the activities that may need to be funded and the potential sources of funding, some of which could be considerable.

Table 2: Road Safety Activities and Potential Funding Sources

Safety activity ***needed***	**Potential funding sources (categories may overlap)**						
	Agency budget	**User charge**	**Road fund**	**Road safety fund**	**Motor vehicle insurance**	**Development loan**	**Private** ***sector***
Safety coordination	✔	✔	✔	✔	✔	✔	-
Road infrastructure	✔	-	✔	✔	✔	✔	-
Traffic management	✔	-	✔		✔	✔	-
Information and advertising	✔	-	✔	✔	✔	✔	✔
Education	✔	-	-	✔	✔	✔	✔
Enforcement and inspection	✔	✔	-	✔	✔	✔	-
Accident data, research and studies	✔	-	✔	✔	✔	✔	✔
Emergency response and medical data	✔	✔	-	✔	✔	✔	-

3.7 Monitoring and Evaluation

All road safety activities should be monitored to ensure that money is being spent effectively and lessons are learned about the most and least successful schemes. Given that funds are always limited for such purposes, it is imperative that the money available is spent in the most wise and effective way to tackle the problem. As each initiative is implemented, the effectiveness of that measure should be monitored (ideally by looking at accident data from the before and after situation for equivalent periods of time).

Monitoring of an overall action plan aimed at institution building and strengthening the key agencies with road safety responsibilities must focus on whether the objectives of the action plan are being achieved. It is necessary to ensure that the activities of the consultants and specialist advisors have been effective and that the impact of such activity is having the desired effect in terms of strengthening the capability of the country to tackle the problem.

The use of monitoring frameworks is to be recommended and generally results in greater success in terms of implementation of action plans.

This identifies (in a framework format) exactly what activities are to be carried out as part of the action plan implementation and seeks to identify performance indicators that can be used to see whether or not the desired impact has been achieved. They can be used during implementation to identify whether the project is progressing as desired in terms of development and institutional impact. In Fiji, an ADB/World Bank funded road safety action plan was monitored using such a framework. The action plan in Fiji has been highly successful in achieving its objectives of institutional strengthening. In addition, by the end of the action plan period, road accidents had already been reduced by about 23 percent. The frameworks and performance indicators used to monitor progress with respect to institutional impact in Fiji are presented in Appendix C for illustration.

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Road Safety Guidelines

for the Asian and Pacific Region

4.1

COORDINATION AND MANAGEMENT OF ROAD SAFETY

Asian Development Bank

4.1

COORDINATION AND MANAGEMENT OF ROAD SAFETY

Road safety is a multidimensional social problem involving many government agencies, so the state must play a leading role in initiating, organizing, and coordinating the national assault on road safety problems in a country. The practical development of road safety capability at a national level has to take into account at least five important aspects as follows:

- definition of responsibility: this means designating a member of the government (prime minister's office [PMO] or ministerial task force) to be responsible for overall road safety policy;
- assigning the task to initiate and coordinate the state's actions. Establish a multidisciplinary team led by a high-level civil servant or high-caliber executive director from the private sector;
- setting up a permanent group to steer the actions (e.g., a national road safety council [NRSC] or an officials' committee);
- planning and assigning adequate technical and financial resources for the NRSC to carry out its work; and
- evaluation of the outcomes of actions.

All activities of the ministries involved in road safety (e.g., health, transport, police, and education) must be complementary and coordination also has to be developed with regional and local organizations so that road safety work is undertaken at all levels.

PRIORITY ACTIONS NEEDED

1. Designate the prime minister's office or a ministerial task force to be directly responsible for road safety policy issues and to oversee development of a road safety strategy and action plan.
2. Establish a multidisciplinary NRSC or a similar body with various subcommittees and a full-time secretariat with adequate technical and financial resources to develop and coordinate road safety activities effectively.
3. Identify high-risk target groups for publicity and education from analysis of accident data.

Strong political, financial, and technical support is needed for those delegated to initiate and coordinate road safety on behalf of the state. Such coordination is best done by a multidisciplinary national road safety council supported by a secretariat of road safety specialists led by a senior government official or high-caliber executive director.

1 INTRODUCTION

These sector guidelines on the "Coordination and Management of Road Safety" are from a set of Road Safety Guidelines for the Asian and Pacific Region policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

The central coordination and management of road safety is one of the most significant factors in optimizing road safety efforts and their effectiveness within any country. These sector guidelines give advice on establishing national and local road safety councils and give examples of their successful operation in various countries in the Asian and Pacific region. Additional information on related matters, including the setting of specific accident reduction-related targets, has already been given in Chapter 3, where the subject of "Coordinated Road Safety Action Plans" was discussed.

2 WHY IS COORDINATION NEEDED?

Where a country lacks an effective coordinating body, road safety activities tend to be fragmented and underfunded and thus ineffective. Typically in such countries, a few organizations carry out intermittent efforts with low budgets. These are undertaken in a sporadic and uncoordinated way, covering a few sectors. This is often done with little technical support and without a real understanding of the underlying problems to be overcome or the most effective way of dealing with them.

For road safety issues to be dealt with efficiently and effectively, the following are needed:

1) adequate political support;
2) adequate funds;
3) adequate technical and administrative resources;
4) an understanding of the problems; and
5) coordinated efforts among at least the organizations working in the fields of:

   a) traffic and highway engineering;
   b) education;
   c) traffic enforcement;
   d) health services;
   e) publicity;
   f) driver testing; and
   g) vehicle testing.

The best way to ensure that budgets are available and protected and that trained staff are assigned to road safety is for the central government to create an organization dedicated to initiating and coordinating road safety ac-

Plates 1 and 2: Road accident deaths and injuries will continue to rise in the Asian and Pacific region unless effective action is taken to tackle the problem.

tivities. This is usually best done by establishing a NRSC or a road safety directorate. Such a body can then help coordinate all the agencies working in the various disciplines, thus ensuring that duplication is avoided and that the activities of different agencies complement each other.

Experience shows that in larger countries, regional or provincial road safety committees or in some cases, even municipal level road safety committees, should also be established to carry out similar activities at a local level. Many road safety sectors typically need improvement in developing countries and such activities can be coordinated by the NRSC and its local equivalents.

3 KEY COMPONENTS

Numerous countries have demonstrated that there are three fundamental requirements of critical importance when setting up an organization to combat road safety problems. Implementation will vary according to circumstances and national contexts, but the essential elements are as follows:

1) political support;
2) technical secretariat; and
3) effective coordinating mechanism.

Each of these is discussed below.

3.1 Political Support

A senior member of the government must be designated to be responsible for road safety policy and to be in charge of coordinating the work of colleagues. This can be the PMO or the head of the government ministry most involved in road safety, acting with the authority of the prime minister. (In such cases the PMO reserves the right to arbitrate when necessary.) The PMO is responsible for road safety in France, Japan, Republic of Korea, and in several other countries. Where the PMO or a minister chairs high-level meetings, other committees need to be established at lower operational levels to implement the decisions of the high-level committee.

3.2 Technical Secretariat

A high-level (e.g., director general) civil servant must be designated to act as coordinator of state action. Needed will be a small multidisciplinary team of officials to assist in coordinating activities in the various government ministries. This approach is particularly appropriate where an officials' committee is to be established. Often the first task is to organize such an officials' committee or to prepare the documents to establish an NRSC. An alternative approach (usually where an NRSC is established) is to establish a multidisciplinary NRSC secretariat and to appoint a high-caliber executive director to the secretariat, who together will operate as the executive arm of the NRSC in coordinating, implementing, and following up NRSC decisions.

3.3 Coordinating Mechanism

There is a need to set up an independent commission, officials' committee, or wider ranging NRSC that has representation on it of the principal civil servants responsible for issues directly related to, or influencing, road safety. The exact structure varies from country to country and the key advantages or disadvantages of each option is outlined below in Table 1.

Irrespective of which coordinating mechanism is selected, all key government and relevant nongovernment organizations should be represented on the council and should meet regularly to discuss road safety activities. Frequency of meetings will depend upon the level of representatives: e.g., if prime minister + ministers (annually), if minister + permanent directaries (two or three times a year), or, if departmental directors (four to six times a year).

To be effective, such councils will need to be of a manageable size (say not more than 25 members) and will need their own operating budget and a small permanent secretariat to provide technical and administration support. The private sector also has an important role to play within the safety council and can contribute fund-raising skills, sponsorship, commercial experience, and contacts. Representatives of the motor insurance, fuel, and other transport-related industries should be welcome to participate as members. Ideally, they should be from the industry or trade organizations rather than from individual firms. The work of the council would be carried out through a number of subcommittees covering different areas of activity.

Table 1: Advantages and Disadvantages of Alternative Options		
Type of coordinating mechanism	Advantages	Disadvantages
1. Independent commission	1. Independence 2. Ability to bring in non-government interests 3. Nonpartisan	1. Advisory only, so no power 2. Outside government system 3. No access to government support staff/resources
2. Officials' committee	1. Key decision makers 2. Power to take action 3. Can use government support staff/resources	1. Interministry rivalries 2. Private sector excluded 3. Less access to private sector funding 4. Wider interests not represented
3. National road safety council	1. Key government decision makers 2. Private sector skills can be included 3. Access to private sector funding 4. Access to government staff/ support via members	1. Needs secure funding 2. Needs secretariat 3. Needs legislative support

NRSCs provide the best mechanism for harnessing the benefits of both public and private sector organizations. Consequently, the following sections will assume that an NRSC is the mechanism in use. For countries using the alternatives, most of the comments or advice remain equally relevant.

It is necessary to coordinate actions and activities at national level, and also to ensure that similar coordination occurs at local level where much of the implementation will actually be done. In the case of an NRSC, this means establishing provincial road safety committees (PRSCs) with similar multidisciplinary local level participation as on the national council. Thus, whereas the national council may have senior officials from the central headquarters of relevant ministries and organizations, the provincial committees will have the provincial representatives of those ministries and organizations as well as representatives of the provincial government. In some countries, it may even be appropriate to establish district or municipal road safety councils in large cities.

4 STAGES OF DEVELOPMENT

In order to achieve a coordinated road safety effort using national and local level coordinating mechanisms, a developing country usually needs to proceed through certain steps, typically as follows:

1) a national road safety seminar at which an interim interagency working group is established and a joint statement (signed by key participants) is published on the need to improve road safety within the country;
2) definition and agreement on the role of the NRSC and potential mechanisms for its funding;
3) development of the necessary legislation for establishment of the NRSC and its technical subcommittees;
4) establishment of the NRSC;
5) provision of technical and financial support for NRSC activities;
6) establishment of local coordinating bodies (PRSCs);
7) development of a program of short-term activities; and
8) implementation of a priority action plan and development of a five-year program.

Each of these steps and the moves necessary to achieve them are briefly outlined below.

4.1 Interim Working Group

This is normally established following a national road safety seminar and comprises senior officials from the seven or eight most important organizations with responsibilities in, or potential to assist in, improving road safety. Typical membership should include personal and agencies such as:

1) director, traffic police;
2) director, roads and highways;
3) director, transport department; (vehicle and driver testing);
4) director, public health;
5) director, primary school education;
6) representative, motor insurance insurers industry;
7) chairman, chamber of commerce; and
8) representative, PMO

4.2 Role and Potential Funding Mechanisms for NRSC (or Equivalent Organizations)

The role of an NRSC is to promote, oversee, and coordinate safety activities. To do this, the NRSC has to include among its membership, all key organizations. Conversely, if there are too many organizations involved, it often becomes difficult to do anything constructive. It is recommended that the number of member organizations be limited, where possible, to no less than 10 and no more than 25.

Plate 3: National road safety seminar, Samoa.

Provision should be made to establish smaller five to six person subcommittees to be responsible for specific areas (e.g., fundraising and finance, safety education in schools, and publicity). Other external agencies or specialists can be co-opted onto such committees as and when necessary. Most of the day-to-day work of the NRSC will be done by the subcommittees and the NRSC secretariat with the whole NRSC meeting only periodically.

Funding can be through an annual grant from government or via a levy on motor insurance policies, driver licenses, fuel, or other sources, which will increase in line with growth in vehicles. Typically about 60 percent to 70 percent of NRSC income should come from such a guaranteed levy, about 20 percent to 30 percent from commercial sponsorship and NRSC fundraising activities, and, say, 10 percent from government to avoid undue reliance on government funding, which may often be subject to severe fluctuation or cutbacks.

4.3 NRSC Legislation

For effective action, there need to be clear lines of authority, and the NRSC should be given statutory responsibility to coordinate and oversee the development of safety activities. There should be an obligation to report back annually to legislators on progress made. The legislation apart from defining the role, responsibilities, and function of the NRSC should define the sources of funding, and should empower the NRSC to raise additional funds through sponsorship. It should also permit the NRSC to establish regional, provincial, or municipal committees.

4.4 Establishment of an NRSC

This should be undertaken with media attendance and it is useful to involve a senior politician (the prime minister if possible) and at least several ministers to formally launch the safety council. The opportunity should be taken to feed the media statistics and facts on the scale and nature of the problem and on its economic and social impact on the nation. Various safety-related articles, e.g., on seat belts and on drinking and driving, can be placed in the media to raise awareness of safety issues.

4.5 Technical and Financial Support

Technical support can be achieved by either establishing a multidisciplinary team to work under the high-level director of the safety directorate or by establishing an NRSC secretariat with its own high-caliber executive director. In the latter case, staff could be seconded to the secretariat from member organizations of the NRSC, and the NRSC can hire additional staff of its own. Funding should, where possible, be organized via the legislation establishing the NRSC, and additional revenue should be raised by the NRSC secretariat through private sponsorship.

4.6 Establish Local Coordinating Bodies

Road safety problems have to be tackled not only in various sectors but also at different administrative levels. It is, therefore, necessary to establish local regional or provincial road

safety committees modeled on the NRSC, operating under it and including local branches of the same organizations. This enables road safety activity to be carried out at grassroots level.

PRSCs provide the same sort of coordination function at regional or provincial level as that provided by NRSC at national level. They should receive general publicity and education materials developed by the NRSC and, in addition, should receive some funds from the NRSC. These will help to cover some of the local administration costs and allow the PRSC to develop and print local publicity material of particular relevance to local needs and problems. This can supplement the material, posters, and safety pamphlets received from the NRSC.

The PRSC, like the NRSC, should, in addition, raise 30 percent to 40 percent of its income from local sponsorship and fundraising activities in its geographic area. This helps to raise awareness of safety issues as well as raising funds.

4.7 Programs of Activities at National and Local Level

It is important that activities at local level are harmonized with initiatives being taken at national level.

The NRSC should prepare a program or calendar of proposed activities and circulate this to the PRCSs so that their local activities can be integrated with national campaigns and initiatives.

In some countries, the NRSC provides exhibition vehicles and specialist presenters to support local road safety committees. In Fiji, for example, NRSC presenters and exhibition vehicles are placed (by rotation) at the disposal of each of the three divisional safety committees who then organize a series of awareness-raising events and visits with the district safety committees (Fiji is divided into administrative regions called divisions).

4.8 Implement Action Plan and Devise Five-year Road Safety Programs

The NRSC should oversee implementation of urgent improvements and coordinating efforts of the different agencies to produce a five-year safety program. Each agency and government ministry that is a member of the NRSC, should prepare within its own sphere of activity and influence a five-year program of activities to enhance or improve road safety; e.g., the ministry of health may try to expand the emergency ambulance system; or the public works department may try to identify and improve 100 of the worst accident black spots on the road networks.

The amalgamation of these various individual sector-specific initiatives into a single document constitutes the national road safety action plan. The NRSC role is to promote and support road safety efforts in each of the important agencies with road safety responsibilities, and to raise public and political awareness to ensure adequate funds and resources are made available to allow the problem to be tackled effectively.

5 BENEFITS AND EFFECTS

The formation of an NRSC and the local PRSCs typically leads to the following:

1) an increased awareness and understanding of the problem, the political will to address it, and serious coordinated attempts to improve road safety;
2) well-targeted road safety campaigns and remedial measures within a coordinated road safety action plan;
3) a source of revenue to finance some safety publicity and education activities. This may come from the central government, or perhaps through a fuel or insurance levy or other funding source from the private sector;
4) an increased recognition of the need for a good accident data system to define the problems;
5) increased technical support for safety interventions in all relevant sectors;
6) a sharing of experiences and a synergy developing between the various disciplines;
7) updated traffic legislation, traffic, and highway design standards; and
8) initially a halt to the rising accident rate and eventually a drop in the accident rate, and often in the total accident numbers themselves.

6 EXAMPLES OF GOOD PRACTICE

Several countries in the Asian and Pacific region have been able to demonstrate effective coordination of their road safety action plans and programs.

There is no single model that has been adopted and different countries have devised different solutions depending upon their particular needs and circumstances.

Some of the more successful coordination mechanisms adopted in the Asian and Pacific region are as follows:

The State of Victoria, Australia, set up a two-minister Task Force to address road safety issues. The two ministers (police and transport) represented the ministries with greatest responsibility. With the assistance of an officials' committee of technical specialists drawn from the main agencies and organizations with safety responsibilities, the two ministers were able to make significant reductions in the numbers of people killed in road accidents during the early 1990s.

Fiji: Under a recent ADB-funded road safety action plan, Fiji has established an NRSC. This has legislative responsibility to coordinate and promote road safety. It has established a network of three divisional and about 15 district road safety committees to carry out activities at local level. Funding is via a 10 percent levy on compulsory third party motor insurance premiums, commercial sponsorship, and a government grant representing 60 percent, 30 percent, and 10 percent, respectively, of total NRSC annual budget. All key public sector and private sector organizations are represented on the council and there is an NRSC secretariat with its own executive director to implement and follow up on NRSC decisions. The actual work of the council is undertaken via several subcommittees and implementation is undertaken by the secretariat, which also provides support services and assistance.

Japan has for many years had an NRSC chaired by the prime minister with all key ministers as members. A number of other safety councils also exists at lower level chaired by ministers and senior civil servants. In addition to these councils and committees, Japan has established, under the management and coordination agency of the PMO, a Road Safety Policy Office staffed by a multidisciplinary team under a senior civil servant. Their role is to coordinate, promote, and oversee road safety and the five-year road safety programs.

Republic of Korea in the late 1980s set up a Ministerial Road Safety Council under chairmanship of the prime minister. The PMO took direct responsibility for coordinating road safety initiatives in the different ministries. Unfortunately, this has never really worked as well as it should have due to absence of a dedicated multidisciplinary team to follow up the council's decisions. What is a successful mechanism in the Republic of Korea, however, is the funding for the Korea Road Traffic Safety Association (RTSA) which receives a large annual income (tens of millions of dollars) from an assortment of small levies on fuel tax, insurance, tire manufacturer profits, and expressway authority incomes. It is believed this provides about US$100 million each year for RTSA activities, which range from road safety research, children's safety education, driver training, and safety publicity, to accident black spot investigation.

In New Zealand, growing concern led to the establishment of an officials' committee under the chairmanship of the Ministry of Transport. This officials' committee, comprising representatives of the 10-12 organizations with road safety responsibilities, collaborated to develop a comprehensive Road Safety Improvement Strategy, which was implemented via annual road safety plans. At local level, task forces (comprising local representatives of the organizations on the national officials' committee) were established to coordinate, implement, and monitor local level initiatives. At national level, the officials' committee was supported by the staff of the Land Transport Department, and at local level it was supported by one-person secretariat partly funded through the national road safety plan. The officials' committee has been replaced by an NRSC comprising chief executives of key agencies supported by a number of road safety advisory groups drawn from interested government and nongovernment organizations.

Although these examples of good practice vary from country to country, those that are more successful have several features in common, as follows:

1) high degree of political support (either via political leadership or willingness to establish a legislative framework for an NRSC);
2) multidisciplinary council with all key agencies and senior officials involved;
3) involvement of the private sector;
4) multidisciplinary secretariat or support team led by a high-caliber, highly motivated executive director or senior civil servant; and
5) adequate funding from government and, especially, nongovernment sources to enable the work to be carried out effectively.

Irrespective of which of these coordination mechanisms is adopted, efforts should be made to incorporate the above elements to ensure likelihood of success.

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Road Safety Guidelines

for the Asian and Pacific Region

4.2

ROAD ACCIDENT DATA SYSTEMS

Asian Development Bank

EXECUTIVE SUMMARY

4.2

ROAD ACCIDENT DATA SYSTEMS

An accident database is needed for accurate assessment of the road safety situation. In order to be useful, the data need to cover more than deaths and should include data on casualties and the circumstances of the accident. This will help organizations that are able to contribute to safety improvement to devise and implement appropriate measures designed to combat specific problems.

The main processes involved in producing an accident database include an accident **reporting and recording** system, a **storage and retrieval** system, an **analysis** system, and an effective **dissemination** system.

Traffic police are the most ideally placed to record and manage accident data. Police do, however, need to be motivated and convinced of the usefulness of devoting the considerable effort required to collect this data and they also need to have adequate resources in terms of staffing, training, and computer systems. The data collected for all recorded accidents need to answer the following questions:

- **where** accidents occur;
- **when** accidents occur;
- **who** was involved;
- **what** was the result of the collision;
- **what** were the environmental conditions; and
- **how** did the collision occur.

Having introduced an effective database system, it is important to ensure that the data is utilized as effectively and widely as possible. Police annual accident statistics reports should be circulated widely and national decision makers should use the data. They should also be made readily accessible to relevant organizations for designing appropriate countermeasures, producing plans, monitoring effectiveness, and carrying out research.

PRIORITY ACTIONS NEEDED

1. Review police accident report forms to ensure that they are easy to complete, used nationwide, and include sufficient information to meet the needs of all potential accident data users.

2. Introduce an easy-to-use computerized data storage and analysis system that provides an understanding of the scale and characteristics of the problem, and permits appropriate countermeasures to be devised for high-risk target groups.

3. Ensure accident data statistics and analyses are distributed to those able to affect road safety and that they are used in designing and monitoring countermeasures.

An effective computer-based accident data system using a standard police data collection form nationwide is one of the most important prerequisites for a country that hopes to improve its road safety problem. It permits the characteristics and nature of the problem to be defined and appropriate countermeasures to be devised.

1 INTRODUCTION

These sector guidelines on "Road Accident Data Systems" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

In order that governments are fully aware of the level of safety, it is necessary to collect information on road accidents and to keep data in a form that allows analyses to be undertaken if and when needed (i.e., a database). Only through analysis of accident data can an understanding be achieved of when, where, and how accidents occur. Many countries appreciate that a significant proportion of their populations suffer death, injury, and economic loss as a direct result of road accidents, and that it is possible to use accident data effectively in planning interventions to improve the situation.

This document includes guidance on what a police accident database should contain, computer software requirements, and indications of how such a database is best utilized. It also describes the Transport Research Laboratory (TRL) Microcomputer Accident Analysis Package (MAAP) system, which is the only microcomputer-based accident data system specifically designed for use in developing countries.

2 WHY IS AN ACCIDENT DATA SYSTEM NEEDED?

To answer this question a widely used definition of a road accident must be first considered; as follows:

> "***a rare, random, multifactor event that is always preceded by a situation in which one or more road users have failed to cope with their environment, resulting in a vehicle collision.***"

Although relatively ***rare*** events in terms of the passage of time and traffic movements at any specific site, they add up to an increasingly worrying problem (as indicated above) for governments and the mobility of a country's population. If these events were purely ***random***, then it is unlikely that anything practical could be done to prevent their occurrence. However, research from all over the world has demonstrated that accidents tend to cluster at particular points or areas on a road network (e.g., within 50 meters [m] of a particular junction) or among particular groups of road users (e.g., drivers aged 18-21, schoolchildren, and elderly pedestrians).

Although the causes of accidents are ***multifactoral***, there are likely to be common reasons for the clustering; i.e., why different levels of risk exist (e.g., due to poor road geometry, or lack of or deterioration in skills of a road user group). There should be potential for treating and even removing some of these problems. The targeting of road user groups, locations, routes, or areas on the network for special remedial action has proven to be effective. For example, many low-cost accident countermeasures such as chevron boards on bends have proven to be cost beneficial: the value of accidents saved in only the first year being several times the cost of the scheme's installation.

To identify particular problems that are treatable and for which specific appropriate action can be designed, a reliable accident database (that is as comprehensive as possible) is essential.

Accident data can be used at the national level by policymakers to understand the broad nature, scale, and characteristics of the prob-

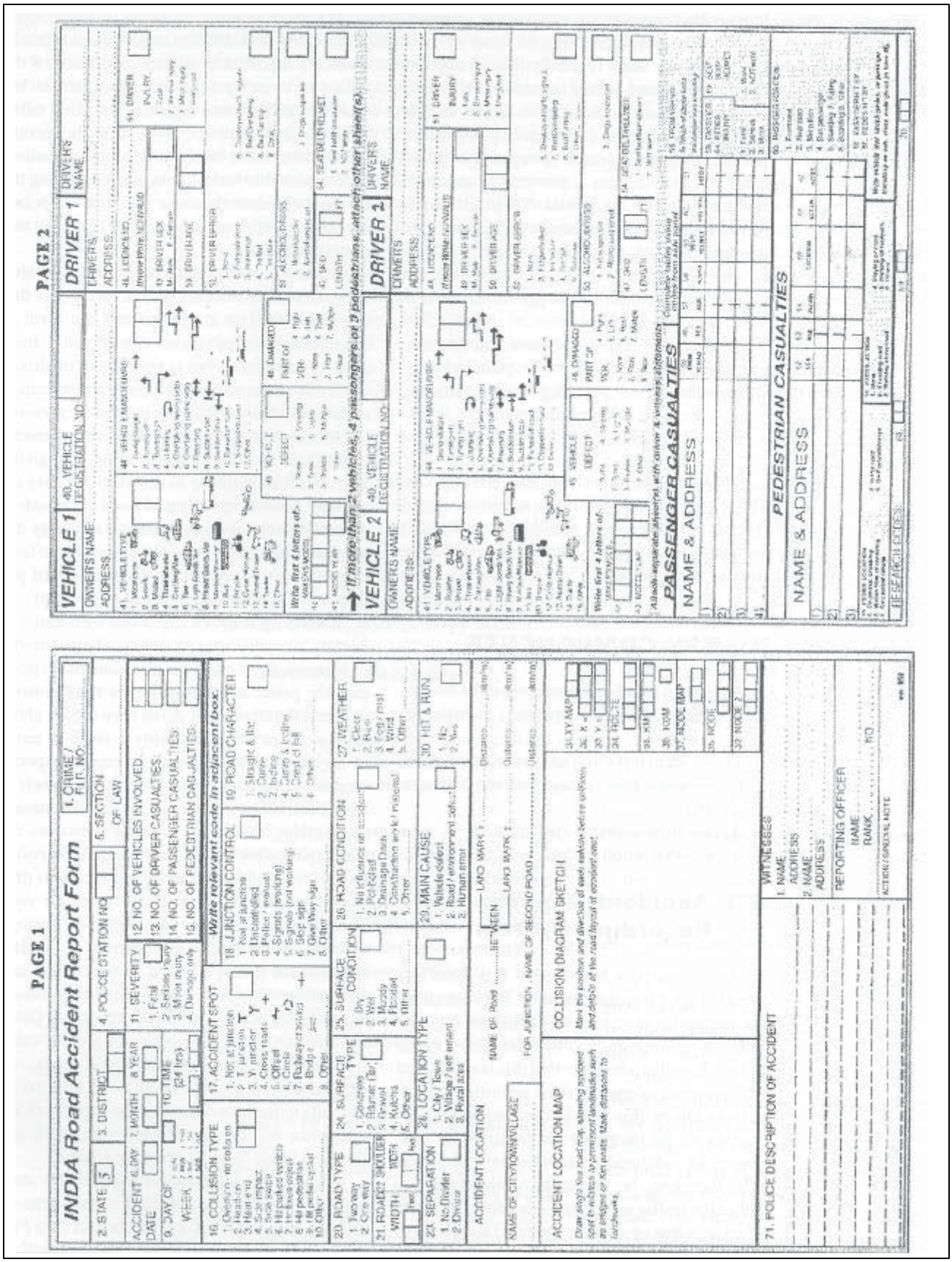

Figure 1: Example of a two-page Indian accident report form (reduced down from original A4 size pages).

lem so that appropriate nationwide interventions can be developed.

There are also several other groups of people with road safety interests at the local level who require accident data. These include road safety officers and highway engineers, police, lawyers, research groups, politicians, teachers, statisticians, insurance companies, and members of the public. They all tend to have slightly differing needs and reasons for wanting the data. These include:

1) the investigation of particular sites or road user groups;
2) designing safety schemes and devices;
3) justification for highway planning;
4) enforcement planning or prosecutions;
5) education and training; and
6) insurance claims.

However, the underlying aim, whatever the above purpose, should be to acquire as much relevant knowledge as possible from the data to help prevent future accidents of a similar nature from occurring.

3 KEY COMPONENTS

There are four basic components to the way an accident data system operates, as follows:

1) accident reporting and recording system;
2) accident data storage and retrieval system;
3) accident analysis system; and
4) dissemination of data.

3.1 Accident Reporting and Recording System

Most countries have found that there is a need for a legal requirement for road accidents (or particular severities of accidents; e.g., involving personal injury) to be reported to the police. It is also advisable that this is reinforced by insurance company rules requiring claimants to follow this law as this encourages reporting of accidents to the police. The best source of validated accident data will generally, therefore, be the traffic police force — either the traffic policemen attending the scene of an accident or when reported to an officer at a police station by the involved parties or witnesses.

However, in some countries different types of accidents or accidents on different types of roads are reported by different sections of the police or even by separate organizations because of jurisdiction agreements. This often leads to problems and it is strongly recommended that there be only one single organization responsible for collating and compiling the national accident database and that the police are the most appropriate group to carry out this important task.

It must be noted that there will inevitably be a substantial number of road accidents that is not reported to the police and the level of this underreporting varies considerably from country to country, but is significant in almost all. Even where there is a legal requirement to report only those accidents involving personal injury, studies of hospital data have demonstrated considerable underreporting, though the level tends to increase as accident severity increases. **Underreporting of road accidents is a particularly serious problem in many developing countries** (wherever possible efforts should be made to check completeness of police data by comparing with hospital data).

Satisfying fully all the needs mentioned in Section 2 would mean recording a large number of features about every single accident. In practice, the police need to strike the right balance between the amount of detail they record about each accident and their ability to do so in terms of their available time and, in certain aspects, their expertise (e.g., few policemen are likely to have been trained to recognize relevant unsafe engineering features). In most countries the traffic police section (within the general police force) is responsible for recording accidents (this is preferable as the traffic police are the ones who can most influence safer behavior through enforcement). The prime objectives of the data required for police use (i.e., prosecutions and enforcement strategies) will inevitably have a strong influence on the details recorded. Other information, which is perhaps of greater value to engineers, education specialists, or researchers, will often need to be kept to an absolute minimum, otherwise the paperwork for the police will become too onerous a task and thus less likely to be complete or reliable.

Ideally, the information required for each accident should be completed at the scene on an easy-to-complete form or booklet (see Figure 1). It is also recommended that, if possible, a single form be designed for all purposes (i.e.,

used for court procedures, filing, and computer data entry) to eliminate the need to transcribe data onto, for example, a computer coding sheet. Otherwise this becomes a separate task and one in which errors could be introduced. The form or booklet will also need to provide space (or forms for attachment) for driver, pedestrian and witness statements, written summary of the accident, and sketches.

Although it is desirable that, as much as possible, the form is completed at the site (and the inclusion of all coding values on the form is helpful in this, see Figure 1), it is likely that some information will still need to be completed in the office. This is where civilian staff are often employed to complete or code the form and enter this data onto computer. Again, this is best done at the local police station. However, where this is not feasible due to the lack of computers, then the forms (or copies) will need to be sent to the police headquarters for entering into the computer. Eventually, the data will need to be collated into a national database and this can be done electronically via a network or other means of computer linkage, or simply by arranging to transfer periodically magnetic material such as floppy diskettes.

a) *Accident database*

Information for any one accident should be contained in a single accident report form or booklet. Ideally, this same form should be designed such that it can be used directly for computer data entry.

Obviously, governments, or road and police authorities, have their own and often different views on what accident information should be recorded. So it is unlikely that a single common unified report form would ever be accepted internationally (see comparison of forms from five Asian countries[1]). It is even difficult to draw up a definitive list of factors required in all cases. However, the database should be able to answer the following basic questions:

where accidents occur:
location by map coordinates, road name, class;
when accidents occur:
by year, month, day of week, time of day;
who was involved:
people, vehicles, animals, roadside objects;
what was result of collision:
worst severity of injury or property damage;
what environmental conditions:
poor light, weather, road surface condition; and
why or ***how*** did collision occur:
collision type, driver fault type.

Table 1 contains a suggested list of factors appearing on accident report forms in many countries of the world that have generally been found to be useful to various interested parties. Some of the more important factors are discussed below.

b) *Accident reference — unique identifier*

Once an accident record has been entered on computer, there is always the possibility that the record may be mistakenly entered a second time, possibly by a second computer operator, or even be copied (in error) electronically. It is important, therefore, that each accident can be identified uniquely by a particular number or combination of recorded fields, for example:

i) police station incident number;
ii) year; and
iii) police station identifier, which may require combination of station and region code.

This provides a check (which should be computerized) that no two accidents can have the same combination of values for these specified (key) fields, thus avoiding the possibility of duplication of records.

c) *Accident location*

An important detail, which is unfortunately often neglected by many police authorities, is a precise and easily-computerized accident location system.

When a roads authority is considering how to tackle accident problems at the local level, it is not possible for it to focus initially on the worst sites (in order to obtain the greatest potential saving in accidents) or ultimately to evaluate the effect of its action unless it can be certain that all accident locations have been correctly pinpointed over a network. A number of possible location coding systems is discussed in the following pages.

Table 1: Recommended Factors for Inclusion in Road Accident Database

General Details/Attendant Circumstances Police Reference	Road type	Environmental features	Precise location
Year Month Date Time Region/state Police station reference Severity Collision type Number of vehicles involved Number of casualties Contributory factors code	Class of road/road no. Carriageway type/no. of lanes Speed limit Junction type Road width Road shoulder width	Light condition Road lighting Road surface condition (dry, wet, etc.) Road surface quality (potholed, rutted, etc.) Weather Junction control Geometry (curvature, incline) Hit and run Roadworks	Map reference X-coordinate Y-coordinate Node 1 } optional Node 2 } Kilometer post To nearest 100 m (e.g., "8" = 0.8 km) Plain language location description (free text — abbreviated) Accident description (free text — abbreviated)

Vehicle/driver details	
Vehicle type	Driver age
Vehicle maneuver	Driver sex
Vehicle damage	License number.
Length of skid marks	Seat belt/helmet
	Alcohol/drugs suspected

Casualty details	
Type of road user	Pedestrian location
Age	Pedestrian movement
Sex	Passenger location
Severity of injury	School student

i) X-Y coordinates

It is becoming increasingly important to have data that can be plotted on maps. It is, therefore, recommended that the national grid coordinates are recorded for each accident to be able to produce accident maps or possibly incorporate the data within other geographic information systems. For the plots to be meaningful, a 10 m grid accuracy is strongly recommended. However, the level of detail possible will depend on the maps available.

ii) Kilometer posts:

Unfortunately, it is often difficult for the police (or coders) to locate rural accidents on a map. Indeed, it is advisable to have another, simpler location system in place to serve as a check on the X-Y coordinate system. On intercity roads where a good system of kilometer posts has been installed, preferably with intermediate 100 m marker posts (see Plate 1), this can be used easily by the police as a referencing system; i.e., they note down the nearest post to the accident site and the distance to it.

Where 100 m posts are not present but culverts are numbered, then strip maps (Figure 2) can be prepared that show each culvert in relation to its distance along the road. The police officer has only to indicate the distance of the accident site from the nearest culvert marker or other physical locations. The exact location can then be pinpointed in the office by referring to the strip map (see Figure 2).

Plate 1:
100 m marker posts on an expressway in Malaysia.

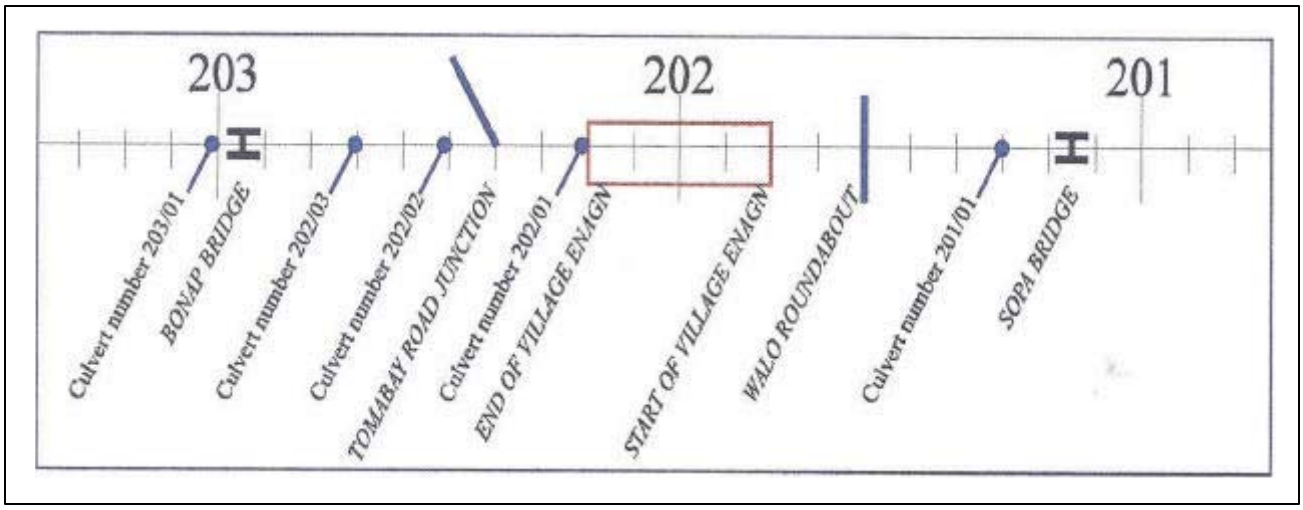

Figure 2: Simplified example of a strip map showing physical locations along road.

iii) Node-link-cell

For towns and cities, there is generally a greater density of junctions, and thus a node-link-cell system is recommended, where each major junction on a map is assigned a unique node number. Links are defined by the length of road between two adjacent nodes. Cells are the least accurate as they are squares covering, for example, a housing estate having many minor junctions. These numbered locations are much easier to read off a map with less chance of error (see Figure 3).

iv) Plain language location description

Another recommended referencing system is a free-text, abbreviated description of where the accident occurred using street names and other landmark features. These serve as a useful check on the coded location and can give a more precise description of the location of an accident.

v) Location sketch:

All police accident reports will include a collision sketch, but it is also strongly recommended that a specified space on the report form is provided for an accident location sketch. This should be a simple line drawing of the roads marking the accident site precisely in relation to prominent landmarks, such as bridges, junctions, or kilometer posts, its distance from these, and the direction of compass point north. These sketches must be sufficiently detailed to guide an investigator to the exact location of where the accident occurred, even if the investigator has not attended the scene of the accident before.

3.2 Accident Storage/ Retrieval System

Irrespective of whether the accident data are stored in a manual, micro-based, or mainframe-based storage system, the data must be easy to store and retrieve as needed. The true benefits of the data are not being harnessed unless it can be retrieved easily for analysis.

The data structure has to be such that information stored on individual accidents can be retrieved either as a single record or in combination with other records. This permits cross tabulations and other analyses to be carried out more easily, and permits more useful annual reports to be produced.

The data should be analyzed at national level and perhaps be utilized more intensively at local level to identify particular problems and tackle them specifically. The software package used to enter data, therefore, needs to be standardized and easy-to-use, such as MAAP[2,3] developed in the United Kingdom (UK) by the Transport Research Laboratory (TRL). It was specifically designed for use in developing countries but is now also being adopted by several police forces in the UK. A number of other more general software packages exist[4,5], but none provides the level of system or proven track record in developing countries of the TRL MAAP system.

The software, irrespective of the system, should facilitate standard analysis techniques

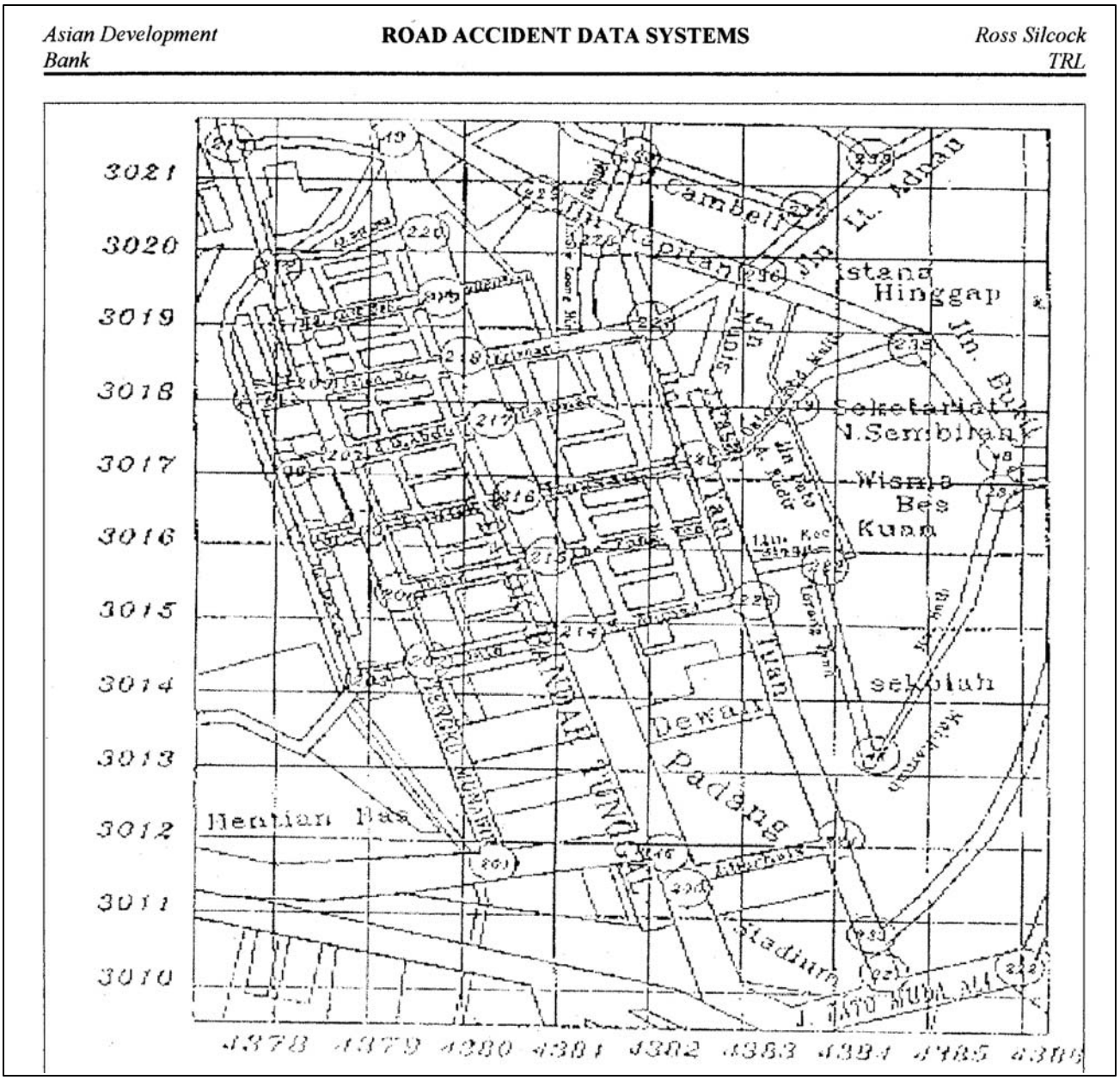

Figure 3: Example of node and coordinate map.

such as the listing of worst accident sites and stick diagrams analyses. Some of the main features are discussed below.

3.3 Computer Software Package Analysis Facilities

a) *Data validation*

As mentioned above, the package should be simple to use, enabling easy data entry, full editing and back-up facilities, and logical internal checking routines to ensure that the data are as accurate as possible at the entry stage.

It is also important to validate the data, which is easier done close to its source so that queries with particular accidents can be answered as quickly as possible. Ideally, the software should contain a number of standardized logical checks automatically applied on data entry to try to ensure the data are accurate from the outset. However, it is important to try to ensure that staff are conscientious and will apply their own checks, and complete forms with minimal missing data fields.

b) Tabulations

One of the main features of general accident data analysis is the ability to provide cross-tabulations that can be done by accident frequencies, casualties, or the vehicles involved. Traffic police authorities will need to produce certain standard tables regularly (monthly or at least annually for an annual report), but the software must also be flexible enough to allow nonstandard cross-tabulations to be produced easily with any combination of data filters for specific studies or to provide rapid answers to ad-hoc queries. Many mainframe computer systems have failed to provide facilities to meet this latter requirement for producing relevant accident information quickly on demand.

c) *Presentation graphics*

It has generally become common practice to display figures and tabular results graphically in the form of bar charts or pie charts, which, indeed, can illustrate points much more clearly to the reader than columns of numbers. The database package should provide such an option, or at least make it simple to export data to proprietary software for this purpose.

d) *Location identification*

Another important facility of any software package is to provide the user with a list of the worst accident sites, however defined, in any area of interest. This can be done using any location identifier such as nodes or distance references along a road. It is often useful to view how accidents are distributed spatially by automatically producing a histogram plot of accidents along a road. A more recent method of visually determining where problem areas exist is by display of accident locations on road maps (i.e., accident maps). This method is gathering more and more popularity among investigators. For example, MAAP software provides such a facility and can analyze groups of accidents within any polygon drawn on a computer screen map (stored in either digital or raster-scanned form [see Figure 4]). This allows particular corridors or residential and city areas to be studied in detail directly through identification on an on-screen map.

e) Stick diagrams

Another useful analysis tool frequently used by highway engineers is stick diagrams, which are the representation of chosen features of an accident (e.g., type of collision or hour of day) using symbols in a column. A column or stick is produced for each accident at a site and the columns re-arranged to search for patterns of accident (e.g., predominance of side impact collisions or high occurrence of accidents in morning peak hour). This process can be automated within the computer package, enabling the investigator to perform the task quickly and easily, thus helping to design remedial action to tackle the most common accident patterns efficiently (see Figure 5).

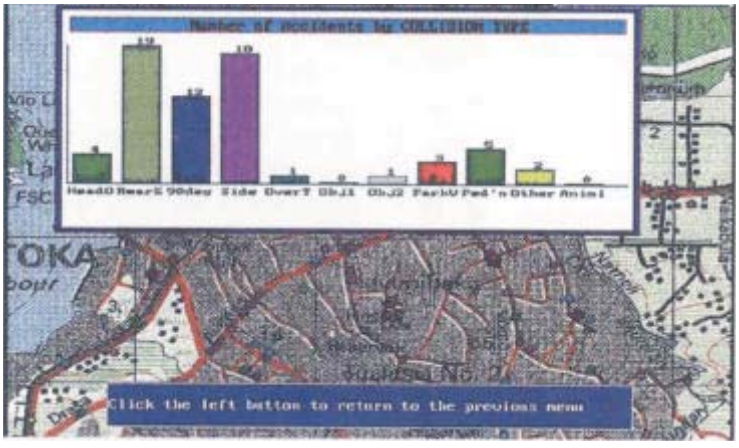

Figure 4: Example of polygon analysis using MAAP 5 software package.

3.4 Dissemination

In order to create a widespread awareness of road safety, it is important to publish annual reports showing clearly the magnitude and nature of safety problems, not least to justify adequate funding and resources to combat these problems. Road safety is a problem that requires activity in many different sectors for improvements to be achieved. Annual police accident reports need to be distributed widely to all agencies with responsibilities in road safety and with the ability to influence road safety. It has been shown in many developed countries that an effective way of managing safety is for authorities, not only at the national but also local level, to use a database to identify countermeasures and to publish details of their planned schemes annually.

The published document should also evaluate the effectiveness of these schemes in

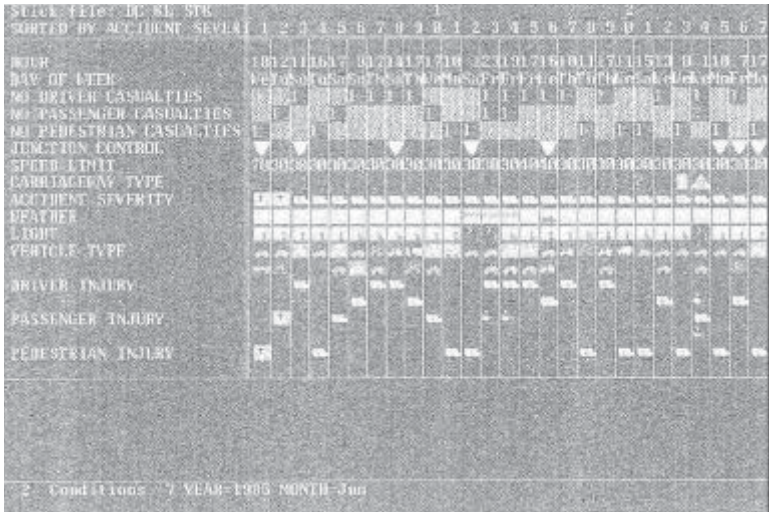

Figure 5: Example of stick diagram.

subsequent years. It is important, therefore, that the relevant accident database is made readily accessible to all organizations able to contribute to improving safety. This means setting up a mechanism whereby these organizations receive updated data regularly.

4 STAGES OF DEVELOPMENT

There are five development stages that can be identified in the development of road accident data systems.

Stage 1: Accidents Included in General Incident Reports

At the earliest stages, the police collect accident data on standard police incident reports and the data are treated in the same way as all other crime records with the focus on prosecution. Only the most basic details are collected and the standard "incident" form used is the same as for any burglary or any other incident that might occur.

There is little information of particular relevance to the circumstances leading to the accident. The concern at this stage is more with identifying the participants involved and reporting the "incident" to the authorities.

Stage 2: Basic Accident Data Form Introduced

At this stage, a separate accident data form is introduced as police begin to see the need for compiling additional information specifically on road accidents. Usually storage retrieval and analysis is manual, hence little real analysis is done of the data. Generally the only work done is to produce basic statistics tables with little interpretation or analysis of them. The data are used mainly for administration purposes within the police to be able to report how many accidents happened and in which jurisdiction they happened. Little or no attempt is actually made to analyze the data with a view to improving the situation.

Stage 3: Uniform Accident Form Introduced after Consultation with Other Parties

Eventually, as the number of accidents increases, a need is acknowledged for better accident data to be available. There is police willingness and agreement to improve the system and willingness to cooperate with other agencies, such as the engineers and others, in order to develop a form that meets the data needs of all key parties. A uniform accident form is designed in consultation with interested parties and introduced nationwide after pilot testing. Often a microcomputer-based accident data system is introduced at police headquarters. From this, an annual accident report is produced at the end of each year and circulated to all the key agencies involved.

Stage 4: Accident Data in Use in Other Agencies

By this stage, the various other road safety related agencies are beginning to use the data. Detailed annual reports would be published, distributed widely to all the agencies, and the database would be available to those who need it. An NRSC will use the data for better publicity and propaganda, highway authorities would be identifying and improving accident black spots, and police would be carrying out more effective enforcement at locations and times known to involve speeding or drink-driving accidents. It is possible that the database would be copied to other major users such as the road engineers. It would also be used by researchers from universities and research institutes to increase understanding and knowledge about the causes of road accidents and the effectiveness of countermeasures.

Stage 5: Supplementary Data Collected

Once a police data system is working well and the key agencies are using it, it will be recognized that a considerable number of accidents is still unreported to the police. Other data sources will begin to be checked to identify the scale of underreporting. This normally implies surveys of hospital data records and insurance industry records by researchers to try to assess the degree of underreporting occurring. By this stage, the police accident database will be widely accessible and in use by a number of organizations. Researchers will be active in comparing police, hospital, and insurance records, and there will be regular surveys of these records to try to reconcile the underreporting problem.

5 BENEFITS AND EFFECTS

Accident data are the base measure of safety and is essential in order that politicians, planners, engineers, police, education and publicity specialists, and researchers are all aware of the scale and nature of safety problems over a road network.

Plate 2:
Accident unit staff in Fiji entering data from police accident forms.

Plate 3:
MAAP accident plot in Dhaka, Bangladesh.

At a ***national*** level, the database should be used to help decision makers formulate national policy, such as compulsory wearing of front and rear seat belts, rider helmets, driving age restrictions, and other legislation, and to produce a national action plan for improving safety. Even within ***districts or states,*** the data can be used to target particular road user groups at risk; e.g., drunk-driving publicity campaigns, school education programs, motorcycle rider training, and police enforcement campaigns.

The accident database is of particular value in the **accident reduction** process at the local level. Here it should be used to draw up local action plans where the worst sites (in terms of accident occurrence) on the road network are identified. Appropriate accident countermeasure schemes should then be planned and implemented by road engineers in consultation with the police to bring about the most cost-effective accident savings. Lessons learned can be used in the design of new road schemes in order to encourage safety-conscious planning and design of roads.

There is reason to believe that accident remedial measures that are found to be effective in one country may not necessarily work well in another (e.g., solid white lines may deter dangerous overtaking in developed countries but can be ineffective in some developing countries). There is, therefore, a need to evaluate the effect of safety schemes and a reliable database is also essential for this purpose. Without proving that remedial work has been effective in reducing accidents or demonstrating that certain trial countermeasures do not work well, it is likely that money and resources will be wasted or certainly not spent to maximum benefit.

6 EXAMPLES OF GOOD PRACTICE

Although a number of commercial software packages (e.g., Arc info or Map info) are available and can be used to create accident data systems, the most common accident microcomputer-based database currently in use in the Asian and Pacific region is MAAP. Although introduced only on a pilot basis in trial areas in some countries, and perhaps with data not as complete as might be desirable in other countries, their value is gradually being recognized by many practitioners actively trying to improve safety. It already serves as the national system in several countries and is under trial for national or regional adoption in several other Asian and Pacific countries.

Papua New Guinea has one of the oldest and most comprehensive accident databases in the Pacific region. MAAP has been in use there nationally since 1986[6] when it was established as part of an ADB-financed Road Safety Project. The Royal Papua New Guinea Police

work closely with the Department of Transport to maintain and utilize the database to determine effective enforcement exercises, to change the worst accident locations, and the Department of Land Transport and the police use it to target specific at-risk groups more effectively for publicity and education campaigns.

Fiji has also recently introduced the package nationwide as part of its ADB/World Bank-funded Road Safety Action Plan. Special units in the NRSC, the police, and Department of Works are actively using it to plan remedial works[7].

Malaysia[8] and **Singapore** have incorporated MAAP nationally with their existing mainframe systems, thus enabling the data to be immediately accessible to a much wider group of practitioners and researchers. In the case of Malaysia, accident data has been incorporated into the geographic information system network. MAAP is also under trial in **Bangladesh**, (see Plate 3) and has also been introduced or is under trial in parts of **People's Republic of China, India, Indonesia, Nepal,** and **Philippines**.

7 REFERENCES AND KEY DOCUMENTS

It is recommended that the annual accident statistics reports, accident database systems, and police accident report forms from several countries are reviewed before decisions are taken to change an existing system.

Several other useful documents are indicated in the appendices to these guidelines.

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Road Safety Guidelines

for the Asian and Pacific Region

4.3

ROAD SAFETY FUNDING AND THE ROLE OF THE INSURANCE INDUSTRY

Asian Development Bank

ROAD SAFETY FUNDING AND THE ROLE OF THE INSURANCE INDUSTRY

Funding of road safety is primarily the responsibility of the central government, supported as necessary by regional or provincial governments. However, the private sector and especially the insurance industry can and should play an important role in tackling road safety. But with a few notable exceptions, it does not yet do so in developing countries.

The insurance industry role is too often limited to the postaccident stage and, while vast sums are spent on accident claim compensation, little thought or financing is directed at road accident prevention. Increased motorization and the associated rise in accident claims require the active involvement of the insurance industry as it bears the majority of the costs of road accidents, and should assume greater responsibility for financing and directly promoting road safety.

The insurance industry can participate both via funding and by sharing its business and marketing skills to assist government in tackling a country's road safety problems.

Insurance companies in many countries, such as Australia, Canada, Finland, and other European countries, have found that there are significant advantages from investing in road safety, as the benefit in terms of reduced claims (because of reduced numbers of accidents) often outweighs the amount invested. The industry also benefits from an improved public perception of being seen as a socially responsible industry.

Other private sector organizations, especially fuel companies and organizations with large vehicle fleets and many drivers, can also help and profit by investing in road safety. Their involvement should be actively sought and encouraged by government.

PRIORITY ACTIONS NEEDED

1. Government should actively seek and encourage the private sector (e.g., fuel companies, transport operators, and especially the motor insurance industry) involvement in funding relevant road safety activities.

2. Legislate a mandatory requirement of third party motor insurance on all drivers, with, say, 5-10 percent of premium as a levy for road safety activities.

3. Motor vehicle insurance regulations should be enforced in order to achieve a high rate of coverage and maximize insurance contribution to road safety.

Opportunities do exist for governments to draw the insurance industry and other private sector interests into the battle to improve road safety by establishing voluntary or compulsory levies. Investment in road accident prevention can reduce outlays in accident insurance claim compensation and is seen as a good business decision by those already active in this area.

1 INTRODUCTION

These sector guidelines on "Road Safety Funding and the Role of the Insurance Industry" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

The role of the motor insurance industry is interwoven into the road safety process and in many countries its influence has been beneficial and significant. While many private sector companies have contributed financially to the direct provision of road safety measures, this section focuses on the key road safety agent in the private sector, the insurance industry.

2 WHY IS FUNDING FROM THE INSURANCE INDUSTRY NEEDED?

While the central government is responsible for developing and implementing a coordinated road safety program, much of the economic costs of road accidents are borne by the private sector. Funding for road safety improvements should be shared with those who stand to gain from accident prevention measures[1].

In most countries, the insurance industry has traditionally limited its involvement to postaccident compensation payments. A no-claims discount was most probably the only incentive or attention that motor vehicle insurance companies gave to accident prevention. This situation has proven unsustainable with many insurance companies (in developing countries), incurring excessively high claims loss ratios; i.e., the amount of money paid in accident claims compared to that collected in policy premium payments, as accident claims increase rapidly in the countries undergoing rapid motorization.

For several decades, motor insurance companies in many industrialized countries have been involved in supporting road safety efforts through the provision of money, either voluntarily or through legislation, and through other means, including research, lobbying for change, and campaigns. While the government will be faced with multiple serious economic and social needs, the insurance industry has a vested interest in seeing road safety receives adequate attention, and that efforts are made to reduce accidents.

The large amounts of regular income that can be raised for road safety via a small levy on third party insurance premiums (TPIP) can be illustrated by some examples. The State of Victoria in Australia, by imposing a levy of 10 percent of TPIP (equivalent to US$21 per vehicle per year), raises US$56.65 million a year for investment in road safety. Finland, which imposes a levy of only 1 percent of TPIP (US$3.67 per vehicle per year), raises US$8 million per year. East European countries, with encouragement from the World Bank, are imposing levies of about 8 percent of TPIP and these will raise annual amounts of US$28 million (Poland), US$20 million (Hungary), US$12 million (the Czech Republic) and US$7 million (Slovakia).

Adoption of similar approaches in the Asian and Pacific region and adoption of a levy on TPIP (accompanied by a requirement for and enforcement of third party insurance for all motorized vehicles) could raise millions of dollars in each country. A levy of only US$10 per registered motor vehicle per year would raise more than US$1.5 billion annually in the developing countries of the Asian and Pacific region.

Individual Asian and Pacific countries could raise substantial income from such sources and Table 1 provides examples of

income possible from a US$10 levy in the selected countries shown.

Table 1: Potential Annual Income from a US$10 Levy on Motorized Vehicles

Country	Annual income (US$ million)
People's Republic of China	273.0
India	252.0
Indonesia	111.0
Republic of Korea	80.0
Lao PDR	1.3
Malaysia	66.6
Philippines	21.2
Sri Lanka	8.6
Taipei,China	148.0
Thailand	110.6
Viet Nam	33.9

Motor insurance involvement is also beginning to occur in some developing countries (e.g., in Fiji a voluntary levy on insurance is financing the recently inaugurated National Road Safety Council [NRSC]). Consequently, those insurance companies involved must see benefits for their industry in being involved in such activity.

3 KEY COMPONENTS

3.1 Legislation

If support from the motor insurance industry is to be significant, then the industry itself must be well established and of a sufficient size to have funds that can have an impact on road safety. Such an industry results from legislation that requires **all** drivers to have at least third party insurance and then grows as the vehicle fleet expands and the population increasingly invests in insurance in other fields apart from vehicles, such as home contents or structure.

In recent years, many countries have introduced third party motor vehicle insurance requirements for all motor vehicles. Two exceptions are Bangladesh, where government vehicles are exempt, and Nepal where vague wording of legislation leaves the requirement of motor vehicle insurance on private vehicles unclear.

Legislation should also stipulate, or at a minimum, allow for a levy to be imposed on the total insurance premiums collected and dedicated to road safety. In Fiji the legislation establishing the NRSC stipulates 10 percent of third party premiums are to be dedicated to road safety while the 1996 Motor Vehicle Insurance Act in Kazakstan allows for a special reserve fund to be established for road safety preventive measures, but does not specify a minimum or maximum amount.

3.2 Enforcement

A road safety fund based on insurance premiums will require the enforcement of motor vehicle insurance regulations in order to realize its full potential earnings. Enforcement of insurance regulations has not always followed the enactment of motor vehicle insurance legislation and many vehicles are driven without insurance cover in the Asian and Pacific region.

One way of ensuring motor vehicle insurance regulation compliance is to have proof of insurance as a requirement of the periodic roadworthiness vehicle inspection. Vehicle fitness certificates should not be given without proof of insurance and, while this is a common legal requirement in many Asian countries, the extent to which the inspection authorities enforce this stipulation varies widely. This approach works best if there is also a legal requirement that a valid roadworthiness sticker or certificate must be displayed and clearly visible on the windscreen of the vehicle. In Kazakstan, in order to promote compliance with the new insurance regulations, motor vehicle insurance can be purchased at the vehicle inspection centers.

Proof of insurance coverage can also be confirmed at the stationary checkpoints where traffic police inspect other required documentation, such as ownership, fitness certificates, and route permits. Proof of insurance can also be checked on the same basis as driver licenses when traffic warnings and citations are being issued. Overdue fines for insurance coverage should be set at several times the insurance policy premium value.

3.3 Road Safety Promotion

The role of the insurance industry should not be limited to a passive funding source for road safety. A more active partnership should be sought between the insurance industry and the

government. The insurance industry's support and commitment to road safety will be greater if it is involved in the organization of road safety and is able to help determine the use of their funds. Accordingly, the insurance industry should be represented on the finance subcommittee, if not the main body of the NRSC.

The insurance industry can do much to promote road safety in its insurance policies, as well as by sharing data and through the direct organization of road safety campaigns. Most insurance policies in the Asian and Pacific region are still vehicle based; i.e., the premium rate is determined by the type of vehicle and its previous accident record regardless of the experience or age of the driver. A driver-based insurance policy would limit the insurance coverage to only those drivers registered for the vehicle and the premium rate would be higher for any younger drivers or inexperienced drivers, as such groups of drivers have a higher accident risk.

In an attempt to improve the accident risk of novice drivers, insurance companies in the United Kingdom (UK) have recently introduced a scheme where additional training (e.g., motorway driving, advanced driver training, and defensive driving) results in a reduction of the insurance premium cost.

The insurance industry is also a good source for accident data and costs. The total cost of the economic consequences of road accidents often needs to be calculated before governments will begin to invest in road safety. Insurance companies can provide much needed data for accident costing. In a few countries, insurance claim data have been found to be more comprehensive than police data.

Plate 1: Damaged vehicles are a cost to the insurance industry.

3.4 Noninsurance-related Private Sector Support

While all private sector companies would benefit from an improved corporate image by investing in road safety, many private sector organizations outside the insurance industry have a direct incentive in promoting road safety. Businesses with large fleets or expensive vehicles are already interested in reducing road accidents among their own vehicles and adopt safety-conscious policies that include strict testing of potential drivers as well as medical and alcohol testing of current drivers. Advanced driver training may be offered and driver hours controlled. Safety bonuses and awards are also standard policy whereby employers try to offer drivers added incentives for safe driving. In order to be effective, company commitment to road safety must be visible and continual. For example, the Shell Petroleum Company has sponsored defensive driving courses for its personnel in a number of countries (e.g., Brunei and Fiji). In Malaysia, Shell requires its new drivers to undergo a three-day defensive driving course and refresher courses are given every two to three years. Close monitoring is kept of driving records and accidents may be classified as preventable and nonpreventable.

Private sector companies have also begun to promote road safety outside their own immediate interests. One of the major commercial banks in Fiji sponsored the first national road safety conference and elsewhere road safety publications and materials have been published, sometimes in return for the company's logo being included on the documents as a sponsor. The private sector has also sponsored research into driver selection systems in India where psycho-physical tests are being developed.

In the UK many private sector industries have acknowledged the devastating impact of road accidents and have become directly involved in promoting road safety. Some fuel companies have adopted road safety, and Texaco has invested both financial support and employee effort, e.g., in campaigning for the reduction of road accident risks to children. In addition to vehicle design, the automobile industry has contributed to campaigns and Volvo, apart from its prestigious international safety award each year to encourage innovation in road safety, has been active in some countries (e.g., Brazil) in raising awareness of

safety issues. The "don't drink and drive" campaigns during the holiday periods and even the provision of some taxi services and late-night buses in the UK have been cofinanced by the major breweries.

Nongovernment organizations and service groups can also play a significant role in raising road safety awareness among the general public.

They are arguably in the best position to reach the local community and road safety can be easily incorporated into a basic life skills and education program. While private sector work can be organized and provided externally, the initiative should be coordinated with government activity to maximize impact.

Apart from the insurance companies, there is considerable scope for drawing in support and funding for road safety from other private sector organizations.

Many large oil companies, motor manufacturers, and transport operators are often willing to support road safety by sponsoring initiatives such as defensive driving courses and publicity campaigns. Large commercial organizations such as banks and trading companies are often willing to support road safety activity as part of their social obligation, for the public goodwill and good publicity it brings for the sponsoring organization.

4 STAGES OF DEVELOPMENT

Stage 1: Government passes legislation making third party motor insurance compulsory but enforcement is lacking. Few motorists are insured and most accident damages are settled privately.

Stage 2: Motor vehicle insurance begins to receive more priority from the government. The insurance industry is represented on the NRSC and insurance companies and other private sector organizations begin sponsoring one-off events, such as conferences or safety publications.

Stage 3: A closer association between insurance and road safety is developed with new legislation requiring that a levy be imposed on insurance premiums. Insurance requirements begin to be enforced by the police and inspection authorities. At this time, policy issues such as premium rates, policy restrictions, maximum coverage limits, hit and run drivers, and processing times are reviewed. Third party insurance premiums may often be increased slightly at this stage and some of the additional premiums received are invested back into road safety.

Stage 4: In addition to the financing role, the insurance industry assumes a more active role in supporting road safety. Government creates a policy of encouraging private involvement in road safety and sponsorship of road safety campaigns. Insurance companies' databases are developed to be of use in analyzing road safety problems and are made accessible to researchers.

Joint campaigns between the government and the insurance companies become more ambitious as they realize the benefits that are accruing from their initial efforts and investments. Other companies with links to the motor industry, particularly the fuel industry and motor dealers, become more involved in road safety.

5 BENEFITS AND EFFECTS

The potential benefits resulting from the insurance industry contributing to road safety funding include:

1) new funding source (nongovernmental);
2) marketing and business skills; and
3) improved perception of insurance industry.

The most obvious benefits accrue from the large amounts of money that can become available to help a country start its road safety efforts or continue with its priority program.

Other benefits involve the synergy developed when different disciplines work together in a coordinated way. In particular, the involvement of insurance industry firms enables them to add their professional expertise to road safety matters in such areas as data analysis, marketing, and publicity.

The insurance industry itself will benefit from an improved self-image as the public acknowledges the companies' social responsibility. Name recognition and corporate image have been found to have been raised from campaigns.

6 EXAMPLES OF GOOD PRACTICE

6.1 Examples from Outside the Region

The situation of insurance premiums funding road safety was well summarized by Lowe[2] at a recent World Bank seminar. The following portion is extracted from that paper and supplemented with other information. Some of the non-Asian countries that have been active include:

1) In 1977, the Province of Quebec in **Canada** adopted a nationalized, compulsory, civil liability insurance scheme using "no fault" principles. The insurer is required to provide driver training and public information campaigns on accident prevention. There has been an improvement in driver behavior, with higher seat belt rates and a fall in accident deaths, which are attributed to the insurers' road safety work
2) In **Finland**, a road safety tax has been levied on compulsory vehicle insurance for about 40 years. At about 1 percent of premiums, the tax raises US$8 million per year. The fund is used to finance the main government organization working in the field of public education, road user information, and road safety promotion.
3) In the **United States** (US), the Insurance Institute for Highway Safety (IIHS) is an independent, nonprofit, scientific, and educational organization. It is supported by the insurance associations as well as by the individual insurance companies and is aimed at reducing the losses — human and financial — caused by road accidents. It produces a monthly publication on road safety entitled *Status Report*.

6.2 Examples from Within the Region

a) *State of Victoria, Australia*

In the early 1980s, compulsory third party injury insurance was provided by a number of commercial companies in Victoria. All of the insurers were losing money, premiums were rising constantly, and no attention was being given to accident reduction and rehabilitation of victims.

In 1985 Government legislated to create Transport Accident Corporation (TAC). In 1987 the TAC came into being with broadly the following functions:

1) to take over all outstanding road accident personal injury claims;
2) to contain the spiralling costs;
3) to provide a "no fault" scheme;
4) to invest in road safety to reduce trauma; and
5) to actively rehabilitate the injured.

TAC is required by law to invest in accident reduction programs as well as injury rehabilitation programs. In 1992/93 it invested US$56.65 million into road safety programs, which was about 10 percent of premiums, and has stated, in its annual report for that year, that the investment made a significant contribution to its profitability by the accident reductions achieved, leading to reduced claims. The TAC management saw investment in road safety as a good business decision to reduce overheads and hence improve profits.

The TAC *1992/93 Annual Report* stated that since 1989, its savings in reduced accident claims amount to US$210 million, which is in excess of the amount it had invested in road accident programs over the same period. It is estimated that TAC's investment in road safety programs for those years was about US$10.7 million a year on television, radio, and newspaper promotions, and up to US$7.7 million a year on road accident medical emergency services.

In 1992/93 it invested in the following programs:

Program	***Amount*** *(US$ million)*
Media promotion and community awareness	*10.7*
Police breath test and speed camera	*5.6*
School traffic safety education	*5.8*
Research	*0.5*
Accident black spot programs (approx.)	*27.0*
Road trauma center	*7.0*
TOTAL	***56.6***

In 1992/93, TAC operations were reviewed by international management specialists, who reported that TAC compared favorably with private insurers in the major elements of busi-

ness[2]. The cost of insurance cover provided by TAC is US$200 a year for a passenger car, which compares favorably with costs in other states of Australia.

b) *Fiji*

In Fiji, motor insurance is provided by only five or six insurance companies. Amounts that can be charged for third party insurance are controlled and have to be approved by the Commissioner of Insurance. Companies engaging in motor insurance business have to present information annually to the Commissioner on premiums received, policies issued, and claims paid. Whenever any requests are made for third party insurance premiums to be increased, discussions are held between the insurance underwriters and the Commissioner to agree any changes. The Commissioner's role is to regulate the industry and to look after the public interest.

In 1992, as part of efforts to establish an NRSC, discussions were held with the insurance industry and Commissioner of Insurance. Agreement was reached that as part of the next review of premiums, a "voluntary" levy of about 10 percent of third party motor insurance premiums would be passed over to the proposed NRSC.

The Fiji NRSC, once established, therefore had a steady stream of income (paid quarterly into the NRSC account by each insurance company depending upon the number of third party motor insurance premiums received). The insurance companies have been permitted to have a representative on the NRSC and in this case, that person actually is chairman of the NRSC finance subcommittee.

The income from the insurance companies provides about 60 percent of NRSC annual income, with a further 10 percent being received from government (via services and facilities provided to NRSC headquarters). A further 30 percent is raised by the NRSC from commercial sponsorship (vehicle dealers, oil companies, and banks) and from fund raising.

This solution thus provides a guaranteed and growing (because funds increase in line with the increase in numbers of vehicles) source of funds for NRSC activity while still requiring the NRSC to actively seek further funding or sponsorship from the commercial sector. This reduces reliance on government grants or funding, which can, in some countries, be erratic and unreliable.

All parties involved benefit from the arrangement and it becomes in everyone's interest to ensure all motorists have at least third party insurance. The NRSC is able to carry out effective safety initiatives and interventions, which in association with other activities undertaken as part of the ADB/World Bank-funded Road Safety Action Plan, had by mid-April resulted in a reduction in road accidents deaths of more than 23 percent against deaths in 1991, the year immediately before the Road Safety Action Plan commenced.

c) *India*

While the insurance industry in India does not yet contribute funds to the national road safety program, the insurance companies have founded the Loss Prevention Association, a nonprofit organization dedicated to the promotion of road safety. In addition to publishing monthly and quarterly safety journals, it has organized training programs, workshops, and conferences, and is active in the education and engineering aspects of road safety.

d) *Kazakstan*

Motor vehicle insurance was introduced for private sector vehicles only in 1997. The legislation also provides for a percentage of premiums collected to be allocated to a road safety preventive measures fund. No decision has yet been made on what percentage of premiums will be donated, or on how or who will receive the contribution, as the priority so far has been on enforcing the motor vehicle insurance requirement.

The introduction of third party motor vehicle insurance also has other road safety impacts as drivers involved in road accidents are now required to bring a certificate from the hospital stating they were not under the influence of alcohol at the time of the accident. Without this certificate, no claims will be considered. Accident underreporting is also expected to be affected as claim compensation represents a new incentive to report accidents to the police.

e) *Republic of Korea*

In the Republic of Korea, the primary organization responsible for coordinating road safety activity is the RTSA, which has more than 200 staff in its headquarters in Seoul and

branch offices located in major cities and provinces.

RTSA funds are raised from a number of sources, including individual fees on persons holding driving licences or owning vehicles, corporation fees, a small levy (0.3 percent) on Automobile Insurance Company annual premiums received, Expressway Authority (0.05 percent of total income received), and tire manufacturers (0.1 percent of value added tax). Whereas these sources were bringing in about US$6 million a year in 1983, it is believed they now result in annual incomes of about US$100 million a year due to the increase in vehicle numbers since then.

The organization has wide-ranging authority to undertake (after approval of the Ministry of Home Affairs) virtually any activity it feels necessary to improve road safety. It now has its own road safety research institute where a number of safety research projects are underway. It has a highly experienced teams of accident black spot investigators located in its branch offices who provide technical assistance to develop black spot improvements for national, provincial, and municipal roads authorities. It also is active in road safety publicity and education.

f) *Viet Nam*

Before privatization in 1994, the national insurance company in Viet Nam, Baoviet, used to donate 5 percent of its premiums to road safety measures. On average, 2 percent would be allocated to the national level and 3 percent to the provincial level. At the national level, the donation was shared between the traffic police and the Ministry of Transport and Communication. At the provincial level, the donation went to specific road safety measures and Baoviet helped finance the construction of escape lanes on mountain passes.

6.3 Scope for Action in the Region

The above case studies from around the region indicate that it is both possible and highly desirable to harness the potential for funding from the insurance industry and other such sources. Whether third party motor insurance is provided via a state-owned monopoly as in Victoria, Australia, or whether it is provided via agreement with a number of commercial insurance firms as in Fiji need not matter. Efforts should be made to persuade the providers of motor insurance that it is in their financial interest as well as in the public interest for some of the premiums to be used for road safety.

If the insurance industry cannot be persuaded to participate voluntarily, then the necessary action should be taken to impose a levy of about 10 percent on at least third party motor insurance and, where possible, a smaller levy (perhaps 5 percent), on all other motor insurance policies. This provides a steady stream of funds for an NRSC for promoting road safety and initiatives.

Each of the countries discussed developed its own unique way of funding road safety activity but all recognized that the motor insurance industry has an important role to play in investing in safety. Each country in the region will need to develop appropriate funding mechanisms that are appropriate for its particular social, political, and economic circumstances. However, the above case studies demonstrate that it can be done successfully.

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Road Safety Guidelines

for the Asian and Pacific Region

4.4

SAFE PLANNING AND DESIGN OF ROADS

Asian Development Bank

4.4

SAFE PLANNING AND DESIGN OF ROADS

Road networks in most developing countries are still being expanded and/or rehabilitated, and opportunities therefore exist to incorporate safety practices (at marginal cost) during the planning and design stages.

Many components of the design process can influence the level of road safety and some of the more important of these are discussed in this section. Simply adopting international design standards from developed countries will not necessarily result in levels of safety that are achieved in such countries because these standards are generally accompanied by effective enforcement, driver training, and publicity. These may not be operating as efficiently in developing countries and, in any case, the traffic conditions and types of traffic using the roads will be different.

More emphasis, therefore, needs to be placed on examining how to make the road network operate safely in the particular operating environment and traffic conditions that exist in each country.

- In **rural road rehabilitation** schemes, opportunities should be taken to minimize direct major road access, keep traffic speed relatively low when such roads pass through small communities, and eliminate Y-junctions.
- **New roads** may require the inclusion of additional safety features such as cycle lanes.
- **Urban areas** may require design of road networks to establish a road hierarchy, and the reduction of through traffic and speeds where pedestrian and cyclist activity exists.
- **On all roads**, greater emphasis needs to be given to the safety of the large proportion of vulnerable road users that normally exist in developing countries.

The Asian Development Bank (ADB), World Bank, and other development aid agencies have found that many potential safety problems can be avoided by safety checking of schemes during the planning and design stage (the safety audit process).

PRIORITY ACTIONS NEEDED

1. Require all proposed new and rehabilitation road schemes to be checked from a safety perspective during the design stage.
2. Review existing design standards, access control, and development control to ensure safety is given high priority, particularly for vulnerable road users in urban and rural areas.
3. Check that towns and cities have localized zoning, and that the existing road network is classified into a road hierarchy.

Developing countries need to adopt more safety-conscious design procedures when planning land use or improving their road networks. Safety audit (or safety checking procedures) should also be adopted to ensure that road networks are designed to be safer, particularly for pedestrians, nonmotorized vehicles, and motorcyclists.

1 INTRODUCTION

These sector guidelines on the "Safe Planning and Design of Roads" are from a set of Road Safety Guidelines for the Asian and Pacific Region policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the ADB.

Road safety should be considered in a comprehensive way through all aspects of highway and traffic engineering works, including planning, design, construction, maintenance, and hazardous location treatments. Sector guidelines 4.4 and 4.5 concentrate on these important aspects. This section seeks to improve safety by preventing accidents through sound planning and good design, and 4.5 by accident reduction on the existing road network.

This section includes guidance on various elements of land use and highway network planning, the design of highways, and, in particular, the need for facilities for pedestrians, cyclists, and motorcyclists who often form a large proportion of the traffic in Asian and Pacific countries.

2 WHY IS SAFE PLANNING AND DESIGN NEEDED?

2.1 Planning

Planning is important because on all kinds of road, conflicts can arise between different types of road users and these may lead to accidents involving death or injury. These conflicts are typically most numerous in town centers, but can also occur on suburban or rural roads. Conflicts between the following types of road users are common in all countries:

Different modes

- motor vehicles versus pedestrians;
- motor vehicles versus nonmotorized vehicles, particularly cycles;
- heavy goods vehicles versus other road users;

Different movements

- high-speed traffic versus low-speed vehicles;
- all vehicle types at road junctions; and
- vehicles overtaking.

Roads in developing countries tend to be used by more nonmotorized vehicles and pedestrians than is the case in the more industrialized countries, where many design standards originated. There may thus be a need to amend standards or devise new ones that take into account the general usage of the national road network. Safety features (for example, pedestrian crossing facilities, motorcycle lanes, signs, and markings) should be considered at the earliest possible stage of road development. Financing for these safety features as well as for maintenance should also be planned at this early stage.

While many problems exist due to previous decisions and poor (or lack of) planning,

Plate 1:
Bicycle versus truck in Hanoi, Viet Nam.

it is never too late to rectify the situation or to plan for the future. This is particularly true for those developing countries where the infrastructure and traffic volumes are growing at a rapid rate (see Reference 1).

2.2 Safe Design

The second element being considered in this section is ***safe design***. This is relevant to all existing roads as well as all new projects. It tends to start with a country, recognizing the fact that it needs to have design standards for traffic signs and road markings, and also specifications for the geometric design of highways and intersections to accommodate the types of vehicles likely to be using the roads. A country should then develop specific safety design techniques and checking procedures such as a safety audit to ensure that standards are applied appropriately or departures from standards are carefully considered.

Plate 2:
Well-planned roads in Australia.

Accidents are caused or influenced by a number of factors and the one that is most prevalent is human behavior.

Engineering design is, however, also important as it should accommodate a wide range of human behavior and encourage safer use of the roads. Sadly, this is not always the case and inappropriate engineering can be a factor in a high percentage of accidents. Indeed, engineering features are often easier and cheaper to change than human behavior, and can have immediate effect.

Engineering design can influence how a road is used at a particular location or under a particular set of circumstances. Young pedestrians, for example, will often tend to behave in a relatively irresponsible and unsafe manner. In some cases, this is due to their general inability to judge speeds accurately. They can, however, be helped to survive in the urban traffic environment by minimizing their need to come into conflict with moving vehicles by the use of segregated pedestrian crossings; for example, underpasses or footbridges.

Good planning employing safe design principles can thus help prevent conflicts arising in the first place. Safe design means ensuring the safety of all road users. Nonmotorized vehicles such as bicycles and rickshaws together with motorcycles and "tuk tuks" are particularly vulnerable. These road users often constitute large proportions of the traffic in the Asian and Pacific region on many roads, and due consideration should be given to them in the planning, design, operation, and maintenance processes. They should have priority on local and residential roads.

3 KEY COMPONENTS

3.1 Safe Planning

The main components in the planning process that influence safety are listed below, together with the key principles associated with each. More detailed guidance is given in Reference 1.

Road hierarchy: The roads in a network should be clearly defined and classified into those that are primarily to be used by traffic forthrough-movement and those that are used primarily for access to housing or other buildings and amenities, and where low speeds are required.

There should be clear, unambiguous priority indicated at each intersection so that traffic on the more important road is always given precedence over that from the less important road. Any road should only intersect with roads in the same class or one immediately above or below it in the hierarchy.

Catering for different transport modes: The provision of facilities for all different types of road users, including pedestrians, cyclists, other nonmotorized vehicles, and different forms of public transport gives the best opportunity for providing a safe traffic environment with minimum pollution and congestion.

Land use: Land uses should be distributed so as to minimize road traffic and pedestrian conflicts. The need for travel by vehicle should, where possible, be minimized by locating shops, work places, and schools within walking distance of homes, including, where feasible, separate networks of footpaths and cycle paths. Traffic and safety implications of all development proposals should be thoroughly examined before approval for construction is given.

The provision of an efficient public transport system serving the various land uses can

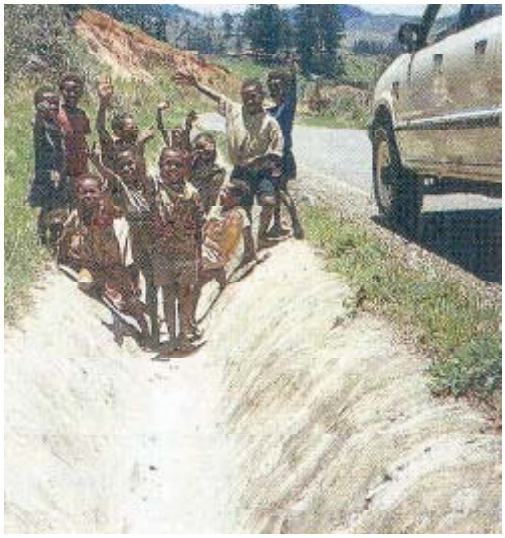


Plate 3: Potentially dangerous deep V-type ditches in Papua New Guinea.

greatly reduce conflicts in an urban area by reducing the overall numbers of vehicles on the road and, in particular, minimizing the problems of pedestrians. Careful planning of the road layout around bus or rail stations and bus stops is essential, and safe routes for pedestrians should be developed near these locations.

Access control: Direct frontage access onto major roads should be minimized. No access should be permitted at dangerous locations such as bends or hill crests. They should also be minimized at or near existing intersections. The construction of service roads for shops or industrial units should be encouraged.

3.2 Safe Design

In general terms, good safe design results in a driving task that is clear, simple, and consistent. Many countries in the region have developed their standards by adapting or modifying existing standards from developed countries such as the Association of American State Highway and Transportation Officials (AASHTO) [2], the National Association of Australian State Road Authorities (NAASRA)[3] or United Kingdom (UK) Departmental Standards[4]. Whatever national standards exist, the design of any location should always consider local traffic conditions and what is most appropriate for all road users at that location.

The road design should present necessary information in a systematic, sequential manner and should always minimize any elements of surprise. A full discussion on the merits of technical designs is beyond the scope of this document, but more guidance is given in Reference 1.

It is also important that care should be taken for the safe operation of roads under construction and maintenance, particularly in the developing world where construction tends to take longer and attention to the safety of workers, pedestrians and other road users is often inadequate.

Cross-section: The technical design of any road will depend upon its category within the road hierarchy (see above), and will comprise lane numbers and widths, shoulders, medians, and other features that are consistent with a set of national standards. It is particularly important, for example, that adequate width provision is made on road shoulders for pedestrians and animals.

Sight distances: A driver needs to see ahead in order to stop, overtake, cross, or merge with traffic in safety, and thus criteria are needed to ensure that the road design allows this to happen and that forward visibility is not obscured. At certain locations where forward visibility is a problem there may be a need to ban overtaking or to construct an overtaking lane. At road junctions, good visibility between major road traffic and vehicles emerging from the minor road is essential for safety. Visibility splays should be provided using the appropriate major road speed "stopping sight distance" as a basis for design.

Curves and superelevation: Horizontal and vertical curves should be designed so that they can be negotiated safely at speeds appropriate for the category of road. This is achieved by having criteria that match design elements, including radius of curvature, surface type, and superelevation with the speed of traffic. For example, radii should be similar for adjacent bends and large variations are to be avoided. Excessive vertical curvature at the top or bottom of hills can be dangerous and needs to be designed carefully in order to help motorists keep control and to ensure that they have adequate visibility. Sudden changes in alignment should be avoided; for example, when moving from flat to hilly terrain, the road should not change immediately from being straight to a series of sharp curves.

Speed limits : Speed limits should be clearly signposted and understood, and should always be appropriate to actual traffic conditions. Slower speeds mean fewer and less severe accidents, but they can rarely be achieved through the use of new signs. It may be necessary to use physical features such as road narrowing, road humps, and other methods to reduce speeds to the desired level, especially where such roads pass through small communities or villages, or where a lower speed is required (e.g., on approaches to single lane bridges). The use of road humps on principal roads needs to be carefully assessed because of noise and vi-

bration problems and the possibility of excessive traffic delays. Good advance warning should always be provided. Roads humps have been used successfully on principal roads in some countries where they pass through small communities or villages.

Road signs and markings: All countries should have standards for road signs and markings to inform and direct motorists, and especially to warn of hazards ahead. These standards should preferably conform to international conventions. Signs and markings should be applied consistently within a country and should be simple to understand with minimum wording. Signs should be carefully sited, well-maintained and should not be obscured by vegetation or other features. High-quality materials last longer, although the initial investment is high. Sign faces should be retro-reflective and road markings should be reflectorized thermoplastic where possible.

Drainage: Drainage ditches, channels, or culverts form an essential element of any road that is not on an embankment. They are needed not only for the short-term safety of road users during rain but also for the long-term structural integrity of the road. Poor drainage can lead to potholes and even the complete failure of the road. Deep drainage ditches too close to the side of the road can be a serious hazard to vehicles that run off the road. They need to be designed with care, particularly on bends. L-shaped ditches are preferred if they can be designed to cope with expected levels of water runoff.

In some rural areas the drainage channel is also the area used by pedestrians and thus needs to be designed with their safety in mind. Poorly maintained drainage, particularly missing or ill-fitting manhole covers, can be hazardous for pedestrians, cyclists, or motorcyclists.

Obstacles and safety fencing: The presence of roadside obstacles, street furniture, and trees have two implications: the first is the potential danger of collision; the second is the obstruction of visibility. Collisions can be prevented by installing safety fencing or high kerbs, or by removing or resiting the roadside feature. Visibility problems can be treated in a similar manner by removing or re-siting the object, or by ensuring adequate trimming of trees or vegetation.

Medians and barriers: Medians or central barriers can be used to segregate opposing streams of traffic thereby helping to prevent head-on collisions with their typically severe results. They can be used to restrict U-turns, to segregate different road users from each other (e.g., bicycle lanes), and to discourage pedestrians from crossing at unsafe locations.

Particular care is needed when designing medians and barriers to ensure that turning movements are catered for and emergency services are not unduly inconvenienced. Medians must be sufficiently wide to provide safe waiting areas where pedestrians are able to cross, and the ends of barriers should not themselves present a hazard (see Plate 5).

Lighting: The provision of adequate street lighting is a proven accident reduction measure in many countries. It is particularly helpful with regard to pedestrian safety or vulnerable vehicles operating without lights. Lighting is, however, expensive to install and maintain and poor maintenance can produce additional safety problems through uneven illumination. Lampposts should not be sited in positions where they will be a danger to a vehicle leaving the road. If this is not possible, then they should be designed to collapse on impact or be protected by safety fences. Where resources are limited,

Plate 4 (above): Movable concrete block and steel rail barrier in the People's Republic of China (PRC).

Plate 5: Vehicle impaled on incorrectly terminated barrier.

lighting should first be provided where the potential conflicts or danger are greatest, e.g., at intersections or at midblock locations of pedestrian crossings.

Bus stops and lay-bys: Bus stops and lay-bys allow vehicles to stop safely and with minimal adverse effects on other traffic. They should be positioned on straight, level sections of road and should be visible from a good distance in each direction. Bus stops should be located beyond pedestrian crossings and after intersections to avoid stopped vehicles from blocking other drivers' views of pedestrians crossing. Where goods are frequently sold at roadsides, the danger can be minimized by the provision of deep lay-bys to accommodate the stalls and parked vehicles.

Intersections: The basic principles of good intersection design are that they should allow transition from one route to another, or through movement on the main route, with minimum delay and maximum safety. The layout of an intersection should be simple and obvious to all road users and should cater for all types of traffic likely to use it. The type of intersection chosen will depend on traffic flows on the intersecting roads and what is appropriate, taking into consideration the standards of traffic control and management within the surrounding area. The advantages and disadvantages of different types of intersection are given in Table 1. Channelization and road markings should be used to position the driver at the correct and safest location for the driver to carry out the maneuver and to guide the driver through the intersection.

Pedestrian facilities: In urban areas in particular, walking is an important means of transport and arguably all road users are pedestrians at some stage of their journey. Pedestrian needs are, however, often neglected or given insufficient attention. Pedestrians are extremely vulnerable road users and tend to be involved in high numbers of accident deaths in many countries within the region. Young children form a large proportion of the pedestrian population, going to school or living near the road, and their road survival skills are often not as developed as those of adults. Pedestrian safety can be improved by a range of facilities, including the following:

1) speed reduction through traffic calming measures;
2) adequate footway areas kept clear of obstructions;
3) zebra or other types of crossings with or without pedestrian signals;
4) bridges or underpasses at busy locations;
5) barriers to prevent hazardous pedestrian movements;
6) pedestrianized streets;
7) central refuges to allow pedestrians to cross safely in two or more stages;
8) special crossing patrols for school pupils;
9) careful siting of bus stops to minimize

Table 1: Advantages and Disadvantages of Different Intersections

Intersection type	Advantages	Disadvantages
Grade separation - High flows	Minimal delays	Expensive
Traffic signals - Low to medium flows	Can accommodate heavy offside turns	Less space than roundabout High delays at off-peak times Electricity reliability needed Sophisticated maintenance needed
Roundabout - Low to medium flows	Good for turning and merging traffic Minimum delays at off-peak times	Poor safety record for cyclists Can become congested if traffic does not give way on entry to roundabout
Priority (give way or stop) - Low to medium flows	No delay to major road	Possible delays to minor road Adequate visibility needed

Plate 6: Pedestrianized street in the PRC.

Plate 7
Cyclists in the PRC.

Plate 8:
Little provision for pedestrians in India.

conflicts between moving vehicles and passengers embarking or disembarking; and

10) special care in the design of all roads where there are large numbers of pedestrians, particularly the young or elderly.

Bicycles and other nonmotorized vehicles: Bicycles and other nonmotorized vehicles are an important part of the traffic in most developing countries in the Asian and Pacific region, comprising more than 50 percent of the traffic on many city streets. They need separate consideration in a road system due to their slow speeds and vulnerability to injury when collisions occur. Problems related to safety and congestion typically occur at major intersections and they are best solved by providing grade-separated, segregated lanes for the bicycles and perhaps other slow-moving vehicles. A less expensive solution might be provided at-grade by bringing the segregated lane crossing points ahead of the main vehicle junction. Facilities for bicycles need to be attractive and well-maintained in order for them to be used. Facilities that are in use to a limited extent in some Asian and Pacific countries include:

1) slow lanes approximately 2 meters wide;
2) separate lanes segregated by a variety of barriers or fencing, ranging from a small narrow mound through various types of temporary fencing to a planted median or a concrete barrier;
3) separate phases at traffic signals;
4) bicycle only streets;
5) one-way streets for motor vehicles that permit two-way bicycle traffic;
6) streets that combine one-way motor vehicles in one direction with one-way bicycles in the other;
7) bridges or underpasses for joint use of pedestrians and bicycles with special ramps for cycle wheels;
8) shared use footways with pedestrians (preferably with marked lanes), often combined with a ban on bicyclists using the main road;
9) pedestrianized areas for bicycle access; and
10) parking bans for motor vehicles to ease the flow of the slow vehicles.

Providing facilities for bicycles and other nonmotorized vehicles not only improves safety but also reduces problems related to congestion and air pollution. Many of the worst cities in the world for congestion and pollution have failed to make adequate provision for nonmotorized traffic. More detailed guidance on facilities for vulnerable road users is provided in two other documents[5,6].

Traffic management*:* Safety and congestion within any city depend upon how well the traffic is managed. A comprehensive plan can produce many benefits using some or all of the following techniques:

1) parking restrictions and facilities;
2) control of minor intersections through signs and road markings;
3) the use of channelization at more important intersections;
4) one-way streets;
5) turning bays for traffic often combined with refuges for pedestrians;
6) central medians to restrict turning traffic;
7) pedestrian crossings, bridges, and subways;
8) segregated lanes for buses, bicycles, or other slow vehicles;
9) bus stops and other lay-bys;

10) traffic signals that respond to traffic demand;
11) linked traffic signals possibly using computer control; and
12) monitoring of traffic conditions through the use of local traffic police or possibly television cameras.

Safety audit: Many developed countries have discovered that even when highway and traffic schemes were professionally designed to the latest standards they could still lead to unnecessary accidents. A common finding was that accidents tended to occur at the ends of schemes where there was a transition to a road of a different standard, or related to pedestrians or other vulnerable road users whose particular needs had not been given sufficient attention. These design deficiencies can best be reduced or eliminated by an independent road safety specialist reviewing the designs at various stages in the design process. The specialist identifies any potential problems and makes recommendations for improvements. There then needs to be a system that rigidly reviews the recommendations and follows up with the required design changes.

This design checking system is called safety audit[7,8] and is mandatory for various types of schemes in Australia, New Zealand, and UK. It is also being used increasingly in the developing world, for example, in People's Republic of China (PRC), Fiji, Malaysia, and Nepal, and is commonly a requirement for aid-funded road projects.

Safety audit was initially developed for new roads but is increasingly being used to check and improve safety on existing roads. Safety audit reports are prepared at different stages of the design process, such as:

1) feasibility stage;
2) preliminary design;
3) final design;
4) before opening; and
5) after opening.

The latter stage may be considered to be part of an evaluation and monitoring process or, as mentioned above, can be carried out on an existing road. For the process to be successful there needs to be a firm policy commitment from the highway authority responsible for the road design and, in due course, this should be supported by legislation.

Following the establishment of safety audit policy, the difficulty encountered in most countries is the lack of skilled auditors with the relevant experience. Ideally these should be highway or traffic engineers with several years' experience in the analysis of accidents and the design of remedial measures. Only a few developing countries have sufficient numbers of these people and thus safety audit training will be an essential component for establishing the procedures within any country.

Foreign experts can be and are being used increasingly by the World Bank and other funding agencies for safety auditing major road projects around the world, but consideration should be given to developing local expertise. For example, the successful establishment of road safety audit nationally could include the following components:

1) designation of a road safety audit manager;
2) overseas visits to learn about procedures;
3) visiting experts to carry out pilot audits and training sessions;
4) development of national road safety audit guidelines and procedures;
5) development of policies and legislation related to national roads; and
6) continuing training of local engineers.

The lack of safety checking or auditing is of particular relevance in the developing world because such countries are still developing their basic road networks. Safety audit quickly improves the safety awareness of all design engineers and could have beneficial effects by eliminating potential future accident sites before they are built into the network where they are likely to remain unsafe for many years into the future. Opportunities exist during road rehabilitation projects, for example, to eliminate Y-junctions, to reduce accesses, and to reduce speeds as roads pass through communities. Failure to take such opportunities during the design stage will result in a less safe road than existed before the rehabilitation.

There are large differences between countries in the road environment and the road user mix on the roads. Use of international design standards does not necessarily mean the road will operate safely, as a developing country may have a completely different mix of nonmotorized vehicles, agricultural traffic, and pedes-

trians. In addition, there may be many problems associated with street vendors and encroachment. These differences can be foreseen via safety audits and appropriate changes recommended in order to ensure that the road will operate safely in the particular conditions that apply in that country.

It is difficult to predict the actual costs and benefits of safety audit, but in the developed countries the cost is typically equivalent to the cost assigned to one injury accident, and it is argued that this can easily be saved within the first year. In developing countries the benefits are potentially even greater.

3.3 Safe Operation

Maintenance needs: All the safety measures described in the preceding pages can fail if they are not properly maintained. This is particularly true of sophisticated equipment such as traffic signals using electronic controllers or computers. But it can also apply to more basic engineering techniques, such as drainage channels that can block up and become completely ineffective if ignored. Provision must be made for regular maintenance before any particular measure is adopted. Maintenance is particularly important for road markings (which can wear out in a matter of a few months) and for signs (that can be vandalized or obscured by vegetation growth).

Enforcement needs*:* Traffic police are readily visible in most developing countries, particularly at urban intersections. They can help improve the effectiveness of any safety measure by ensuring that the facilities are used correctly. It is important that the police understand any new facilities that are constructed and that their efforts to enforce regulations and penalize irresponsible road users are focused in a way that is most effective in reducing safety and capacity problems. This requires a close liaison between the engineers and police. Traffic police need to be trained to ensure they see their role as increasing safety rather than just maintaining the traffic flow. It is particularly important to have trained police carrying out enforcement activity when a new scheme or intersection is opened in order to guide and direct road users during the initial period. That is, until the public becomes familiar with the facility and how to use it.

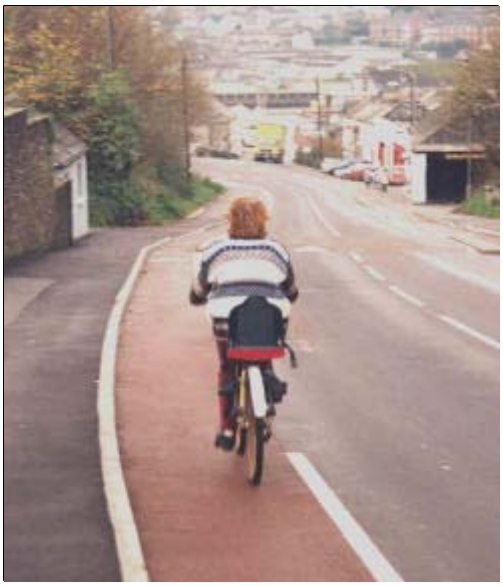
Road user education: This should be a major consideration in planning and design because traffic can be expected to flow safely and smoothly only when all the road users understand clearly both the layout of the road and how they are supposed to behave. This is best achieved by simple design and good clear road marking, but a precise set of rules that sets out correct behavior in all common situations, and that is well-enforced, is essential. However, at times the rules need to be reinforced by publicity and education. This is particularly true when new regulations or measures, such as segregated facilities, one-way movements, or new types of intersection, are introduced. Many developing countries use the media to publicize important messages related to traffic. Targeting of young people through their schools is increasingly being used to spread important road safety messages, particularly related to pedestrian behavior. Indeed, road safety should be a part of the national primary school curriculum (see Sector Guidelines 4.6).

4 STAGES OF DEVELOPMENT

The key stages in developing a safer planning and design process normally include:

1) regulations in place covering land use, development, vehicles and road users, road signs and markings, highway design standards, and safety audit;
2) a traffic act requirement introduced stating that the road authority must make efforts to improve safety on its networks and to report annually on the action taken (and subsequently its effectiveness);
3) road authorities set up a small safety team to monitor the network and identify problems;.
4) staff and financial sources found to implement a traffic act;
5) regulations applied and procedures developed covering development control, access control, uniform design standards, and safety audit;
6) training requirements are met to increase skill levels of local engineers;
7) monitoring and improvement of safety problems on existing road network;
8) systematic safety audits of all proposed schemes are carried out; and
9) as experience is gained, new advice

Plate 9:
Cycle lane in the United Kingdom (UK).



notes and guidance manuals by safety specialists are issued to road authority engineers with particular emphasis on improving safety for vulnerable road users such as pedestrians, cyclists, and nonmotorized vehicles.

Technical assistance in all these stages can be provided by development banks and funding agencies.

5 BENEFITS AND EFFECTS

The application of the techniques listed above should lead to an environment that is safer for all road users. A good planning and design process will help minimize conflicts by:

1) reducing the number of local trips and trip lengths by better land use and public transport;
2) helping to ensure local trips are separated from the higher speed through-traffic;
3) optimizing modal separation and local needs; e.g., pedestrian requirements are served by providing better facilities than those found in the industrialized countries;
4) providing guidance and warnings to road users of changes in the road environment; and
5) ensuring safety hazards are not included unintentionally in new schemes, for example, deep V-ditches on rural roads, dualling, keeping existing uncontrolled access, and visual traps such as troughs or unbroken sightlines across junctions with major roads.

While many of the techniques require funding, they can all be considered to be an investment. To ignore the techniques can lead only to unacceptable conditions that will have damaging financial implications for the cities and countries.

Plate 10:
Lane for bicycles in Hanoi, Viet Nam.

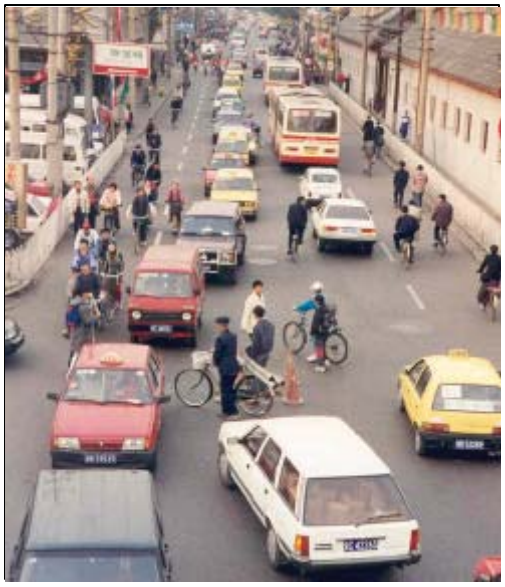
6 EXAMPLES OF GOOD PRACTICE

Japan, UK, United States (US), and countries in Australasia and Europe have arguably the most advanced and sophisticated road planning and design techniques. They are also in many cases rediscovering the bicycle and designing special facilities aimed at reducing problems of safety, congestion, and air pollution. Some countries such as the Netherlands have designed their cities around the needs of cyclists and pedestrians (up to 70 percent of commuters are cyclists).

Ideas from the above-mentioned countries may well be relevant to developing countries, but it is likely that even more can be learned from good practice adopted by their Asian neighbors where perhaps more similar road and traffic conditions prevail. Some examples of such good practice, which may also be relevant to many other countries of the developing world, are mentioned below.

1) Several major cities have produced comprehensive studies covering their planning and transport needs. These include Guangzhou in the **PRC**, Yogyakarta in **Indonesia**, Rawalpindi in **Pakistan**, and Hanoi and Ho Chi Minh City in **Viet Nam**. All these studies included planning and traffic proposals to improve safety and, in particular, provide facilities for pedestrians, cyclists, other slow vehicles, and for public transport. These studies were financed by development banks and were produced with the help of local institutes and/or international consultants.
2) **Malaysia** has had some success in reducing motorcycle accidents by designing segregated motorcycle lanes alongside a freeway. This example, although of relatively high cost, may well have a lot to teach other countries in the region where the traffic and accident compositions are similar. In particular, a study has demonstrated that high standards of design must also be applied to motorcycle lanes to prevent collisions between motorcycles.
3) Road safety audits have recently been introduced in **Nepal** under a Road Maintenance Project funded by the Overseas Development Administration (ODA) of the UK. Audits have already been conducted on several aid-funded road improvement projects and a local safety audit manual has been produced. The Traffic and Engineering Safety Unit in the Department of Roads of Nepal has been given the responsibility for conducting safety audits on all major new road projects. The World Bank has recently financed a safety audit of a major highway in the **PRC** and is also introducing safety audits into its road rehabilitation program in **Bangladesh**. The ADB and World Bank have provided assistance in **Fiji**, **Papua New Guinea**, and **Philippines** to develop local procedures for safety audit.
4) Many countries have newly produced national standards for highway design, road markings, and signs. Many of these were similar to, and based on, American, Australian, or European standards, but with minor local variations. Some of these standards are, however, still in draft form and have been for a considerable period. Suitable standards are relatively easy to develop for any country but there is then the need to ensure they are adopted formally.
5) Many countries in the region have at least a few examples of facilities for bicycles and other nonmotorized vehicles. These are separate lanes either physically segregated or delineated by road markings. Where encroachment has been resisted, they are usually well-used and beneficial from the capacity and safety points of view. The **PRC** has perhaps more examples of this facility than other countries, but many other examples of good practice were observed in, for example, **Indonesia** and **Viet Nam** (see Plates 8, 9, and 10). References 5 and 6 provide more information on facilities available for nonmotorized and vulnerable road users.

Plate 11:
Cycle lane on minor road, PRC.



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Road Safety Guidelines

for the Asian and Pacific Region

4.5

IMPROVEMENT OF HAZARDOUS LOCATIONS

Asian Development Bank

EXECUTIVE SUMMARY

4.5

IMPROVEMENT OF HAZARDOUS LOCATIONS

The safety benefits that can be derived from identifying hazardous locations through the careful analysis of accident data, studying sites, and then designing appropriate remedial measures have proven to be particularly high. The benefits achieved by low-cost remedial measures can be many times the cost of their implementation.

The effectiveness of this approach can be maximized by a planned program of remedial measures based on accident reduction targets for highway authorities. The authorities will, of course, need to allocate a specific annual safety budget for their plans, or at least ensure adequate funding is set aside within the maintenance budget.

The four main strategies are: single site or black spot programs, mass action plans, route action plans, and area-wide schemes.

The stages of the hazardous location improvement process are as follows:

- a good accident database;
- agreeing a local hazardous location improvement program;
- accident analysis to identify accident black spots;
- design of remedial measures;
- implementing the measures; and
- monitoring the effectiveness of remedial measures.

Remedial measures can include better signs, road markings, pedestrian facilities, fencing, guardrails, junction modifications, and improvements to visibility. Traffic calming through various speed reduction measures has proven particularly effective where vulnerable road users are at risk.

PRIORITY ACTIONS NEEDED

1. All road authorities must establish and train a small team to monitor the operational safety and efficiency of their road network.

2. Identify and improve the most hazardous locations on the major inter-urban road networks according to annual targets.

3. Identify and improve the most hazardous locations on the road networks of each of the major cities and towns according to relevant annual targets, focusing on speed reduction near schools, and in residential and other areas where there are high numbers of pedestrians and cyclists.

Improvement of known hazardous locations is one of the most cost-effective investments that can be made in the transport sector and should be a high priority for every government.

1 INTRODUCTION

These sector guidelines on "Improvement of Hazardous Locations" are from a set of *Guidelines on Road Safety for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

One of the main responsibilities of all governments is to ensure as safe a living environment for the country's inhabitants as is realistically possible. There are strong moral and political arguments for this, but of equal concern is the economic importance. Road accident costs can strain the resources of any country, whether developed or developing, and experience shows that one of the most cost-effective ways of using funding in the roads or transport sector is to apply it to the identification of hazardous locations and the design of appropriate remedial measures.

This document contains guidance on accident data analysis, the identification of hazardous locations, determining priorities for action, remedial measures, and the evaluation of results. Examples of countries using simple but effective systems are included.

2 WHY IDENTIFY HAZARDOUS LOCATIONS?

As the number of vehicles increases in a country so does the number of road traffic accidents. In the early stages of motorization, the impact of these accidents in financial terms is small. However, as the number of vehicles reaches a high rate of growth, the cumulative financial impact of accidents becomes much greater, impinging noticeably on the country's economy. Accidents typically can cost a country up to 2 percent of its gross domestic product. It is possible to alleviate this situation before it becomes too great by establishing a system of accident reduction. This is best achieved by setting a researched, realistic, long-term accident or casualty reduction target for highway authorities, and also by ensuring that appropriate institutional arrangements are in place as well as annual budgets for safety improvements.

Highway authorities should ideally be constantly working towards achieving their own annual accident or casualty reduction target on their network and, with budgets that are inevitably limited, they need to be sure that they are getting maximum value (in terms of accidents saved) for money spent on safety improvements.

On any road network, accidents have been shown not to be completely randomly distributed but to be clustered at certain locations; i.e., hazardous locations or black spots. If the accidents occurring at these locations are studied, it is often found that there are common patterns of, say, driver error to which a particular engineering feature may have contributed. An appropriate road improvement could prevent or ameliorate similar occurrences in the future. By definition, black spots are locations in which many accidents occur and thus, logically, treatment of these sites first should provide the best return in terms of accidents saved.

The application of low-cost engineering at hazardous sites has generally been proven to produce high returns over many years. Simple measures can significantly reduce problems at such sites and can often be shown to pay for themselves in a few months in terms of the monetary value of accidents prevented. For example, the use of road signs and markings

to channel traffic through complex intersections, or to provide safe waiting areas for turning vehicles, can often result in a substantial reduction in accidents.

These techniques are always most cost-effective if they are based upon good accident data systems that allow hazardous sites to be located accurately, causal factors to be identified, and appropriate remedial measures designed to address the problems. It is important that governments realize that the most effective use of often scarce transport resources is by applying them to low-cost remedial work at accident black spots.

The techniques described in this *Guidelines* have been used successfully for several decades in the United Kingdom (UK) and other countries, particularly Australia and New Zealand. More recent experience shows that this process is also effective when applied in developing countries, as the accident problems are usually of greater magnitude and the simple low-cost remedial measures have an immediate and fairly easily identified effect.

3 KEY COMPONENTS

3.1 Target Setting

Experience in several developed countries has demonstrated that good progress can be made towards reducing a nation's accident numbers significantly if all highway or roads authorities adopt realistic accident or casualty reduction targets.

These targets, if achievable and treated seriously, tend to focus the minds of engineers in finding appropriate cost-effective solutions regularly and on a wide scale. This does, of course, assume that a reliable road accident database is in place for the highway authority's network (see Sector Guidelines 4.2, "Road Accident Data Systems" for information on setting up a suitable data system).

3.2 Identification

A good accident data system will allow the easy determination of where accidents cluster and will thus allow the preparation of priority lists of hazardous sites needing attention. This is carried out in various ways around the world, typically by ranking sites by actual accident numbers, injury accident numbers or a weighting system to take account of the severity (e.g., a points scale with more points given to higher severity accidents), and perhaps the cost of the accidents. There will, of course, need to be further analysis to determine those accident types that would respond to remedial measures, as not all locations will have easily identifiable patterns that can be improved.

The actual definition of a black spot will depend upon local conditions and should be determined after a preliminary summary of all the worst sites has been carried out. Then a cutoff can be made at the level of perhaps the 50 worst sites.

Thus a black spot in a county in the UK may well have only five injury accidents in three years, while a city in Bangladesh may have black spot defined as having more than 10 injury accidents in a year.

In the definition of "black spot" it is important to use the same time period (usually accidents are expressed per year) and also to be consistent about type of highway unit compared or have a number of different black spot groups (e.g., 200 meter [m] or 1 kilometer length of highway, within 50 m of a junction) such that the highway authority is really identifying the worst accident clustering within road group type.

3.3 Analysis at Hazardous Locations

Many accident databases in the developing world do not record all the information desirable for identifying the real cause of an accident, often because the police collecting the data focus on blame in order to enable prosecution and compensation issues to be resolved. In developing countries, accident data systems will often need to be expanded and modified to include appropriate information necessary for the accident investigating engineer.

There are four basic strategies for accident reduction at hazardous locations. These are, as follows:

1) **single sites or black spot programs:** the treatment of specific types of accidents at a single location, where large numbers of accidents occur;
2) **mass action plans**: the application of a known remedy to locations with a common accident problem;

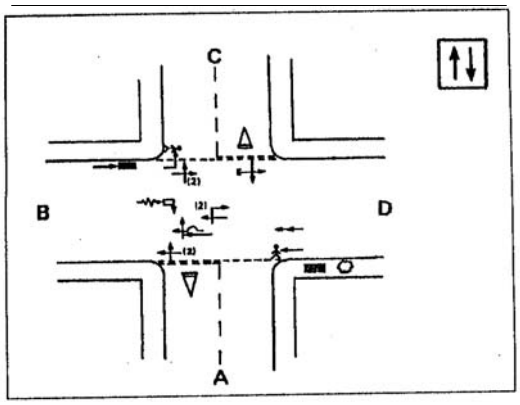

Figure 1:
Collision diagram.

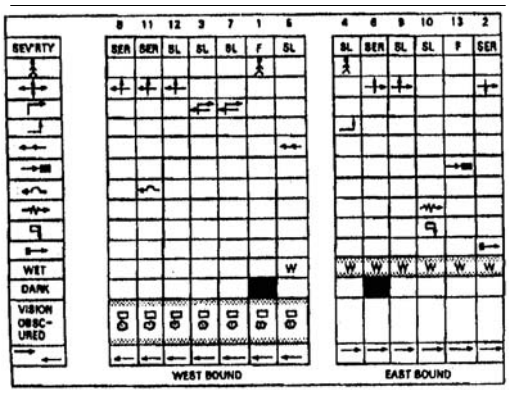

Figure 2 (far right):
Accident factor grid.

3) **route action plans**: the application of known remedies along a route with a high accident rate; and
4) **area-wide schemes** the application of various treatments over an area of usually a town or city.

Most countries, at the earlier stages, commence with single site or black spot programs and then later move onto mass action plans, area-wide schemes and route action plans. Other documents[1,2,3,4] give guidance on the sorts of activity needed or each strategy, so the following section simply outlines the process involved in developing single site improvement programs to illustrate the general approach. Once the accident sites for investigation have been determined, there usually follows a three- stage investigation process, as follows:

1) a preliminary analysis is carried out on the accident data to understand the accident types and conditions. Collision diagrams and accident factor grids (or stick diagrams) are useful tools here (see Figures 1 and 2 for examples);
2) a site investigation is carried out by specialist accident investigators to determine the exact conditions at the location. The investigation will observe traffic flows and road user behavior at the times accidents most frequently occur, determine what other information may be required (such as speed measurements and skid resistance), and start to define the problems associated with the location. Where data are limited, observation of conflicts (either simply by watching traffic informally to see typical maneuvers and conflicts or via formal conflict studies) can provide insights into the problems to be addressed; and
3) a detailed analysis of the accidents occurring at that location is then carried out. This should include simple statistical tests to determine whether the accidents have resulted from a real increase in risk or are a result of random fluctuation.

The information should be presented in a report, which will typically include a collision diagram and an accident factor grid, the accidents having been classified into types and the

Plate 1:
Traffic calming in Tokyo, Japan.

Plate 2:
Town center traffic calming, UK.

dominant causal factors determined. Perhaps the most important part is to recommend remedial measures for the location and justify them on a cost benefit basis. This is done by estimating the cost of the improvements and predicting the accidents that will be prevented to ensure "value for money".

Once all black spot sites have been investigated, a prioritized list for action over the road network can be established and the implementation process set in motion.

3.4 Design and Implementation of Remedial Measures

The main objective in deciding on remedial measures is to consider solutions that ideally will remove the main accident patterns identified. This can involve one or more of the following:

1) removing the conflict causing the problem;
2) improving the situation (e.g., give earlierwarning) so that road users can cope better; or
3) reducing speeds, thus reducing the chance of the accident happening or its severity.

Table 1 lists typical accident situations along with the proven remedial measures known to have been effective in both developing and industrialized countries.

Table 1: Accident Situations and Remedies

General Accident Situation	Remedial Measures
Skidding	Restoring surface texture Resurfacing Improve drainage
Collisions with roadside objects	Better delineation Guardrails or fencing Frangible posts Remove objects
Pedestrian/vehicle conflicts	Pedestrian/vehicle segregation Pedestrian crossing facilities Pedestrian fences or other protection
Loss of control	Bigger or better road signs Road markings Speed controls Safety fencing Superelevation
Nighttime accidents	Reflective signs Delineation Road markings Street lighting
Poor visibility	Trim or remove vegetation Improved sightlines Realignment
Poor driving behavior or lane discipline	Road markings Enforcement Median barriers Overtaking lanes

Often the remedial measures relate in detail to the type and positioning of all the road furniture. This is particularly true in urban areas and at intersections. Further measures that are relevant in city centers include:

1) turn prohibition, channelization, or protected turns;
2) traffic signals, roundabouts, or revised intersection designs;
3) refuges, pedestrian crossings, bridges, or underpasses;
4) segregated bicycle tracks or defined bicycle lanes;
5) parking restrictions or controls;
6) speed limits or enforcement; and
7) traffic calming

The most important part of this whole process is a mechanism that ensures the following:

1) up-to-date data are available to the engineers investigating hazardous locations; and
2) their recommendations are implemented either by a specific budget being set aside or by ensuring that the remedial measures are implemented within existing maintenance or other budgets.

3.5 Traffic Calming

In recent years, speed reduction or traffic calming has developed as almost a separate science to accident remedial work, as it can produce significant environmental improvements as well as accident reduction. Because of this, it has proved to be popular with engineers and residents.

Traffic calming can be defined as the improvement of the traffic situation by reducing traffic speeds and perhaps numbers of vehicles, particularly in residential areas, with

emphasis on the safety of pedestrians, cyclists, and vulnerable road users, such as children or the elderly. It has been shown that when pedestrians are hit by vehicles traveling at a given speed:

95 percent survive at speeds up to 32 kilometers per hour (km/h);
55 percent survive at speeds up to 48 km/h;
15 percent survive at speeds up to 65 km/h;

and so the use of traffic calming to ensure low speeds can have a pronounced effect on reducing the severity of injury in accidents.

Traffic calming commonly includes:

1) speed humps;
2) road narrowing;
3) gateway features;
4) footway widening;
5) pedestrian crossing areas;
6) landscaping and environmental features;
7) special warning signs;
8) possible reduced speed limits;
9) miniroundabouts;
10) horizontal carriageway deflection; and
11) priority systems.

Examples of traffic calming schemes are shown in Plates 1, 2, and 3 and much more information on such measures is included in References 2 and 5.

Traffic calming is particularly useful for area-wide schemes and particularly so in residential areas, as illustrated above.

It is also, however, increasingly being used to slow traffic on rural routes in many countries, particularly on the approaches to villages, see Plate 4.

Traffic calming is one way of avoiding the increased road safety problems that can occur when major roads are rehabilitated, often via aid-funded projects. Speed though settlements and villages along the route often increase dramatically and result in increased deaths and injuries. Such gateways on entry to traffic calmed sections of route have been implemented in Fiji (see Plate 3) and are being used in Samoa (see Figure 3).

Plate 3: Rural gateway, UK.

Not all the traffic calming techniques listed above will be relevant to all countries within the region. What is important, however, is that speed reduction reduces accident occurrence, and countries need to discover what traffic calming methods work best for their particular road users and traffic mix.

3.6 Monitoring and Evaluation

While many of the countermeasures listed above are well-tried remedies that have been used for many years all around the world, it is still important that all treated accident sites are monitored for actual accident reduction and then the true cost and benefit evaluated. It is important to use equivalent before and after periods (ideally two to three years) when making comparisons or evaluations and the construction period should be treated separately. This has at least two beneficial effects: first, it helps determine what remedial measures are most effective and appropriate for local conditions; and second, it is an excellent way of illustrating the benefits to be obtained in a manner that can readily be understood by the policy-makers responsible for allocation of workforce and financial resources.

4 STAGES OF DEVELOPMENT

The first stage is to establish an effective accident data system. As mentioned above, all these techniques rely on an accurate accident data and the development of such systems is described in the accompanying Sector Guidelines 4.2 “Road Accident Data Systems.” The importance of appropriate and accurate accident data cannot be overemphasized; they are the base measure of safety and are indicators of how and where improvements can be made.

The second stage is defining the staffing and financial resources needed to carry out the investigation and remedial work. It has been stressed how cost-effective these techniques are and thus all countries would be wise to set aside sufficient resources for the task. It does, however, assume that the costs of road accidents to the community have been

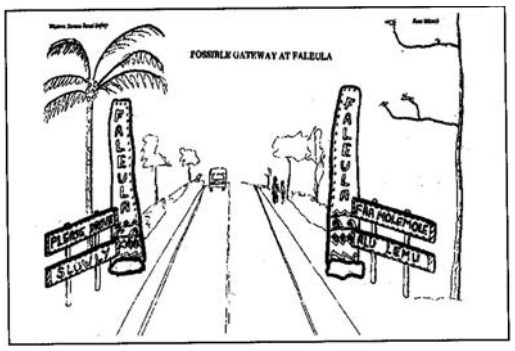

Figure 3: Gateway feature, Samoa.

established and accepted within the country. These costs are firmly established in most developed and some developing countries, but in others the concept of putting a realistic price on death and injury has not yet been fully adopted. It is important that this is accomplished (see Sector Guidelines 4.14) in order to evaluate correctly the benefits of highway and traffic schemes, and thus establish priorities for infrastructure development between different options. For example, will the inclusion of additional safety features, such as guardrails, be worth including in the scheme? If the accident "savings" are greater than the cost of such guardrails, they may be worth including.

The most common problem facing developing countries is finding experienced accident investigation engineers. The techniques originated in the UK more than 30 years ago and are still strong throughout road authorities there. There are now many skilled teams operating around the world, particularly in Australia, New Zealand, UK, and a number of countries in the Asian and Pacific region; e.g., Fiji, Republic of Korea, and Papua New Guinea.

One way of developing a local team of experts is by forming a link with an experienced country and then tailoring training schemes to suit local conditions and/or setting up exchanges of staff or arranging for specialists to assist (often via aid funding, as in Fiji and Papua New Guinea) in establishing a road safety unit within the public works department.

The finances needed for the remedial measures are always relatively low as almost all the remedies mentioned above are low cost. For instance, they are low when compared with highway construction costs or maintenance budgets and thus one way of earmarking sufficient resources for hazardous locations may be to reassign small percentages of the funds from the highways or maintenance budgets (say 5 percent) to specific road safety improvement work.

When an accident investigation team has been established, it is often useful for it to publicize its work to the traffic police, and the design and maintenance engineers. Many workers in these roles are surprisingly unaware of what can and is being achieved and as a result of the liaison between the disciplines there are often several benefits. First, accident data from the police can improve in accuracy if they understand how it is being used; and second, the police and the engineers improve their understanding of the causes of accidents and can start improving their own effectiveness in accident reduction in their own fields of enforcement, design, or maintenance.

In addition, following the accident analysis at a problem site, there is often a need to reinforce the recommended engineering measures with enforcement or publicity. The closer the disciplines work together, the more effective the accident reduction becomes.

5 BENEFITS AND EFFECTS

Assuming that realistic costings for particular accident types have been established, many accident remedial schemes can be shown to pay for themselves in a matter of months. For any new country adopting these techniques, it is unlikely that their priority lists for action would include any schemes that would take more than one year to return the investment and many (via savings in accidents) will pay for themselves within a matter of a few months.

Figures vary from scheme to scheme, but where there is a well-defined accident problem with many accidents of a similar type, the accident reductions that can be achieved are likely to be between 30 percent and 50 percent. If, however, there is a specific problem, such as run-off-the-road accidents on a severe bend, then in many cases low-cost signs, road marking, and perhaps delineation may remove the problem altogether, giving an 80-100 percent reduction.

6 EXAMPLES OF GOOD PRACTICE

As described above, the accident black spot investigation techniques described in these guidelines originated in the UK during the 1960s. In recent years, several developing countries, including Fiji, have set up accident data systems and have established accident investigation teams.

Plate 4:
Rumble bars, Fiji.

Plate 5 (far right):
Road humps, Fiji.

Plate 6:
Gateway, Fiji.

Examples of their remedial schemes are shown in Plates 4 and 5. Figure 3 shows a gateway feature planned for villages in Samoa following an accident analysis project funded by the World Bank and based upon the success of similar features in Fiji (see Plate 6).

Reference 2 was developed specifically for developing countries and provides step by step guidance on how to improve road safety through engineering measures. Reference 6 is an example from India of analyses of various black spot sites, including remedial action recommendations, and Reference 7 includes an evaluation of some treated black spot sites in Malaysia.

7 REFERENCES AND KEY DOCUMENTS

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Road Safety Guidelines

for the Asian and Pacific Region

4.6

ROAD SAFETY EDUCATION OF CHILDREN

Asian Development Bank

ROAD SAFETY EDUCATION OF CHILDREN

On average, 20 percent of all people killed in traffic accidents in developing countries are aged under 15. This is twice as high as in the developed world.

- Human error plays a large part in road accidents, being a contributory factor in about 95 percent of accidents.
- Teaching safety skills to children can provide lifelong benefits to society.

Roads in developing countries are often more unsafe than roads in industrial countries and the traffic safety problems faced by children will often be greater in the developing world. Absence of traffic education can leave children exposed to unnecessary risk. Since the traffic circumstances and problems faced by such children are very different, it is inappropriate to simply use teaching materials from developed countries. Local materials need to be developed. Although these may be based on principles and materials from developed countries, they will need to be adapted to reflect the needs, problems, and circumstances of relevance to local children.

In addition, an incremental approach is needed to improve road safety education. Road safety provision should not rely on only occasional, isolated talks by visiting speakers but should include regular practical training. Essential components in developing and improving this sector are as follows:

- inclusion of road safety in the school curriculum appropriate to each age group;
- development and production of classroom materials;
- production of a teachers' guide and dissemination to all teachers;
- inclusion of road safety in teacher training courses; and
- coordination of activity and clearly defined responsibilities.

PRIORITY ACTIONS NEEDED

1. Review current extent of road safety education in school curriculum and assess adequacy and practicality of lessons and materials.

2. Develop road safety education pilot projects in high-risk areas, especially around roads being rehabilitated where the road accidents are likely to increase.

3. Strengthen road safety education in national curriculum with on-road practical lessons.

Children need to be made more aware of road safety and should be taught survival skills appropriate to their age and needs. Teaching of road safety in schools is best done by teachers who have themselves been trained on road safety issues and who can provide such instruction on a regular basis to their students.

1 INTRODUCTION

These sector guidelines on "Road Safety Education for Children" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

This section deals with children's traffic education through formal education (schools) and nonformal education (community programs). Road safety publicity and education for the general public is dealt with in Sector Guidelines 4.8, "Road Safety Publicity."

2 WHY IS ROAD SAFETY EDUCATION (RSE) NEEDED?

Children in many motorized countries are more likely to die or be injured as a result of a road accident, than through any other cause. In developing countries, 20 percent of traffic deaths are people under the age of 15 and the threat of road accidents will increase with motorization. Several factors contribute to this risk to children in developing countries:

1) both the speed and volume of motor vehicle traffic will increase, especially on rehabilitated roads;
2) roadside friction will continue as poor land use planning, operational control, and limited road space lead to conflicting uses of road and roadsides;
3) road improvements tend to focus on motor vehicle requirements and not pedestrian needs;
4) traffic police can offer only limited help as they are poorly equipped to control motor vehicle traffic and not properly trained to consider pedestrian needs; and
5) most parents are unable to provide road safety training as they themselves never received any training and even if they did, traffic conditions have changed dramatically since their childhood.

RSE is needed to provide the necessary structure for the acquisition of safety knowledge and skills. These include decision making skills, and the identification and assessment of risk and strategies to reduce these risks. RSE attempts to prepare children for different tasks at each stage of their increasingly independent use of the road network and, later, as adults.

3 KEY COMPONENTS

3.1 Road Safety in the Curriculum

Road safety is too important and complex to be dealt with by simple messages given a few times a year. Experience from various countries has shown repeatedly that one-off talks by visiting speakers (e.g., police or other well-meaning groups) are not particularly effective unless they are part of ongoing work in the school through a structured program of RSE.

It is essential for long-term prospects of road safety education in schools that there is adequate provision in the national curriculum. This is the building block on which further traffic education is based.

Without this, there will be only ad hoc activity with little control of content. By specifying what should be taught to each age group, some control over content and quality will be achieved. The curriculum content must of course be well-defined, based on sound educational principles and should reflect local needs and accident problems.

Road safety is an area of work that fits naturally into many topics and centers of interest already going on in schools. It can provide a vehicle for basic skills of literacy and numeracy as well as being a topic in its own right, for example, within life skills, social studies, or health education.

Where possible, specific road safety lessons can be included in the school timetable, but it should also be incorporated into other subjects throughout the year.

In addition to being appropriate for the age group, road safety lesson content should also be relevant to local conditions, include practical roadside training, and be reinforced on a regular basis. There is often a tendency to overemphasize the teaching of road signs and signals, especially to young children. It is essential to move away from the idea that knowledge of the road signs and traffic lights equates to road safety.

There should be more emphasis on teaching survival skills in a progressive manner that is appropriate to each age group. Rather than rigid rules that may not be applicable in a new situation they come across, children need to be taught concepts for survival. For example, teaching children that they **must** cross the road at traffic lights may cause confusion if the lights are not working properly, or if there are none in the locality. It is preferable to teach rules and principles for crossing the road that can be applied equally to traffic light controlled junctions, marked pedestrian crossings, rural roads, or other situations.

Like other measures aimed at increasing road safety in a country, actual problems should be identified and specific age groups targeted, based on accident data. For example, if there is an accident problem involving 10-12 year olds crossing roads, this should be highlighted in the curriculum.

It has been shown that it may be more effective to teach children the skills needed to cross a specific road by practical training; i.e., to concentrate on behavior.

As they grow, older children will be able to generalize specific situations and actions to other situations. There is evidence that practical training is the most effective means of improving young children's skills and judgments and, therefore, they will learn about road safety best by being exposed to real traffic situations in a controlled, safe manner. However, classroom-based RSE can help, for the following reasons:

1) without effective classroom work, children may not give sufficient attention or priority to the dangers of road use; and

2) without effective classroom work, children may not learn the vocabulary of the road, may not have concepts such as car stopping distances explained to them, and may not understand exactly how they are in danger or putting others in danger.

However, classroom work alone will not improve critical skills such as road crossing. Supervised practice in the traffic situation is much more effective and should be carried out as close to the age as possible when children in the community start using the roads on their own.

Many countries have traffic parks but rarely do the conditions inside the parks reflect the conditions on real roads that children have to cross in that country.

There is little point in teaching children in the park on roads with well-maintained footpaths and a well-marked, well-signposted road network if these do not exist in their local environment. It is more effective to teach children on real, local roads under proper adult supervision. Groups should be small, with a high ratio of adults to children to ensure safety. Classroom and practical lessons need to be given on a regular basis to reinforce safe road use behavior in children. Road safety education should be incorporated into the national curriculum with lessons conducted on a regular basis.

Plate 1:
Road safety being taught in school.

3.2 Teachers' Guide

Once there is adequate provision in the curriculum, it is necessary to give teachers the correct information to be able to teach road safety effectively. By producing a teachers' guide, and distributing it to schools, the ability of teachers to teach road safety will be increased substantially. In countries where the majority of primary school age children do attend school, it is appropriate to concentrate initially on increasing and improving road safety education through the schools, before considering options for nonformal education.

Production and dissemination of a full teachers' guide will facilitate the process of encouraging road safety teaching in schools and will give teachers a permanent reminder and source of reference in the classroom. The guide should enable teachers to teach the concepts included in the core curriculum and ideally should be produced in a large enough quantity for every primary school teacher to have a personal copy.

3.3 Teacher Training

Teacher training should be of existing teachers, through a series of local seminars, and of new teachers entering the profession, through the teacher training colleges. To train all teachers in basic road safety teaching throughout a country is a large commitment. It is unlikely to be achievable unless a dedicated person is appointed to this task, full time, for at least two years. Their role should be primarily to train trainers to run road safety seminars, for head teachers initially, but then covering all class teachers. They could also be involved in resource development to gradually build up the road safety materials available in a country.

In the longer term, it will be necessary to include a road safety element in initial teacher training courses to ensure that teachers coming into the profession are fully equipped to teach road safety to their students.

3.4 Teaching Aids

Research from other countries has shown that it is important that effective road safety education does not rely simply on talks by visiting speakers at irregular intervals [1,2]. Talks can supplement ongoing, curricular-based classroom work, but are arguably more effective if supported by teaching resources. Some countries have found it beneficial to establish specialist road safety officers to assist and support teachers — by providing ideas, resources, and teaching materials. Materials for use in the classroom can include, but are not limited, to the following:

1) worksheets;
2) posters;
3) teaching pack;
4) slides;
5) books and games; and
6) videos.

The most basic of these to produce are the worksheets, which are cheap and therefore easy to reproduce. These should concentrate on vocabulary development for young children and then move onto crossing skills and more complex issues as the children's ages increase[5,6].

Initially, resources can be adapted from those of other countries, an approach that minimizes development costs and time implications, but eventually local resources — teaching packs, worksheets, videos, and posters — should be produced. There should always be the option for adapting resources for local needs, as materials that are appropriate in one area of a country may not be as relevant elsewhere and vice versa. It is also useful to have good quality resources that can be used immediately while a comprehensive curriculum is developed. Approaches used in other teaching areas can be used for road safety. For example, if puppet shows are popular among children, they can be used as an effective carrier for road safety messages. In some countries, including Malaysia, computer-based learning is popular with secondary students.

3.5 Community Education

Once formal education practices are established, it is necessary to turn attention towards nonformal education methods to bring road safety education to children who do not regularly attend school, especially in high-risk areas.

There are various options available. One community-based program that it may be possible to use is Child-to-Child[4], which has been developed and used in many countries around the world. The basis of the program is that children attending school are taught about

various health and social problems, and how to deal with them. This includes such issues as water, malaria, AIDS, and an element of road safety. The children are encouraged to disseminate the information to younger children and their parents, and to take practical action in their communities to improve their own chances of survival. Many of the materials are available in different languages.

Other community groups that can help in getting the road safety message across include the Scouts and Guides and women's groups (e.g., literacy or health programs) to teach parents how to teach their children to be safe.

Community education should also be used to emphasize lifelong learning and to build links between home, community, and school.

3.6 Policy Coordination

Lack of awareness by policymakers of the need for RSE can be an impediment in improving this sector. It is often the case that there is ad hoc road safety education already taking place. A national road safety council (NRSC), or similar body has a vital role to play in coordinating road safety nationally, to increase efficiency and prevent duplication of effort. This is especially important when there are limited resources available in this sector.

Plate 2: Children being taught on real roads in Nepal.

Many government and nongovernment organizations (NGO) can play a role in RSE. Obviously, the ministry of education is an important player, but also ministries of health, police, etc., can play a part. Highlighting of accident problems, and even a network national accident database, can help to direct activity in all organizations towards the same target.

For the development of road safety within a country, it is essential that information, ideas, and examples of good practice are disseminated among professionals working in the field. At the very least, if there is no NRSC in place, this could be done within the appropriate ministry. Information could be shared by:

1) regular meetings or seminars;
2) a newsletter;
3) membership of overseas road safety organization to keep abreast of current international advances; and
4) training — external and in-house.

In some countries, the private sector (e.g., banks, insurance companies, manufacturers, and distributors) are willing to invest in road safety as part of their corporate responsibility and/or marketing and public relations strategies. The association of insurance companies in India has funded development of road safety education materials. Businesses may be willing to finance publication costs in return for sponsorship credit or company logos printed on the publications.

Although it is generally recommended that there should be an increase in road safety tuition through schools, police teams already in existence in many countries do have a role in supplementing this, and supporting topic work. However, one problem that the officers face is that they are unlikely to stay in one section of the police for a long period.

Valuable resources are lost by training officers for this specific role and then losing their expertise. Consideration should perhaps be given to road safety being a career position within the police.

4 STAGES OF DEVELOPMENT

The development of an effective road safety education program in a developing country will most probably involve the country proceeding through a number of stages. The major steps are typically as follows:

1) **review of current practices and responsibilities for RSE.** RSE provided by schools, police, or service groups should be assessed in light of accident data and recent trends to identify priority areas and opportunities for improvement;
2) **short-term and immediate improvements to the current system identified and introduced.** To enable RSE to continue in a more effective form while more substantial programs are set up, short-term improvements to the existing system should be undertaken. For example, if police teams visit schools to give

talks on road safety they can increase effectiveness by basic training, content review, and production of worksheets that can be left at the school to encourage follow-up work. Maximum use should also be made of school outings with practical road safety lessons incorporated;

3) **introduce RSE pilot project**. Areas where road accidents are a serious problem should be targeted first. Local expertise should be developed. Villages near rehabilitated roads are an ideal candidate as the accident risk is increasing. Aid-funded projects are beginning to fund local RSE programs in order to prepare roadside communities for expected increases in vehicle speeds and traffic volumes. Local reference material should be produced and may require preliminary road safety awareness seminars offered by an RSE specialist;
4) **develop RSE school curriculum content**. To ensure relevant skills are taught to each age group in a structured way, RSE policy and plans should be drawn up to improve provision in a sensible and organized manner and to identify priority areas in the country. Clearly defined responsibility for RSE and good coordination between providers is necessary;
5) **produce basic classroom materials and teachers' guides**. It is important to ensure relevance of materials to the local situation and to accident problems identified. Teachers' guides and materials should be pilot tested before final production. When a teachers' guide is available, ideally all current and new teachers should have their own copy;
6) **improve teacher training**. Development and inclusion of road safety in initial teacher training through colleges and continuing professional development. This should include the abilities of different aged children, implications for their behavior on the roads, how to teach safety effectively, how road safety issues can be incorporated into current school topics, and an introduction to available teaching materials;
7) **introduce community education initiatives.** To ensure road safety messages reach children who are unable to attend school on a regular basis and to educate parents and older generations, community education programs should include RSE. (Once schools are all teaching road safety, RSE can be expanded to involve NGOs for supplemental support).

5 BENEFITS AND EFFECTS

The potential benefits of RSE for children include the following:

1) increased awareness and knowledge of the traffic environment;
2) appropriate survival skills necessary for the safe use of the road environment;
3) understanding of the behavior and attitudes that have an influence on road safety;
4) knowledge and understanding of how humans, vehicles, and systems interact and work;
5) decision making skills that will enable them to make choices and to take responsibility for their own safety and that of others;
6) esteem and care for other people;
7) knowledge and understanding of the causes and consequences of road accidents; and
8) necessary knowledge, understanding, and skills to travel safely in or on a vehicle, while showing consideration for others.

Research shows that human error plays a large part in road accidents. It is a contributory factor in about 95 percent of accidents. By teaching the basics of road safety to children, they are being prepared for the future and developing positive, safe attitudes that will have benefit in years to come as these children become teenagers and then adults. Inculcation of safety skills in children can provide lifelong benefits to society. In countries where the number of motorized vehicles is still increasing, the number of accidents is likely to rise unless steps are taken to educate road users at an early age.

Attitudes developed in the earliest years largely define how the individual behaves on the road in later years. Attitudes are difficult to change once they have been formed. It is

easier to teach good habits at an early age than to break bad habits later. RSE has long-term benefits for the community in terms of road user behavior as it helps to develop positive attitudes and values. RSE should commence at an early age — at kindergarten, or even earlier through publicity initiatives aimed at parents.

Road safety education is necessary to provide the basis for improving road user behavior over time. Because it involves the development of safe, positive attitudes, it will always be a long-term investment. This is especially because it is trying to counteract attitudes and behavior learned from and continually reinforced by parents and others in close contact with the children who tend to pass on unsafe behavior.

Many of a child's attitudes are learned in the first five years of life from their parents and carers. Once developed, attitudes can be difficult to change.

6 EXAMPLES OF GOOD PRACTICE

In **Bangladesh**, where road safety education is limited, one organization, the Centre for the Rehabilitation of the Paralysed, has begun sending current and former patients who were paralyzed in road accidents to visit schools and discuss their tragedy. The center has also produced road safety advice leaflets, which it distributes to schools. NGO promotion of road safety is the objective of a recent World Bank initiative in Bangladesh.

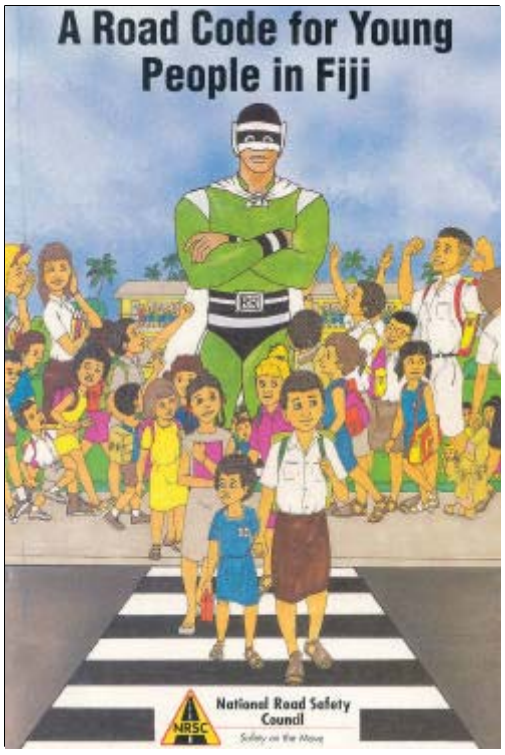


Plate 3: Fiji child education material.

Fiji has recently introduced traffic safety into the curriculum. A teachers' guide is being developed and the National Road Safety Council[7] in association with the Department of Education is introducing a number of initiatives, including visiting drama groups to present safety plays for school children and development of a road safety character called "Road Ranger" to provide safety advice (see Plate 3).

Several road safety education booklets have been produced recently in **India**. The previously mentioned Loss Prevention Association's publication and *Dealing with Traffic — A Guide for Young People* were produced from the proceeds of an art exhibition held during the International Conference on Traffic Safety in New Delhi in 1991.

In **Kazakstan**, the traffic police are active in the organization of road safety lessons by teachers in the schools. Parents are also involved with the parents of entry classes being tested themselves on their road safety knowledge. Parents are requested to help their children identify and map out a safe route to school.

A road safety education project in **Nepal** funded by the Overseas Development Administration (ODA) of the United Kingdom (UK) has produced local road safety education materials, including readers, workbooks, posters, and teachers guides.

These materials were produced by a team of writers from the Primary Education Curriculum Text Book Design Unit after undergoing a week's orientation, which included field visits to rehabilitated roads, discussions with traffic police and pediatricians, and a brief review of road safety materials designed for schools in the UK.

Puppet shows were used to introduce the topic of road safety education into primary schools as well as women's groups and roadside communities[8].

The experiences of accident victims are used in many countries to emphasis the personal consequences of road accidents. In **Denmark**, a team of people crippled in road accidents visit schools as part of an RSE program. In **the United States (US)**, Mothers Against

Drunk Drivers often send representatives to speak to schools, especially, the age groups where students are starting to drive.

All speakers must be properly trained and can serve an effective supplementary role.

7 REFERENCES AND KEY DOCUMENTS

1. Department of Transport (DoT). 1995. Road Safety Education in Schools: Good Practice Guidelines. UK: DoT.
2. DoT. 1996. Child Development and the Aims of Road Safety Education: A Review and Analysis. Road Safety Research Report No. 1. UK: DoT.
3. More information can be obtained on Road Safety Officers (RSO) from the Institute of Road Safety Officers, 16 Southlands Avenue, Louth, Lincolnshire LN11 8EW, UK. Tel: (44 1507) 327 028.
4. Child-to-Child Trust, Institute of Education, 20 Bedford Way, London WC1H OAL, UK. Tel: (44 171) 612 6650; Fax: (44 171) 612 6645.
5. Information about resources and teaching aids can be obtained from: the Royal Society for the Prevention of Accidents (RoSPA), Cannon House, The Priory Queensway, Birmingham B4 6BS, UK. Tel: (44 121) 200 2461; Fax: (44 121) 200 1254.
6. British Institute of Traffic Education Research (BITER), Kent House, Kent Street, Birmingham B5 6QF, UK. Tel: (44 121) 622 2402; Fax: (44 121) 622 3450.
7. National Road Safety Committee, P.O. Box 7125, Nasinu, Suva, Fiji. Tel: (679) 394 886; Fax: (679) 393 253.
8. Ram Badan Joshi, Private Boarding School Organization, Kathmandu, Nepal. Fax: (977) 141 2572.

Road Safety Guidelines

for the Asian and Pacific Region

4.7

DRIVER TRAINING AND TESTING

Asian Development Bank

4.7

DRIVER TRAINING AND TESTING

Recent studies in the United Kingdom (UK) and United States (US) have shown that in about 95 percent of recorded accidents, driver error was a contributory factor in some form or other. It is, therefore, vital that the human factor is addressed in tackling the problems of road safety. Fundamental to this is an efficient driver testing and training regime. This regime must not only be efficient and cost-effective, but just as important, it must have public confidence. Regrettably, at the moment, it must be said that the systems in some countries are obviously failing on all three counts.

It is readily appreciated that driver testing and training are only a small part of a whole series of initiatives necessary to solve the road safety problem. However, these sectors must make an important contribution to any initiative aimed at reducing road casualties and long-term reductions in accident statistics. It is essential that all road users are made more aware of the heavy responsibilities inherent in the possession of a driving license.

Novice drivers, especially those in the 17-21 age group, have a disproportionate number of accidents. By training all new drivers in skills for life, there are immeasurable long-term economic and social benefits arising from a more responsible attitude to driving.

Driver testing and training procedures are inadequate in many countries in the Asian and Pacific region and, with the rapid pace of motorization, urgent remedial measures are required to improve the situation. The state has a responsibility to ensure that only safe, competent drivers are allowed on roads.

The majority of driver training is used only to prepare a candidate for the driving test and therefore the standard of the driving test will determine the extent and quality of driver training. In order to improve driver training, the quality of driving instructors must also be improved and monitored and, in each country, a recommended syllabus for learner drivers should be introduced.

PRIORITY ACTIONS NEEDED

1. Ensure that the driving test examines the driver's judgment, decision making, and ability to drive safely on public roads in normal traffic conditions with stricter tests for drivers of large commercial vehicles.

2. Provide adequate training and staffing for driving examiners and ensure they are taught to drive all vehicles to the highest standards.

3 Organize training courses for professional driving instructors, develop a standardized driver training curriculum, and established a registration system, driving instructors, and driving schools.

Effective driver testing is the best way to ensure that only safe, competent drivers are awarded a driver's license. Good control and registration of driving schools and driving instructors is also highly beneficial in ensuring learners are given competent instruction.

1 INTRODUCTION

These sector guidelines on "Driver Training and Testing" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

This section deals with driver testing and training and emphasizes the responsibility held by all drivers and riders of motorized vehicles. The importance of an early awareness of this responsibility and the value of a structured program of testing and training for all new drivers is detailed.

These guidelines are targeted at the rapidly motorizing countries in the Asian and Pacific region and are restricted to standard, conventional licensing programs; i.e., where drivers passing the driving test are treated the same as all other licensed drivers. Advanced programs, such as probationary or graduated licenses, where certain restrictions and stricter penalties are imposed on the learner or novice driver, require a computerized database and an efficient monitoring system.

2 WHY A DRIVER TESTING AND TRAINING SYSTEM ARE NEEDED

There are about 235,000 road accident deaths in the Asian and Pacific region each year. Recent studies in the UK and US have shown that, in about 95 percent of recorded accidents, driver error was a contributory factor in some form or other.

It is, therefore, vital that the human factor is addressed in attempting to solve the problems of road safety. Fundamental to this is an efficient driver testing and training regime. This regime must not only be efficient and cost-effective, but, just as important, it must have public confidence.

Driver education should be at the forefront of any program designed to reduce road accident figures.

The experience of most countries with growing numbers of vehicles and drivers is that a program of structured training, followed by a valid and reliable test of competence, can contribute towards a reduction in road accidents. The alternative is an unrestricted increase in untrained, undisciplined drivers with an inevitable spiraling in accidents and consequent pain, grief, and costs.

Most vehicle accidents are **not** accidents, but result from a lack of planning, anticipation, concentration, or control by those involved. In industrialized countries, younger drivers (aged between 17 and 21) make up only 10 percent of all license holders but may be involved in more than 20 percent of all accidents; a young male driver is seven times more likely to be involved in a fatal road accident than a middle-aged man. However, research by Transport Research Laboratory (TRL) of the UK indicates that lack of driving experience, not immaturity, is the main contributory factor. It also concludes that the more driving situations that are experienced by drivers, the safer they become. Can any country afford to let its new drivers learn by trial and error and kill each other in the process? All new drivers require appropriate instruction and have to be guided through situations where a lack of experience can make them vulnerable and have serious consequences.

New drivers, of whatever age group, need to be made aware of the correct attitude and approach from day one of their driving careers. The development of driving as a **skill for life** should be instilled. Skill in the control of the

vehicle needs to be supplemented by many other qualities relating to the vehicle's interactions with its environment. These can be gained by a mixture of comprehensive training and real-life experience.

The need for an effective driver testing and training system is overdue in the Asian and Pacific region for the following reasons:

1) the mixture of motorized and non-motorized modes with an inadequate road network and hierarchy, and poor traffic control methods contribute to a difficult driving environment; and
2) the rapid increase in motor vehicles and novice drivers will result in a proportionate increase in accidents unless there is a dramatic improvement in driving standards.

3 KEY COMPONENTS

3.1 Driver Testing

The driving test will always be the main judge of any driver training syllabus. For this reason, although driver training is experienced first, the driving test is reviewed first. Most training is geared towards passing the driving test rather than teaching the student to become a safe and competent driver. In newly motorizing countries, ensuring proper training through a comprehensive driving test is the most practical way to improve the standards of novice drivers.

a) *Legislation*

The traffic regulations must define both the legal authorities of the state that controls driver licensing and specify the requirements for potential license holders. Licensing legislation is discussed in Sector Guidelines 4.10, but should include criteria on the following:

1) minimum driving ages by vehicle type;
2) vehicle classifications;
3) medical limitations;
4) driving test procedures;
5) provision for training; and
6) restrictions on learner or novice drivers.

License categories should follow international guidelines to enable interchangeability and acceptance in other countries. Such classifications should be similar to those set out in European Community (EC) Directive 91/439/EEC.

While 18 is the standard minimum age, according to the EC Directive 91/439/EEC, for legal driving of cars, the age for driving a light (or low-powered) motorcycle is only 16 and the minimum for commercial passenger carrying vehicles, i.e., those with more than eight seats, is 21. In the Asian and Pacific region, the minimum age for driving commercial vehicles is typically set higher (although only 18 in the Republic of Korea and 19 in the Philippines) with a requirement for one year or more experience of driving light vehicles.

License durations (including duration of a learner's license) should be specified by law. In several Asian and Pacific countries, the learning period allowed by the validity of a learner's license is too short and should be expanded to a 6-12 month period. Their is no realadvantage in road safety terms of imposing a short duration for the normal driving license. In the UK, for example, light vehicle driving licenses do not require renewal until the holder reaches the age of 70, after which the duration between renewals is three years.

Heavy commercial vehicle licenses last until age 45, after which they need to be renewed every five years until age 60 and then annually; these renewals must be accompanied by a medical report form.

Several Asian countries have adopted legislation restricting newly-qualified motorcycle riders from carrying passengers for the first year. Such legislation should be linked to the display of probationer plates on the motorcycle. As with all legislation, only that which can be enforced should be enacted, in order to promote respect for the law.

Legislation should, where possible, enable changes in the driving licensing procedures without lengthy delays. For example, countries may wish to introduce driving licenses with photographs or holograms as security measures.

b) *Medical examination*

The medical examination could in practice be limited to an eyesight check (a simple test of reading a registration plate at 20.5 meters [67 feet] is still used in the UK) and a consent form declaring that the candidate has none of the medical conditions specified in legislation as prohibiting driving. Many countries still use a medical or general board to test the candidate's mental or physical fitness, although the growing number of license candidates may cause backlogs and problems.

c) *Theory examination*

In addition to the pure driving skills of candidates, their knowledge should also be subject to examination. A theory examination should test the candidates' knowledge of the highway code: traffic signs, traffic regulations, as well as basic knowledge of vehicle performance and simple safety checks before using a vehicle. It may be tested in one of several ways. Test by oral examination, while labor intensive, is still appropriate in countries where the literacy rate is low. In this case, the oral examination may be carried out by the driving examiner either immediately before or after the practical driving test and should follow a set pattern. If a formalized question paper or computer-based exam is used, it should be taken **before** the practical driving test and passing will be a prerequisite for the practical test.

It must be emphasized that literacy is not necessarily a requirement for a good driver and that, for most countries, there is no requirement to move immediately to a state-of-the-art testing system. Where a theoretical (oral or written) test is used, it should be available in all the main languages in use within the country or the use of translators should be permitted. A test covering sufficient topics will require about 50 questions and last about 45 minutes.

Subjects covered by the theory test should include at least the following topics:

1) traffic regulations;
2) vehicle handling;
3) vehicle maneuvering procedures;
4) hazard perception; and
5) effects of weather and road conditions on driving.

d) *Practical driving test*

Few countries conduct the whole practical test on public roads but use off-road facilities to examine the technical control of vehicles; i.e., emergency stop, hill start, zigzag maneuvers, and parallel parking. Normally the off-road test is carried out first and this is followed by the on-road test, which should be conducted in light traffic on normal roads. All test routes should ideally be on-road, although it is acceptable to have a combination of off- and on-road routes. They should be as uniform as possible and include a common range of typical road and traffic conditions. The test route should be chosen to test candidates' hazard perception skills without exceeding their capabilities. Pedestrian crossings and junctions (right and left turns), including roundabouts, should be included to provide opportunity for give way testing. The on-road test should include (but not be limited to) the following checks and exercises:

1) take proper precautions before starting the engine of the vehicle;
2) make proper use of all controls;
3) position normally on the road and make normal stops in a safe place;
4) drive at a speed appropriate for the conditions;
5) make effective use of rearview mirrors;
6) give all necessary signals;
7) show alertness and anticipation of the actions of other road users;
8) overtake, meet, and cross the path of other vehicles safely;
9) act properly at road junctions;
10) take appropriate action at pedestrian crossings; and
11) take prompt and appropriate action on all traffic signs, road markings, traffic lights, signals by traffic controllers and other road users.

Motorcycle tests can be conducted by an examiner observing set exercises on a normal road system or by specially trained examiners, riding their own machine, following the test candidate round a set route on normal roads. Contact can be easily maintained by simple radio equipment. By its very nature, this would be a more expensive option. Careful location of a number of examiners around a route could enable a large number of motorcycle tests to be performed efficiently.

When testing drivers of heavy goods vehicles or large buses, recognition should be given to the fact that the potential for damage by these vehicles is extremely high. It is recommended that the time taken to examine a candidate for a vehicle in one of these categories should be about twice that for a driving test for a light vehicle. Large vehicles should have an area of prescribed minimum dimensions available for maneuvering exercises. It is important that vehicles on these off-road areas do not interfere with one another.

Standardized assessment forms are necessary to ensure consistency among tests, to facilitate monitoring and to provide feedback. Errors should be precoded and thus standardized.

It is recognized that drivers will experience many different conditions that cannot be examined. These include nighttime driving and driving in rain, mist, ice, or snow, and on high speed highways or gravel roads. In spite of these deficiencies, it is not feasible to extend tests to any other conditions than those experienced on the day of the test. There is, therefore, an opportunity for driving schools to offer training courses in conditions such as night, snow, or highway driving. The taking of such courses could be encouraged by insurance companies as a dual road safety and cost reduction program.


Driving Test Report

Figure 1: UK Driving Test Assessment Form.

e) *Driving examiners*

No matter how elaborate or strict the driving test is designed to be, it can be effective only if driving examiners are properly trained and have adequate time to conduct the test. The increase in driving examiners has not kept up with the increase in license applicants. Lack of staffing has had a greater impact than inadequate training. Even with forms and procedures, the effectiveness is wasted if only a few minutes is available for each test due to demand.

All examiners, whether employed to test drivers of cars, motorcycles, heavy goods vehicles (HGVs), or public service vehicles (PSVs), or for the police or the military, should be subject to the same training and should be qualified to drive all categories of vehicles that they are likely to examine. Examiners should be trained to drive to an exemplary standard at all times. Training should include both an external course as well as a probationary period (three to six months) on the job. One-week refresher courses for existing driving examiners should also be conducted on a regular basis. It is essential that driving examiners are seen to be fair and impartial and that the test sets a uniform standard wherever it is applied.

Examiners should give clear directions and instructions, and should be understanding and sympathetic, making every effort to put the candidate at ease. They should assess and mark driving faults as they occur. It is useful to have a standard form (Figure 1) that examiners complete during the actual test (i.e., not retrospectively).

Driving examiners should be subject to frequent supervision to ensure that their individual assessment is checked and that the tests are being conducted in accordance with the regulations. Test results can easily be monitored by computer over any period. Any pronounced individual variation from the average results obtained by colleagues in similar areas would readily show up. To facilitate this checking process, it is necessary that records of tests should be retained and collated at regular intervals.

Examiners can be recruited from many backgrounds. They need to have good interpersonal skills, have a wide driving experience of most types of vehicles, be good communicators, and be able to write clear and concise reports quickly. An even temperament to cope with often stressful situations is essential, together with a firm and confident manner.

To avoid any accusation of corruption, examiners should not be made aware of their test programs before the day of the test. They should not be permitted to give driving instruction themselves or be associated with any driving schools. Candidates with criminal records should not be permitted to become driving examiners.

f) *Test administration*

Clear requirements for the administration of driver testing are necessary. These should cover all classes of driving licenses and should be available in published format for sale to the public. A complete list of areas to be tested and standards required should also be published.

There should be an appeals procedure to cover allegations from candidates that tests have not been conducted in accordance with the regulations. However, there should be no appeal against the result of the test apart from the above reason. Appeals can be easily investigated by senior examiners if there is a standard marking and reporting system for each test.

Driving test centers need to be convenient for large numbers of the population and it is

important that potential drivers do not have to travel unreasonable distances for their test. These centers should be able to accommodate sufficient numbers of examiners to meet the likely demand for tests in that area and also provide waiting and toilet facilities for candidates.

Parking should be convenient at the test center and provision made for all types of tests that are to be carried out at the center. For example, it may be considered convenient to carry out some of the test exercises off-road at marked-out areas. Theory tests and medicals may also be provided at the same venue if considered practical. Clerical staff may be necessary if tests are booked at a local level. Computers will ease this function and the collating of test results.

In countries with a widely distributed population, it may not prove feasible to combine the requirements of reasonable distances with expected demand for driving tests. In this case, it may prove acceptable to use a traveling examination center in which examiners may travel to outlying towns either regularly or on demand to carry out driving tests (e.g., once a sufficient number of candidates makes a trip worthwhile).

Depending on the size of the country and demand for tests, there should be a senior manager with day to day responsibility for the operation of the driving test organization. They should be supported by supervising examiners to monitor the testing and training systems and assess the validity of appeals. They will also be supported by clerical staff to monitor test and training results for uniformity, to maintain a booking and cash handling system, prepare statistical summaries of driving test data, and perform staff administration.

g) *Cost recovery*

The provision of a driving license should always be seen as a privilege and not a right. The provision of a testing regime infrastructure amounts to considerable capital sum with substantial running costs. However, most countries using a testing system, as described, try to recoup the running costs from the driving test fees. Administration staff and management do not usually conduct tests, so the cost of their services should also be recouped from driving test fees. There are no known instances of countries providing a driving test as a free public service.

Examiner training facilities need to be considered. Classrooms, accommodation, training staff, and vehicles will all need to be costed into the driving test fee. A central training establishment is found to be usually more cost-effective. The cost of training and training facilities should be taken into account when setting the fees for driving tests. Further cost recuperation can come from the dual use of such an establishment to train candidate driving instructors.

Driving instructors are charged for entry examinations to the instructor register and also pay an annual fee. These charges also help to defray the cost of the testing operation. The publication of official guidelines to help candidates prepare for tests can also be a worthwhile source of revenue.

3.2 Driver Training

a) *Curriculum*

In most industrialized countries, driver training is seen as a necessary requirement in the quest for a driving license or permit. The normal approach is to follow a syllabus that covers sufficient elements to enable the student to pass a test for granting of the license. Ideally, the syllabus and the training should aim to prepare learner drivers for all potential hazards and situations and not just those tested by the examiner at the time of the test. But in reality, it cannot. It is evident that most candidates are concerned only about learning enough to pass the test.

Driving is a skill that takes years to master properly. Learning does not and should not stop when the candidate passes the driving test. Safe driving is as much about attitude as about ability to control the car. Driver training should not only introduce this message but should reinforce it throughout training. The learner must also gain the following:

1) a thorough knowledge of the highway code and the motoring laws; and
2) a thorough understanding of the responsibilities of a driver.

This means that drivers must have real concern, not only for their own safety, but for the safety of all road users, including pedestrians. There can be no minimum number of lessons, as the requirements of each pupil will depend on a variety of factors. The syllabus will list

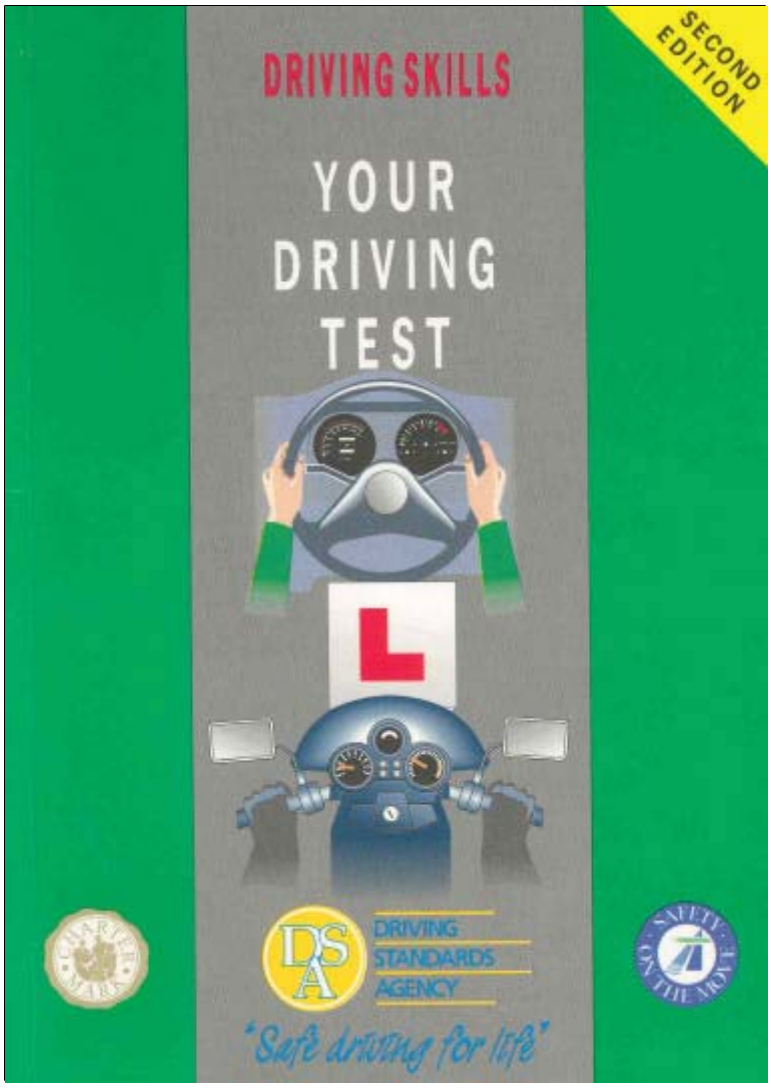
the skills in which basic competence must be achieved in order to pass the driving test (see Plate 1).

Any syllabus for learner drivers of motor vehicles should cover the following main headings:

1) legal requirements;
2) car controls, equipment, and components;
3) road user behavior;
4) vehicle characteristics;
5) road and weather conditions;
6) traffic signs, rules, and regulations;
7) car control and road procedure; and
8) additional general knowledge about driving-related situations.

Trainees should be made aware of the need to take further training to cover those aspects not included in the "official" test.

Plate 1:
Typical driving test manual.



For motorcycle riders, training needs to emphasize their vulnerability and the risk of not using an approved safety helmet.

Defensive driver training, either as part of the initial training or as an advanced driver course, has been found to be effective, especially in reducing accidents involving company vehicle drivers. Once the initial training syllabus has been determined, it may be useful to consider defensive driver training as an accident prevention strategy. Initially, large companies could be approached and the scheme then extended to the general public, if the decision is taken not to include such techniques in initial training. Again this kind of training may be left to the private sector.

Depending on the mix in the vehicle fleet of a country, it may also be necessary to consider training and testing requirements for drivers of nonmotorized vehicles. It is likely to be impractical, however, and publicity relating to general road behavior may be more cost-effective and productive.

b) *Driving instructors*

Governments must ensure that people advertising themselves as driving instructors are qualified to do so. In order to receive a qualification they must have successfully completed a training course organized by the appropriate authorities and be qualified to drive vehicles of the type in which they wish to instruct. Once qualified, their names should appear on a register of driving instructors and they are then entitled to charge for driving lessons. However, it is not essential that learners be instructed only by a qualified driving instructor. In many countries, a variety of options exist for learners varying from driving instructors to training by family members or friends who are qualified drivers.

Driving instructors should have the ability to impart practical and theoretical knowledge to their students. As well as the obvious skills in driving the vehicles and giving demonstrations of techniques where appropriate, they should be conversant and comfortable with classroom procedures and be good communicators. It should always be remembered that a competent driver does not necessarily make a good driving instructor, but a competent driving instructor must always be a good driver.

In an ideal situation, all instructors would be trained and qualified in these techniques

by a recognized authority and this should be the aim of any driving instructor registration scheme. The most efficient way to monitor the profession is by way of a central register. This ensures that the public can be assured that an acceptable standard of tuition is offered by all instructors and driving schools. It should be illegal for anyone to charge for driving instruction unless their name is on the register.

There is no reason why driving instructors should be employed by the government. A privatized tuition system where driving schools operate in a free market environment works well in most countries. Individual instructors either work for multivehicle schools or are self-employed with only one vehicle. It is now recognized that an official supervisory system is necessary to ensure that standards of instruction are maintained. There also needs to be a facility to ensure that unsatisfactory or criminal practices are punished by removal from the roll of driving instructors.

Potential driving instructors should be required to pass a qualifying examination. This should cover:

theory: a multiple-choice question paper on all aspects of driving and instruction;
practical driving: a test of driving ability to advanced standards and lasting about one hour; and
instructional ability: a practical test where the potential instructor gives a lesson to a assessing examiner on a random driving topic.

Each of these modules must be passed in turn before going on to the next stage. Only on satisfactory completion of all three modules is the instructor eligible to join the register. A fee is paid to remain on the register and continued membership is dependent on favorable reports from frequent check tests by government inspectors (the fees should cover the costs of inclusion on the register and supervision). Similarly, although separate, schemes need to be considered to provide adequate training for instructors of motorcyclists and drivers of HGVs and PSVs.

Some countries allow approved driving instructors to test drivers at the end of a recognized training course. This procedure does require intensive supervision to ensure that the system is not abused. It can also be useful to standardize the various systems of driver training and testing within a group of neighboring countries. This should ideally involve development of a common policy on the grouping of vehicles and the requirements of tests for licenses for the various groups.

c) *Driving schools*

It has been found to be beneficial to register driving schools separately from driving instructors, but it is not essential. It will encourage driving schools to meet criteria, such as having registered instructors, adequate numbers of training vehicles, and lecture rooms for theory training (see Plate 1). This ensures better quality control as instructors and schools can be taken off the register or disciplined for any corruption or other deficiencies.

There are also benefits in organizing a driving schools association to aid coordination between driving schools and to establish an industry code of practice (such as happens in Fiji). Driving schools can also be involved in the training and rehabilitation of offenders, especially if the government organizations such as the police do not have the necessary resources.

4 STAGES OF DEVELOPMENT

This section describes the typical stages in the organization of driver testing in developing countries. It is not necessarily meant to imply that, to get from stage one to stage four, stages two and three have to be taken in the sequence shown. In some countries it may be possible to miss a whole stage to improve the system. The ultimate aim must be to implement a driver testing regime that fairly and adequately prepares new drivers for the challenges of driving.

1) **Stage 1:** This is a basic but ineffective level. Tests are conducted mainly off-road or on quiet local roads. The test is short and simple (less than 10 minutes) and requires little training for drivers. There are few examiners as they have little or no training and with no written procedures or monitoring. The driving examiners are often also required to conduct vehicle inspections.
2) **Stage 2:** This next level is first seen in major urban areas while Stage 1 may continue to exist in provincial areas. On-

or off-road tests are carried out but they are not standardized. Driver training schools begin to develop and training may be offered for instructors. The examiners will begin to be concerned solely with driving tests and routine monitoring will be conducted.

3) **Stage 3:** Assessment forms are introduced and used by driving examiners, and monitoring of driving instructors and driving schools started. The focus on training will be shifting away from classroom and mechanical knowledge to hazard perception and practical training. A basic theory test will be included.

4) **Stage 4:** Feedback is given to candidates, and a monitoring system in place with publication of statistics. Quality assurance of exam system will lead to improvements in examiner consistency. An adequate number of examiners will be available and the test workload will be adjusted to suit the number of examiners. A theory test will be introduced that will comprehensively assess candidates' knowledge.

It is essential that improvements in the driving tests are introduced immediately before or simultaneously with improvements in training. If this is not done, it will prove difficult to improve driver training standards. **Driver training must be led by improvements in the requirements for the driving test.**

5 BENEFITS AND EFFECTS

Any road safety improvements such as those described in this sector have to be seen as a long-term policy designed to accelerate the acquisition of driving experience and thus improve the skills of new drivers and the safety of all road users. The positive aspects of a structured training program followed by a professional, valid test should be readily recognized by most drivers. The effect on road safety and accident figures will not be immediate, however, as it will take time for the more highly skilled drivers to become a significant percentage of the total. These improvements must be linked into an efficient accident data system in order that the qualifications of drivers involved in accidents may be monitored. This monitoring could also extend to traffic citation data if available.

The introduction of such a change in driver licensing should not be seen in isolation and the benefits should be widely publicized. Inevitably they will initially result in the lowering of the pass rate. This is no bad thing, especially when the pass rate may have been excessively high (e.g., more than 80 percent) on first test. One way of fine-tuning the system will be to establish the current pass rate and gradually bring in changes to the test to reduce it. The introduction of professional driving instruction should then gradually counteract this reduction and tend to improve the pass rate. Driving schools should be monitored on the basis of obtained pass rates.

Consideration should be given to retraining and/or retesting drivers who have committed serious motoring offences. This should have a deterrent effect on any tendency towards reckless or aggressive driving and can actively assist in the reduction of accident figures. Categories of vehicles and drivers that show high accident rates should also be targeted for possible revisions to training or testing procedures or standards.

6 EXAMPLES OF GOOD PRACTICE

A standardized Euro-test based on the best practices of all member countries is planned to be implemented throughout the European Union. This planning is at an advanced stage. It is one of the conditions of entry for any aspiring member country that their driver testing will follow similar patterns.

The **UK** implemented a driving test for light vehicles and motorcycles in 1935 and has since developed and refined this test. The HGV and PSV tests for professional drivers have been in existence for more than 25 years and the professional register for Approved Driving Instructors for about the same period. In 1996, a written theory test replaced the previous informal question-and-answer session held at the end of the driving test. This is based on a multiplechoice question paper and has to be passed before the candidate can sit the practical driving test. All of these systems are now administered by the Driving Standards Agency (DSA), a division of the Department of Transport formed in 1990.

The Agency has its own central training establishment where initial and refresher courses are given to all examiners. Promotion courses and pilot exercises for possible improvements to test practices are a regular feature. Trainees from many countries have attended four-week basic examiner training and in recent years, Australia; Bangladesh; Hong Kong, China; and Sri Lanka are among the governments that have used the facilities.

It is recommended that all countries should move, eventually, to the type of on-road test undertaken in developed countries. At present, tests in many Asian and Pacific countries are carried out on a mixture of off-road and on-road locations. Some countries (e.g., **Republic of Korea**) still carry out the whole test off-road, even though this means that the driver will never actually drive in normal traffic until after passing the test. Despite such undesirable systems, there are a number of examples of good practice in the region.

Each province in **the People's Republic of China** has designated driving schools and these normally own large off-road areas with networks of roads, intersections, parking practice areas, and ramps (for hill starts). They also own fleets of vehicles that are used for driver instruction and trainees must pass a series of modules as part of their training. The test itself is carried out by traffic police driving examiners who visit the driving schools by arrangement to conduct the test. Some of the test is conducted on the off-road facility and if the driver performs satisfactorily, the remainder of the test is undertaken by driving 15-20 minutes on the real roads in normal traffic.

In **Fiji**, the driving test is conducted largely on the normal road network and only parking and a few other basic maneuvers are tested off-road. A recent ADB-funded road safety project implemented improvements such as the introduction of a new theory test that could be conducted orally and had a preset pass mark, standardized test routes, and the production of manuals for licensing (including driving schools and instructors). Training was also given to all driving examiners on the new manual and procedures. The monitoring system has been improved and checks have been imposed on driving examiners. Efforts have also been made to strengthen the driving school industry in Fiji by developing a code of practice and standardized training curriculum. A defensive driving instructor course was also developed and many driving instructors were trained as defensive driving instructors.

Driver training in **Kazakstan** is undertaken by a mixture of organizations with the best training schools being well-equipped with classrooms containing displays of traffic signs and typical situations, and technical displays of vehicles, components, and systems. Students take about three months to complete their training, which includes 190 hours of theoretical training plus eight hours on a driving simulator and 22 hours driving a vehicle. However, this thoroughness of training is not matched by the eventual test, during which only 10 theory questions are asked and a short practical test, lasting about 15 minutes, is given.

In **Singapore**, special large off-road areas are available containing a network of roads with various types of junctions, ramps, and parking practice areas for learner drivers to practice on. Part of the driving test is carried out off-road at these locations and part of the test is conducted on the road network in normal traffic. This appears to work well.

7 REFERENCES AND KEY DOCUMENTS

1. Information on driving tests or driver training in the UK can be obtained from: DSA Head Office, Stanley House, 56 Talbot Street, Nottingham NG1 5GU, UK. Fax: (44 115) 955 7735.
2. Information on examiner training can be obtained from: The Training Manager, DSA Training Establishment, Paul Waller Avenue, Cardington, Bedford MK45 3ST, UK. Fax: (44 1234) 742 728.
3. DSA. 1992. *Driving Skills: The Driving Manual*. UK: The Stationery Office (ISBN 0 11 551054 0).
4. DSA. 1995. *Driving Skills: Your Driving Test.* UK: The Stationery Office (ISBN 0 11 551158 X).

Information on 3 and 4 can be obtained from;

The Stationery Office
P.O. Box No. 276
London SW8 5DT, UK,
or Overseas Sales, The Stationery Office,
Fax: (44 171) 873 8203

Road Safety Guidelines

for the Asian and Pacific Region

4.8

ROAD SAFETY PUBLICITY AND CAMPAIGNS

Asian Development Bank

ROAD SAFETY PUBLICITY AND CAMPAIGNS

Mass media has a profound effect on the daily lives, health, and well-being of people, and effective publicity can influence road user behavior and raise awareness of road safety issues. Well-planned publicity can influence both short-term behavior and long-term attitudes. For instance, publicity might deter drunk-driving because of the risk of being caught by police, but may also influence the long-term way a society thinks about and accepts the need to deter such unsocial behavior.

Publicity has the potential for being highly cost-effective in that it can address the safety of large numbers of people using media and materials. However, it can also lead to wasted resources if it is not handled in a manner that is carefully planned. Publicity campaigns and selection of target groups should be based on analysis of road accident data. In the absence of detailed data, awareness-raising campaigns can be undertaken to highlight the worsening situation.

Suitable publicity should accompany, or prepare for, the following: new legislation, new standards, enforcement initiatives, new safety products, and new highway features. Such publicity should be appropriate to local conditions and should focus on a single concise message.

Where possible, the publicity should be part of a wider marketing strategy aimed at raising awareness and influencing behavior.

PRIORITY ACTIONS NEEDED

1. Road accident data must be analyzed to identify the nature and characteristics of the problem, and the road user group to be targeted.

2. Publicity and campaigns should focus on a single concise message, and the media materials and images used must be appropriate to local conditions and the target groups.

3. Publicity campaigns should, where possible, be coordinated with engineering, legislation, and enforcement and should be evaluated by conducting before and after surveys.

Road safety publicity is an indispensable part of any nation's road safety strategy and is most successful if used in conjunction with engineering, legislation, or enforcement.

1 INTRODUCTION

These sector guidelines on "Road Safety Publicity and Campaigns" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

Publicity is the means through which the population is given information for a specific purpose, and which contains a message that people can readily act upon. It differs from **education** in that it does not involve a face-to-face interaction between the giver of the information and the recipient. Thus it does not generally allow a dialogue.

It involves the imposition of information and opinions upon a whole population or a subset of that population. Its potential effectiveness depends on a number of factors, including:

1) credibility of the message;
2) design of the message;
3) implementation of the delivery; and
4) the extent to which the country in question has a publicity culture.

The extent to which the publicist can "reach" people depends on the number of opportunities for them to see or hear the message through the printed or electronic media. Publicity can be purely factual; for example, announcing a new law on seat belt wearing, or target a subset of the population with information about the effects of alcohol on driving performance.

It may also be used as a tool for persuasion (sometimes referred to as propaganda), where the information and use of images are designed to create support and sympathy for an opinion; e.g., creating an opinion that drunk-drivers are antisocial by depicting the injuries they cause to innocent children.

Publicity is often managed within a campaign that involves mass communication designed to promote safety through the actions of the public. Probably the single most important lesson in publicity is "know your audience," and in particular what motivates it.

Recent experience from well-developed market economies points to the need for a more sophisticated approach to discerning adult populations that expect to exercise individual choices about behavior. The concept of **marketing** has been borrowed from commerce and adapted for social issues. **Social marketing**[1] is an increasingly important concept that requires road safety bodies to understand the needs of individuals, as indicated by the individuals themselves.

2 WHY IS ROAD SAFETY PUBLICITY NEEDED?

As road user error is believed to be a factor in 95 percent of all road accidents, improving road user behavior should always be a priority. With the ability to educate and influence the general public, road safety publicity is needed in order to:

1) create awareness of road accident threats and vulnerability of certain road users;
2) educate road users as to what constitutes safe road user behavior;
3) change attitudes and beliefs to a more positive road safety approach; and
4) inform road users of changes in traffic regulations or operating conditions.

On the face of it, it might seem unnecessary to have to devote resources to guide people to behavior that may obviously be in the best interests of their own health and safety; e.g., not drinking and driving, wearing of safety helmets and seat belts, not driving at excessive speed. People may not actually understand the risks, or if they do, may displace the risk by acting on the basis that "it will happen to someone else, not me." Many people are skeptical or even superstitious about certain safety measures, such as the wearing of seat belts. In some cultures there might even be a fatalistic attitude that all accidents are "the will of God." Breaking down these barriers and convincing the public that many accidents can, and have been prevented, can be a slow process. Publicity should, therefore, be seen as a sustained commitment.

Publicity will often be most applicable to adults, as children in formal education may have the opportunity for detailed work on road safety direct from a competent source in schools (see Sector Guidelines 4.6). Adults are difficult to reach on an individual level, and mass publicity is often the only viable way of informing them and voluntarily modifying their behavior. Safety publicity will have to be sufficiently powerful to counteract influences presented in mass media, including the images of speed and glamour frequently used in the advertising of cars and powerful motorcycles. Safety will have to compete for the public's attention with other influences that offer more immediate and tangible benefits.

Publicity is often used to tackle problems that cannot be easily solved by other means, such as altering the environment or police enforcement. There are many parallels with public health issues where the threat of disease in the population outstrips the pace at which medical or infrastructural support (e.g., clean water programs) can be applied. While the chances of complete success in such campaigns may be small, it is still accepted that some attempt has to be made to equip the target population with sufficient advice on which to act[2].

Publicity is also very valuable in helping to raise the general level of expectations and desire in society for safety, and may give it a status and perceived level of importance that will prompt a culture change.

Without an effective publicity capability, other engineering, legislative, or enforcement measures may fail, or not deliver the full benefits possible. It is not unusual for road safety practitioners to overestimate the understanding of the general road user population of such basic devices as road signs and lane markings.

The failure of a lane-marking program in Bangladesh in the 1970s can be largely explained by the absence of any explanation to drivers as to their meaning, and partly by inadequate enforcement to ensure compliance. In countries experiencing an explosion of traffic growth, the driving conditions and traffic laws can change rapidly. Not all drivers will understand the changes. There are also particular problems facing pedestrians, the disabled, and users of nonmotorized vehicles, who are often overlooked as road users in need of special information.

Publicity is not always easy to direct effectively to the elderly, children, or the illiterate. However, it will still have a role to play in countries where some of the population does not have access to formal schooling. While mass public education through posters, leaflets, radio, and television make less impact than school-based education, it can be effective. For instance, a targeted public information program on the effects of alcohol or drugs can go some way to fill in the gap in understanding that might otherwise be filled in school or college-based traffic education.

3 KEY COMPONENTS

Most of the countries in the Asian and Pacific region employ road safety publicity techniques based upon posters, leaflets, billboards, newspapers, and often radio and television. However, few of these campaigns appear to be planned in the systematic manner necessary to ensure success. The key components that need to be considered in this sector are discussed below.

3.1 Problem Assessment

Publicity campaigns should be based on the best understanding of the road accident situation at the time and, ideally, publicity initiatives should be data-led. It is important to understand the nature of the particular accident or behavior problem being targeted in some detail, if the message is to be credible with the audience. There are various types of data that can be utilized, including the following.

a) *Accident data*

Accident data gives the broad picture and may give an indication of the road user group, gender, and age group most at risk. Accident data should be used as a starting point, and may be sufficient if detailed data is available or there are constraints on use of other data. Accident data from the previous three years is normally accepted as giving a fair indication of the problem.

However, accident data is often incomplete and may not be able to provide a clear understanding of the priority areas or the reasons behind the accidents (which are needed to determine how to prevent their future occurrence). Neither will accident data indicate the extent to which the road safety problem is perceived. For these reasons, the assessment of the situation should extend beyond accident data analysis and include other approaches.

b) *Observation*

Observation of road users involved in accidents highlighted in the data may give an indication of the behavior that should be targeted. For example, if many casualties are pedestrians, there may be some indication of the behavior that needs to be modified to reduce conflicts.

c) *Police discussions*

Although the police focus following an accident tends to be on prosecutions, discussions with groups of officers who regularly attend the scene of accidents may reveal commonpatterns of behavior that publicity campaigns could be specifically designed to address.

d) *Attitude testing*

A person's attitude will affect the way they behave and by changing attitudes it is possible to change the resultant behavior. Attitude testing needs to be done properly to be valid. Sample groups of the target population (focus groups) can be surveyed by specialist public opinion organizations. If there is a limited budget it may be possible to involve university students to carry out the work as a piece of research.

e) *Knowledge testing*

It could be that road users are not behaving in a safe way because of lack of knowledge. For example, if many accidents occur because of drunk-driving it may be that the drivers concerned do not know the effects of alcohol. Knowledge testing can be more easily carried out than attitude testing by means of a questionnaire or survey.

One of the advantages of using data-led methods to determine the behavior, knowledge, or attitudes that may contribute to accident causation, is that the same measures can be applied at a later date to help determine the effectiveness of the campaign.

3.2 Campaign Design

Once the problem has been identified, it is necessary to consider the target behavior, target audience, what will motivate the target audience to change their behavior, message content, the media, and the appeal that are most appropriate.

3.3 Campaign Message

The campaign has to identify the changes people should make. These should be actions that have a realistic chance of being influenced and may be the outcome of a political decision to accompany another remedial measure (e.g., new legislation) as a result of public pressure, or as part of a long-term road safety strategy. The objectives of the program should be clearly defined so that relative success or failure of the publicity can be measured.

Traditional publicity campaigns have often been seen as the imposition of ideas, or preferred behavior, upon a public that has largely remained slow to be convinced of the benefits. The problem is that often certain actions are not seen as risky when they are something the individual does, probably daily, without experiencing an accident. Whatever the behavior change that is being promoted through publicity, it must have benefits to the target audience, even if it is not directly safety-related.

The message content for publicity should be clear, unambiguous, and directional. General exhortations such as "drive safely" are not particularly effective. Campaigns should concentrate on a single concise message (e.g., do not drink and drive) and should not confuse the target audience with related messages, however well-meaning. It is easy to assume that the intended message is actually being received, but

this is not always the case, and campaign messages should be used in copy trials to ensure the proper message is conveyed and that the message catches the attention.

Market research techniques can be used to find out if the message is understood, or can decide which of several designs is the most memorable or eye-catching. It should be noted that in general, a one-off campaign is unlikely to result in any long-lasting behavioral changes. When a change in attitudes is required (e.g., drunk-driving or speeding) it is especially necessary to plan a sustained series of campaigns on a theme over a long period of say five or even ten years.

The timing of any single campaign or other initiative needs to be considered in terms of length of the campaign and also the most appropriate times of year to run it. Individual campaigns should not generally be too long as impact is lost and the message becomes diluted or ignored.

Positive instruction is preferred. As most road users overestimate their road safety behavior, if perpetrators are targeted, most viewers will not identify with the offender.

3.4 Target Audience Selection

Although the use of mass media will result in widespread awareness, a publicist should select messages, images, and media such that the target group will be particularly influenced by them. It may often be appropriate to direct publicity at a limited and more manageable audience of, say, local opinion leaders. In some societies, particularly those with well-developed local community structures, it is not always necessary to target the public direct, but to reach the **enablers**, who are then able to **accelerate** the information process in ways appropriate to that local community.

The target group need not be the same as the accident victim group as, in the case of pedestrian accidents, motorists are often the target group for publicity campaigns. Likewise, child accident involvement problems are often addressed through targeting parents and care providers.

Mass media can be used to advance a social or public policy initiative, such as road safety. This approach is termed media advocacy. It does not attempt to change individual risk behavior, but focuses attention on changing the way the problem is understood as a public health issue. It attempts to use the media to increase public support for more effective policy-level approaches to public health problems.

3.5 Pilot Testing

It should be stressed that publicity is a culturally sensitive device and is probably the least directly transferable from country to country of all the road safety measures available. It is also a demographically sensitive tool, and the use of language, images, and messages should be designed for precise target population groups, whether by age, sex, ethnic origin, or the recently revealed importance of lifestyle. Of prime importance in publicity is not only **knowing your audience,** but, in particular, what motivates it. Certain general principles and techniques may, however, be established that will be of relevance to all countries in the region.

3.6 Success Indicators and Methods of Evaluation

Unless clear objectives have been defined, it will not be possible to devise effective evaluation methods. The indicators used will vary according to the complexity of the subject and the time period involved. Criteria for effectiveness may involve one or more of the following:

1) drop in numbers or severity of accidents;
2) changes in actual (observed) behavior;
3) changes in claimed (not observed) behavior;
4) changes in knowledge;
5) changes in opinions; and
6) recall of the campaign.

In general, this list may be seen to be in ascending order of validity, but descending order of convenience and ease of use. If reduction of accidents is to be used as a measure, then the time interval must be great enough to pick up any effects. While use of accident statistics may be appropriate, especially in the case of long-term (five- or ten-year) campaigns, in the shorter term it is not appropriate to use ac-

cident data alone. Wherever possible, multiple measures should be used. If accident data is used as a means of evaluation, only the stimulus, i.e., the publicity, and the end result are known. It can be helpful to have information on the best path that will achieve the end result. It may help to indicate why certain programs were successful and other why other programs failed. The information gained should be fed back into the design of future campaigns so that there is a dynamic process of improvement.

3.7 Identify Any Other 'Players'

It is sometimes preferable to have the message come from more than one source. Other groups with a likely interest include police, doctors, health promoters, interest groups, and the private sector. Where different agencies have responsibilities for road safety, it is important to ensure that coordination takes place to maximize effectiveness and to reduce fragmentation of effort.

Some countries will find it useful to create a campaign planning group that will steer the initiative. Once a message has been agreed upon by the safety specialists, it is sometimes the subject of top-level political scrutiny. Although road safety is generally not regarded as party political, there may be political sensitivities about the nature of the message or the likely public response. Clearly, politicians are not always ready to publicize a safety issue that opponents could seize upon to point to past failures, or that might conflict with policies from elsewhere within the administration.

It is probably at this stage also that consideration will be given to employing the services of a professional advertising and marketing agency. These companies can offer good value for money with their creative advice, media buying power, and experience of the market place. A good agency should be able to extend the **reach** of the campaign by drawing in the financial or service support of other organizations.

These agencies can be asked to compete for a single contract, or for a more long-term association. They can usually be asked to provide a speculative presentation of how they would tackle the brief if they won the contract. Those agencies with a proven track record in safety, health, or public service publicity will obviously have the advantage.

3.8 Sources of Funding

Although some countries will have direct access to radio and television time, or be able to influence program controllers, it is likely that paid advertising will form part of the publicity strategy. This can be expensive, especially if prime air-time or newspaper spots are sought. Sharing the cost of advertising with others, including commercial sponsors, may extend the buying power of the campaign planning group. Many businesses, particularly those in the field of insurance, will have an interest in being associated with safety. Part of the brief to an advertising agency could be to locate other sources of funding or **value added** from within the private sector. It may also be possible to negotiate special rates with the media to increase value, as part of their public responsibilities.

3.9 Select Carriers of the Message

The carriers selected will depend on their cost in relation to the available budget, and their appropriateness to the target population group. Not all publicity needs to utilize paid media advertising, though this is the obvious route to take in any country with a well-developed commercial press, radio, and television. In these countries, a budget for advertising should create a media mix suitable for the target group and message. Thus a campaign aiming at youth might concentrate on popular journals and radio and television programs with high audiences of teenagers.

Television is by far the most potent mediumfor awareness, though in some countries this will preclude certain rural areas, and certain socio-economic groups that do not have ready access to the electronic media.

In countries with well-developed family and community networks, these may be accessed to great effect, and most countries have their informal communication network. The practices and expertise within health agencies should be closely observed in this field, as they usually have had many more years of experience than road safety practitioners in changing individual behavior through community action and public education.

Once the problem has been identified, it is necessary to consider the target behavior, target audience, what will motivate the target audience to change behavior, message content, and the media that is most appropriate.

The media used will depend largely on the target audience. It is necessary to consider where the targeted road users are likely to see a message, e.g., what newspaper do they tend to read, and issues such as literacy rates. The choice of media will also be influenced by cost. A combination of media should be considered and could include: television, radio, cinema, newspapers, posters, billboards and hoardings, leaflets, stickers, speeches, or special events such as conferences, exhibitions, and competitions.

3.10 Appeal

The images chosen will depend on the target audience. Shock/horror is not always appropriate or effective though, effectively handled, it can tackle complacency among the target population.

The campaign's appeal could be based on: horror, fear, grief, humor, information, endorsement, or responsibility. It is often possible to combine celebrity status with personal appeal as road accidents have affected so many. Actors and sports celebrities in many countries have begun campaigning for road safety after loved ones have been injured or killed in road accidents.

Campaigns can have several appeals, as in the case of pedestrian safety. Different approaches might be taken with pedestrians than with drivers and with children than with adults, although all will be aimed at reducing the risk of a selected pedestrian accident pattern.

3.11 Implementation

The timing of the publicity should be synchronized such that it is associated with another **partner measure,** such as the planned introduction of a new law, an enforcement initiative or engineering initiative, or the availability of new safety equipment (e.g., reflective clothing for use by pedestrians and cyclists after dark). It is particularly useful to synchronize a centrally-run campaign with local initiatives on the same theme.

Formal launches designed to attract free media coverage can also be a useful opportunity to involve the appropriate minister or other figurehead, and thus further legitimize the measure. Thereafter, every effort should be made to put the message in front of as many of the target group as possible, as often as possible. There is evidence that people need to see the publicity many times before they acknowledge it, and even more times before they act upon it.

3.12 Monitoring and Documenting

Once the campaign is over, it is important to collect data regarding its effectiveness. This should be documented, in order that it may contribute to a knowledge of what does and does not work.

The above-mentioned aspects of planning and implementing road safety campaigns represent the ideal. Developing countries should review their procedures and devise a program that will allow campaigns to become more targeted and effective according to these principles, but in a way that is feasible for their particular circumstances. There are now various tried and tested methods available in the field of road safety publicity and several documents that offer guidance[3, 4]. The consensus of professional opinion is that road safety initiatives should be data-led and evaluated to determine their effectiveness.

4 STAGES OF DEVELOPMENT

For a country to make progress with road safety publicity there are some preconditions to satisfy, and then a logical and progressive course of action to follow.

A publicity campaign can be pursued only if there are the material and human resources available to give it a chance of success. Qualified staff should be sufficiently familiar with publicity techniques to run the campaign, or to commission and monitor a campaign run by a professional publicity and marketing consultancy.

While a certain amount of free publicity can be expected from media editorial, or by piggybacking on other organizations' materials, a realistic budget is needed to penetrate the market.

There also needs to be a companion initiative running alongside the publicity. This could

be an engineering development, new legislation, a new enforcement program, or a new safety product. In many countries, political will is also an essential precondition.

The main milestones and activities recommended during the different stages of development are as follows:

1) **collect data**, not just about accidents but also about the people involved. Many campaigns fail because they are devised by one type of person (often in the professional classes), yet are directed at another type of person (often in lower socioeconomic classes) whose motivations have not been adequately researched;

2) **decide who you want to communicate with, and what you want them to know or do**. Do not try to communicate with everyone just because you are using mass media. Choose a specific target sector;

3) **design the campaign and build in performance indicators**. When you have selected the best type of media, write down what success indicators you would expect for each phase, and review them regularly;

4) **implement the campaign** alongside other measures and agencies if possible. It pays to link the publicity to related safety measures. It can also be useful to have the campaign backed by other agencies or organizations. Commercial sponsorship is useful not only for the extra money, but because it implies the endorsement of the message by another organization not usually associated with road safety. Linking road safety with health promotion is particularly useful; and

5) **learn from the success or failure of the campaign**. The temptation can be for the campaign organizers to neglect monitoring outcomes and claim success based on output alone. The temptation must be avoided whereby the production of a glossy poster can be seen as a success in itself. To justify the diversion of scarce safety funds into publicity requires more than an act of faith. It requires **evidence** that its objectives have been met.

Plate 1: Speeding campaign supported by posters in the United Kingdom (UK).

5 BENEFITS AND EFFECTS

Publicity can help achieve compliance with road traffic laws, and help achieve general public support for the aims of road safety, thus making it easier to justify the continued allocation of central resources to other measures. Publicity can create a better informed public and contribute to that elusive achievement of a safety culture, where the demand for safety eventually comes from the population itself. Even the publicizing of road accident data in itself can boost the awareness among the public of the scale of the country's safety problem.

If the campaigns are potent enough, most people are likely to be affected, including the nation's opinion leaders, magistrates, politicians, and police. These key people may not always be as well-informed, or give safety the

personal priority and attention they might. Enforcing a drunk-driving program will be easier if the public perceives that politicians lead by example, magistrates give appropriate sentences, and police are not themselves suspected of drunk-driving practices.

Publicity is an indispensable part of any nation's road safety strategy, though it should not be used in isolation of other measures. Campaigns will be successful if they are implemented alongside an engineering, legislative, or enforcement measure. If road safety publicity is mishandled it can be ineffective, and a waste of resources. To be successful in meeting its objectives, publicity deserves to be given the same specialist attention and thorough preparation that would be given to the other technical components of the road safety plan.

6 EXAMPLES OF GOOD PRACTICES

The following documented examples of successful of road safety campaigns are taken from both developed and developing countries. They illustrate the benefits of targeting, planning, and monitoring the results of publicity. Themes for campaigns can be adapted from those found to be successful in other countries, but they must be adapted to local needs and cultural sensitivities.

Subject: Child pedal cycle helmets
***Location*:** Australia
Facts: As a result of a social marketing strategy, involving mass media, head injury rates for cyclists declined by 20 percent within three years, and helmet wearing rates rose in young children from 5 percent to 39 percent in a little more than a year. These results were due to a number of changes that made helmets more attractive to the target group, and the use of television and other media reinforced the benefits of making the exchange in social marketing terms.

Subject: Encouraging left-turn drivers to yield to pedestrians
Location: Victoria, Canada
Facts: After an intensive five-month multimedia publicity campaign, a significant improvement in yielding behavior was observed. This occurred in the longer, rather than shorter term, and may have been more effective with older and female drivers.

Subject: Public awareness of accident problems, particularly to children, and awareness of a new National Road Safety Council
Location: Fiji
Facts: Using funding from a national levy on car insurance policies, the newly established Fiji National Road Safety Council recruited the services of a local advertising agency with a clear brief to promote awareness of the Council. To demonstrate the function of the Council, there was publicizing of road accidents to children by the distribution of a child accident leaflet, a junior road code, a touring safety theater production, and printed advice to parents in several languages.

Subject: Pedestrian safety
Location: Nepal
Facts: A road safety project in Nepal funded by the Overseas Development Administration (ODA) of the UK provided a road safety publicity technical assistance input that supervised the design and production of a pedestrian safety campaign and produced a road safety publicity design manual for use with future campaigns. Market research surveys and focused discussion groups were conducted to determine the most effective media for different road user groups, including drivers, adults, and children. The pedestrian safety campaign was directed at pedestrians and motorists alike. Good coordination was achieved with traffic police as initially offenders received warnings and instructional leaflets.

Subject: Drunk-driving campaign
Location: UK
Facts: A sustained media advertising commitment between 1979 and 1994, combined with improved police testing procedures, resulted in a halving of the numbers of men who drove after drinking, and a reduction from 15 percent to 4 percent of men who drove while over the limit. The proportion of men who felt it was difficult to avoid drinking and driving in the social context fell from 61 percent to 30 percent. Between 1979 and 1994, drunk-driving deaths dropped from 1,780 per year to 550. The breath test failure rate dropped from 42 percent to 6 percent. Drinking and driving is now popularly regarded as a totally antisocial activity.

Subject: Home safety
Location: Newcastle, UK
Facts: A television campaign on safety resulted in 9 percent of families in the study taking action to make their homes safer. When

another mass media campaign was followed by targeted advice by health visitors during home visits, the proportion of families making changes rose to 60 percent.

Subject: Seat belt wearing
Location: UK
Facts: It took 22 years between the first Parliamentary questions relating to mandatory front seat belts in cars to their approval in legislation in 1981. Before legislation, long-term intensive media promotion of belts resulted in a slight increase in voluntary wearing. The wearing rate after legislation rose to more than 95 percent, and this has been sustained. The media phase helped convince the nation, including policymakers, of the benefits of belts, and the subsequent passing of legislation was the cue for most people to change their behavior.

Subject: Children falling from windows
Location: New York, United States (US)
Facts: A combination of mass media, individual education, home inspection, and provision of reduced price window locks resulted in a 35 percent decline in deaths due to falls.

Subject: Traffic safety
Location: Viet Nam
Subject: Drunk-driving
Facts: The National Traffic Safety Commission of Viet Nam initiated a regular television series on traffic safety. Each program lasted ten minutes and more than 80 percent of the programs related to road safety. While Commission funds paid for the production costs, Viet Nam television did not charge for the broadcasting time and showed each program during peak hours (before the Wednesday evening film, as well as another showing during the day). Many topics were covered by the series and the program could have benefited from fewer messages being regularly reinforced. One message, on motorcycle racing, had been reinforced by increased enforcement targeted at motorcycle racing. The Commission also began publishing a traffic safety magazine, but had not been able to coordinate the topics with the television series.

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Road Safety Guidelines

for the Asian and Pacific Region

4.9

VEHICLE SAFETY STANDARDS

Asian Development Bank

4.9

VEHICLE SAFETY STANDARDS

Without vehicle construction regulations governing safety standards, for systems such as braking, lighting, and signaling, there can be little control over the general safety of the country's vehicle fleet. For public service vehicles (PSVs), standards of comfort, access, and additional safety requirements are also needed. For heavy goods vehicles (HGVs), standards of size, gross vehicle weight, and maximum axle loads are necessary to ensure the safety of all road users and to minimize damage to the environment. Imported used vehicles must always be checked on arrival in a country to ensure they comply with national safety standards. Statutory testing is required to ensure that at regular intervals, vehicles meet a minimum acceptable standard of safety. The most important items that should be inspected are as follows:

- braking system;
- steering;
- tires; and
- lights.

While there is no international fixed agreement on the age of first testing of vehicles, it is recommended that light vehicles in developing countries are tested after three or four years and then annually, whereas high utilization vehicles such as HGVs, PSVs, and taxis should be tested after one year, and then annually with inspections every six months after 10 years of age. These are recommendations for minimum testing frequencies. In order of priority, the components necessary for an effective vehicle roadworthiness testing system are as follows:

- a legal framework;
- a coordinating and managing authority;
- trained and qualified staff;
- adequate testing facilities and equipment; and
- an enforcement and backup operation.

PRIORITY ACTIONS NEEDED

1. Vehicle defects most likely to contribute to road accidents and casualties should be targeted in routine and roadside vehicle inspections.

2. Checklists, assessment forms, increased controls, and training programs should be used to encourage uniform testing standards and procedures between stations and inspectors and to minimize corruption.

3. Random roadside inspection checking should be introduced involving the police and vehicle inspectors day and night to encourage compliance with safety standards.

Vehicle safety standards are necessary to ensure unsafe vehicles are not imported and to develop a safety culture among vehicle operators, owners, and users. They must be backed by adequate roadside checks in order that the overall standard of vehicles is gradually raised. The end result should then be a reduction in the contribution of vehicle defects to road accidents.

1 INTRODUCTION

These sector guidelines on "Vehicle Safety Standards" are from a set of Road Safety Guidelines for the Asian and Pacific Region policymakers, developed as part of a regional technical assistance project (RETA 5620) funded by the Asian Development Bank (ADB).

They deal with the need for effective control of vehicle design, construction, operation, and maintenance standards and the means by which these can be assured in order to reduce to a minimum the effect of poor vehicle condition on road users and infrastructure. These sector guidelines consider the need for enforcement of vehicle standards, how standards are assured, and the essential links in a vehicle standards system.

2 WHY THE NEED FOR VEHICLE SAFETY STANDARDS?

Studies carried out in the United Kingdom (UK) in recent years have indicated that between 5 percent and 8.5 percent of accidents are directly caused by vehicle condition faults. Other recent studies in the country indicate that 25 percent of goods vehicles and 11 percent of large passenger carrying vehicles involved in accidents have contributory defects.

In developing countries, it is likely that vehicle defects are more often a factor in accidents as vehicle condition is generally much worse. The vehicle fleet is usually older with many vehicles imported second-hand from other countries. And there may be difficulty in obtaining suitable spare parts.

In addition to a shortage of specialized equipment and tools, maintenance skills are often scarce and knowledge of modern repair techniques is frequently poor. Short-term thinking often dominates maintenance and repair decisions. Lack of a formal apprenticeship system or of technical training colleges can result in poor maintenance as there is little incentive to develop trained technical repair staff.

Lighting defects are common in developing countries. Roadside surveys conducted in Kathmandu, Nepal, in 1996 found only 40 percent of trucks and buses inspected had front lights and a nighttime survey of long distance buses found two thirds with one or no rear lights. Vehicle lighting is even more important in developing countries where road lighting, and road marking, and signs are inadequate and driving conditions poor.

Bus accidents are likely to be serious with a high loss of life when they occur in inhospitable regions remote from rescue services. For example, a bus accident in Peru in 1995 killed more than 30 people when the vehicle rolled down a mountainside after the driving lights had failed and the driver steered the vehicle with one hand while holding a flashlight out of the window in order to follow the road. Similar accidents are common where the predominant form of passenger transport is the bus.

Overloading is a serious problem in many developing countries. Each vehicle has a designed maximum weight, which depends on the structural strength of the chassis, suspension, braking system, tires, and engine power. In addition, many countries regulate the effect on road surfaces and bridges by controlling the gross vehicle weight and individual axle load to a figure lower than the gross vehicle design weight.

Unofficial modification of goods vehicles by welding reinforcements or extensions to the chassis or the addition of an extra axle can result in a vehicle with a seriously compromised safety performance. This practice is common in many countries that have ineffective regula-

tion of construction standards. Trucks may use a combination of chassis strengthening and an extra axle to double their load carrying capacity. Unfortunately, even the extra axle may only increase braking capacity by 50 percent, whereas the gross weight may have increased by two thirds.

Buses are often constructed on truck chassis using materials and designs that offer little or no protection to passengers in the event of an accident. Leg room between seats is often exceptionally poor in order to squeeze the maximum number of seats in the vehicle, and the seat frames themselves are usually formed from angle steel, frequently causing amputation of limbs in an accident. Emergency exits, when provided, are often blocked by a row of seats, making their use difficult.

Secondary safety in general, i.e., what happens to occupants during an accident, is a subject the vast majority of local vehicle builders appear to know little about. They rarely incorporate safety elements during indigenous vehicle construction or adaptation.

Some form of regulation of vehicle builders, especially those in the informal sector who build bodies on basic chassis, is an essential step on the way to providing safe transport for all sectors of the community.

Vehicle construction standards can also influence the extent of injuries incurred in road accidents. Seat belts, pedestrian-friendly vehicle fronts, and safety glass are examples of how vehicle standards can help protect and minimize casualty severity. Conversely, the construction of vehicle bodies from timber can result in severe injuries in even minor accidents as the wood splinters rather than deforms as sheet steel should, and it absorbs more of the impact energy in so doing.

Vehicle gaseous, particulate and noise emissions also have major effects on the environment. When at high concentrations, and in conjunction with certain other atmospheric conditions, these can present a major health hazard. This is especially important in cities within the tropics where large numbers of people live and work on the streets, or where the topography does not permit easy dispersal of such gases.

Plate 1: Simple low cost inspection ramp in Fiji.

3 KEY COMPONENTS

In order that a vehicle can be maintained in a safe, roadworthy condition it is necessary for various legal and operational systems to be linked. These systems include:

1) legislation;
2) management and administration;
3) equipment and facilities;
4) training and staffing; and
5) ownership.

These constitute the key components that must be in place for this sector to operate effectively in terms of road safety. Each of these is discussed briefly below.

3.1 Legislation

Before any testing system can be embarked upon, the legal framework by which it is to be regulated should be produced. The legislation should include the components or systems, standards, and authority for testing. It is essential that the legislation is in the form of an enabling bill that is unambiguous, clear, and general rather than specific. The specific requirements of a testing scheme should then be detailed in separate regulations that can be easily updated and are enabled by the main legislation.

Procedures (including monitoring) are the responsibility of the relevant government body and should draw on best practices of existing methods from other countries. For example, the relevant European Community directive (77/143/EEC[1] and amendments) forms an excellent basis for any roadworthiness scheme and can easily be modified to cope with local conditions. Similarly, the British Vehicle Inspectorate publications[2-6] on the inspection of

the different classes of vehicles are models of clarity and are freely available.

Similarly, the regulation on construction and use may be drawn up with reference to legislation from other countries adapted as appropriate to local needs, conditions, and resources. These should define the requirements for the various types of vehicles and what initial inspection (type testing) of locally-built or imported second-hand vehicles is necessary.

In order to ensure that vehicles are presented for test when required by law, it is necessary to have an easily identifiable control system. This, if enforced, can help to ensure all vehicles undergo inspection testing and can control the flow of vehicles through testing. Many countries have legislated the use of color-coded windshield stickers that give the vehicle inspection date and that make it easier for police and other enforcement authorities to see when a vehicle is due for retesting. This encourages compliance with testing requirements.

Plate 2: Training of vehicle inspection staff in Fiji.

Given the reliance on imported vehicles (both new and reconditioned) in many Asian and Pacific countries, regional standardization and harmonization of vehicle design and construction safety standards would prove useful for the motor vehicle importing nations, ensuring safe vehicle standards. There is nothing intrinsically wrong with importing second-hand vehicles as long as they are roadworthy. Care should, however, be taken to ensure that these vehicles have not been imported because of dangerous faults. Any second-hand vehicles imported should be subject to a roadworthiness inspection that is, of necessity, more rigorous than the routine inspection. A system of type approval should be established that requires all imported vehicles to comply with safety requirements of the major vehicle manufacturing standards in international use.

3.2 Management and Administration

The policy implications of operating a particular vehicle testing regime need to be carefully evaluated by the responsible body. The requirements need to be continuously monitored and the degree to which performance targets are met assessed. Inspection frequency and length of inspection determine staffing requirements but the organization of test stations is also critical for staffing needs.

It is vital that clear lines of reporting are constructed that allow two-way communication between the headquarters and the test stations. These comments apply equally whether the inspections are carried out in the private sector or in the public sector. Irrespective of who does the actual testing, the overall policy and management should be kept within the government.

Clear manuals and documentation are necessary to ensure that common systems, and standards of testing and enforcement are used throughout the region, and that all essential vehicle systems are checked. These manuals should include procedures and failure modes and should also be freely available to the public in order that their confidence in the system is not only generated but maintained.

Public perception of vehicle testing in many countries is that illicit payments to the vehicle inspector will result in preferential treatment. The regular checking of testing premises, procedures, and recently tested vehicles is necessary to ensure that the system can be seen to be open and honest. Wherever possible, direct and private contact between the tester and vehicle owner or operator during the test procedure should be eliminated in order to reduce opportunities for corrupt payments to influence the test outcome.

3.3 Equipment and Facilities

Requirements will vary considerably, depending on the resources available in a particular country, the stage that existing and proposed testing has reached, and the technical education and skills of the users. The use of low-cost, locally manufactured equipment may often be preferable to expensive high-cost equipment that requires skilled use and maintenance, often at a high regular cost. Basic testing of brakes and lights can be done even with simple equipment. The exact equipment requirements are not listed here as they are beyond the scope of this Guidelines. They would obviously be customized to the requirements and resources of any country requiring them. De-

pending on sophistication required, the cost could range from US$100 to US$100,000 per test lane.

Although equipment is essential for many of the standard tests used in more developed countries, it is not totally indispensable and it may often be feasible to replace it with simplified test procedures. Although precision and accuracy may suffer, similar tests may be carried out with low-cost, locally produced equipment. Table 1 below gives an indication of equipment requirements for different levels of roadworthiness testing.

It should be noted that computers are now relatively inexpensive so that even the lowest-cost organization should actively consider their introduction for all aspects of administration.

Equipment is often designed by a manufacturer for a particular market. When sold in a new market, the problem arises of lack of know-how, both in equipment operation and maintenance. The provision of equipment without maintenance contracts is unfortunately all too common even where the inspectors have been given instruction in operation of the equipment. In several countries roller brake testers have been observed in an unserviceable condition because of a lack of maintenance and parts. In other countries this may be compounded by the donation of equipment through bilateral aid without any training or maintenance backup.

The preparation of clear, written procedures, where possible in the local language but most definitely in the official language, is essential. These procedures should include elementary fault finding, routine calibration, cleaning, and basic maintenance. Where the results from testing a system are dependent on the design of that system, then amplification notes must be provided. More complex maintenance should be contracted to the local agent for the equipment or to a reputable local company with skills in the maintenance of electro-mechanical equipment.

Monitoring of pass rates by inspector, test station, and vehicle class can quickly identify departures from the norm. Although computerization of testing is feasible, it is likely to be impractical given available resources. How-

Table 1: Equipment Requirements

Level of testing	Equipment/characteristics
Basic • No previous effective testing • Below 20 vehicles/1,000 inhabitants • Gross domestic product (GDP) per capita below US$500/year • Widespread evasion of testing	Low-cost equipment • Headlamp pattern marked on wall • Black smoke visual inspection • Brake test on road using decelerometer
Medium • Testing carried out but has been restricted due to domestic situation or lack of resources • Below 100 vehicles/1,000 inhabitants • GDP per capita above US$500/year • Evasion common	Mixture of equipment • Optical headlamp meter • Black smoke meter • Tire tread depth gauge [low-cost] • Roller brake tester for heavy vehicles • Brake test on road using decelerometer for light vehicles • Steering free play meter
High • Routine testing to consistent international standards • Above 100 vehicles/1,000 inhabitants • GDP per capita above US$3,000/year	High-quality, standardized equipment • Optical headlamp meter • Black smoke meter • CO/HC meter • Tire tread depth gauge • Roller brake tester for all vehicles • Steering free play and suspension checking equipment
State of the art • High motorization with need for control of vehicle numbers • High income GDP per capita above US$10,000/year	Computer controlled equipment minimizes operator subjectivity and maximizes throughput. • Possible full control by one organization • High security documentation and control paramount

Plate 3: Singapore training station.

ever, computerization of all testing data results will permit rapid evaluation of performance. A quick response to irregularities will have much more effect than disciplinary action 6 or 12 months after the effect. Such monitoring should take place weekly to ensure upholding of standards.

Accident and defect data records will be an important way of evaluating the relevance of the vehicle inspection process and should be carefully maintained. The need for an accident inspection capability should be evaluated in connection with the police and insurance companies, and a clear funding mechanism should be established.

All vehicle inspection services should charge fees to recover costs and generate funds for investment in equipment and control systems. This applies to operations carried out by both the public and private sectors. It will also apply to regulatory work carried out by a government body to oversee private testing.

3.4 Training and Staffing

Inspection and supervisory staff, qualified to a set standard of technical ability in order to make judgmental decisions on pass/fail criteria, are necessary in any system. Training of inspection staff in methods, standards, administration, and control of the systems and equipment is essential before any testing regime can be adopted. The training could be from either the public or private sector, depending on the local situation, or could be carried out locally by trainers from other countries. It can be carried out in public sector or private institutions, but may involve overseas training or visits by experienced staff in order that best international practices may be assimilated.

The Vehicle Inspectorate in the UK, for example, runs numerous courses on vehicle inspection and has team of expert trainers that are available for training staff in all aspects of vehicle testing, to a variety of technical standards.

Plate 2 shows a group of examiners in Fiji being shown vehicle testing methods and techniques using videos produced in Germany and the UK as part of practical and theoretical instruction on location. Such training should always be focused on the vehicles and equipment that are available in the test stations in the home country.

Courses should all be aimed at qualified mechanics who should have a detailed knowledge of vehicle technology, repair, and operation. The training itself can then concentrate on "how to inspect a vehicle". It should concentrate on components and systems to be inspected, how to inspect them, and reasons for failing them. Such a course could cover all vehicle types and classes within a two-week period. Each course would train up to eight inspectors with one trainer being involved per class. This will obviously depend on a common language between trainer and students.

Frequent information updating and in-service training sessions are important for maintaining the professional standards of vehicle inspectors. Staffing requirements will obviously vary with the complexity of the inspection and facilities.

3.5 Ownership

Different countries adopt different policies towards ownership and control of vehicle testing facilities. Each has its own advantages and disadvantages that may be more suitable to the country, its demographic situation, and legal, political, and financial policies. The vehicle inspection system can be privately or publicly operated or a combination of both. In any event it should be regulated by the government via the local ministry of transport. The key features of these alternative approaches are outlined below.

Private ownership and operation: Full private ownership reduces the capital costs to the state to a minimum but necessitates strong and independent supervision of testing standards, facilities, and training of testing station staff.

This system has been adopted by Singapore where three main contractors (all qualified to International Quality Assurance Standard ISO 9002) have been licensed. There is, in addition, an enforcement regime operated by the Registrar of Vehicles and the police. A government testing station, formerly the only standards enforcement facility, is available for testing suspect vehicles by government examiners. Testing of light vehicles in the UK is also carried out by the private sector with appropriate control and enforcement by the government.

Public ownership/private operation: Public ownership of the testing facility but operated by a private enterprise is one of three systems operated in Hong Kong, China and regularly offers the business out to contract. This has the advantage of lowering the immediate capital cost to small operators interested in tendering. Since government maintains a presence in the testing station for booking and other functions, it is also possible to monitor standards closely. It increases the government capital outlay but ensures it keeps closer control over property and land rights.

Public ownership and operation: Public ownership and operation of the facility is the system used in the UK for much of the testing of HGVs and PSVs. It ties up considerable governmental capital but can offer an unbiased and relatively corruption-free service whose running costs are completely funded from test fees. It is appreciated by most vehicle operators, whose associations canvased for its retention when privatization of the testing system was proposed. This system is also used for testing of all types of vehicles in a number of Asian and Pacific countries. Effective monitoring of activities is, however, necessary. In many such countries, public servants are extremely badly paid and the possibilities of corruption may be higher within an inefficient government system than in a closely regulated private system.

Private ownership/public operation: Private ownership of the facility with testing carried out by public sector inspectors is a system now being encouraged in the UK. The private operator (often a transport operator with a large fleet of vehicles) installs equipment in the premises to the specification of the Vehicle Inspectorate. Tests are booked through the parent Vehicle Inspectorate Testing Station by operators who wish to have their vehicles tested in the facility. A vehicle inspector visits the premises and carries out the tests. This has the advantage of providing a more immediate service to the customer, reducing traveling and down time but increases staff costs to the Inspectorate.

Much of the specified equipment should already be held by large organizations for regular maintenance and diagnostics, providing a safer operation; it has the disadvantage of possibly adding a capital cost to their operation for any extra equipment not already needed for maintenance. However, some of this cost can be recouped by charging a fee to visiting operators.

3.6 Spot Checks and Enforcement

Random roadside spot checks, using a joint team of police and vehicle inspectors, are of crucial importance in reminding drivers and operators of the continuing need to upkeep vehicles for safety. These checks can be combined with document and weight checking, forming a useful enforcement tool that can be installed for long or short periods at a variety of locations.

The standards of vehicle maintenance and operation can be effectively controlled only by regular vehicle condition checks carried out in approved and regulated testing premises and by frequent roadside spot checks so that all drivers feel at risk of prosecution if they drive a vehicle without a valid roadworthiness certificate.

4 STAGES OF DEVELOPMENT

The most simple systems should be considered first. They are the least likely to be affected by corruption, will need the least funding and training, and can proceed with the minimum of outside help.

Countries should be realistic about the number of vehicles they can test in relation to the number of trained staff available. Frequently a country's existing inspection system is struggling under the weight of requirements of testing every six months and lack of staff. Consequently, one of the ways to reduce the number of vehicles to be tested is to increase the time to initial test for new vehicles, reducing the severity and range of vehicles to be tested. As a general rule, fewer good tests of dangerous vehicles are preferred to many tests of minimal value.

Training should be carried out in the home country and tailored appropriately to the vehicle type and systems of the country.

Monitoring systems should be established and should be rigorous and independent. Data should be collected frequently and analyzed quickly to identify unusual patterns in pass rates.

Fees should be set at a level that will enable the organization's costs to be recovered and that will allow investment in improved control procedures and equipment.

Routine inspection should be reinforced by frequent random roadside checks undertaken by police and vehicle inspectors working in collaboration.

5 BENEFITS AND EFFECTS

Maintaining vehicle safety standards has the following three main benefits:

1) safety culture is promoted and all motorists know they have a responsibility and obligation not to drive unsafe or unroadworthy vehicles on the road;
2) vehicle defects are a contributing factor in a smaller proportion or road accidents; and
3) the severity of injury of casualties is reduced as vehicles are safer.

Perhaps the most important aspect of a vehicle roadworthiness scheme is the promotion of a safety culture. Knowing that the vehicle has to meet certain minimum standards of safety will encourage drivers to think about safety and why the roadworthiness requirements are there. Safe driving and vehicle condition are closely interconnected as it is difficult to care about driving standards when you do not care about the condition of the vehicle you drive and the safety of your passengers.

The phrase "minimum acceptable standard" has a very clear meaning and is one that should be appreciated by all vehicle operators. It means these are the lowest standards at which vehicles should be allowed to operate. Vehicles that are maintained to barely "acceptable standards" will be unsafe and in an unroadworthy condition for most of their time on the roads. It therefore follows that vehicles should be maintained to a higher standard to allow for any deterioration between servicing to ensure that they do not reach a condition in which they are unsafe to use.

Safer vehicles will generally be involved in fewer accidents. Even when accidents do occur, less serious injury may result because of the safety features (e.g., seat belts or safety glass). When all systems are working correctly, it is possible that drivers may be able to reduce speed more quickly and take evasive action such that the effects of an impact are minimized, perhaps with reduced injury.

It should be emphasized that vehicle inspection is a safety inspection. Incorporation of too many nonsafety-related items can have a detrimental effect on the inspection, and it is strongly advised that these are kept to a minimum and only included if they are directly relevant to the operation of the vehicle; e.g., exhaust emission testing.

6 EXAMPLES OF GOOD PRACTICE

Singapore has what is probably the most sophisticated and closely regulated system in the world for control of vehicle standards. Plate 3 shows the interior of one computer controlled and automated station, owned and operated by Singapore Technologies Automotive (STA). A third station is shortly to open.

The Singapore vehicle testing system might be perhaps better described as ideal practice. The inspection flow chart for Singapore testing stations is shown in Figure 1. Other countries within the region with good vehicle testing systems include People's Republic of China; Hong Kong, China; Republic of Korea; and Malaysia.

In the UK, the testing system has evolved over many years. The testing of buses started in an informal way early this century and developed until it was formalized in 1982. Inspection is carried out to a strict regime by examiners of the Vehicle Inspectorate in authorized premises equipped with specified facilities.

HGVs have been subject to this scheme since 1968. HGVs, PSVs, and taxis (i.e., including most public passenger carrying vehicles) are tested annually from the end of their first year of service.

Testing of private cars and other light vehicles was introduced in 1960. The date of first test was originally at ten years old but this pe-

Plate 4:
UK Testing station.

riod was reduced to three years. Light vehicles (under 3.5 tonnes design gross weight or 12 passenger seats) can be tested in private garages. There are about 18,000 of these throughout the country, authorized and supervised by officers of the Vehicle Inspectorate.

All testing systems are subject to continuous development to improve standards, and harmonization with European and international requirements, such as braking and environmental pollution. The HGV and PSV system in the UK is being developed to adapt it to computer control. It will maintain the depth of human inspection necessary to accommodate a wide range of vehicle ages, which can be difficult to achieve with the fully computerized systems used in some countries. Plate 4 shows a UK Vehicle Inspectorate Testing Station carrying out a close visual examination of a front wheel system.

The UK's period of testing is annual after three years for small private vehicles and annual after one year for HGVs, PSVs, and taxis. This is stricter than the equivalent European Union standards and the justification for more frequent testing is difficult to make. Some countries, such as Singapore, with its highly productive and sophisticated test system, specifies inspections every six months for HGVs, PSVs, and taxis.

7 REFERENCES AND KEY DOCUMENTS

The International Motor Vehicle Inspection Committee is a nonprofit making organization that exists to exchange information and experience continuously among its members within the field of safety and environmental inspection of vehicles. An International Motor Vehicle Inspection Committee, Comite International Del Inspectorate Technique Automobile (CITA), 1991 survey[7] of 21 countries in Africa, Asia, Europe, and North America concluded that there should be standardization throughout every country on methods of compulsory periodic inspection, the number of testing stations in relation to in-service vehicles, the testing station equipment, the minimum period of test for each type of vehicle, and a time limit during which different countries should comply. It also recommends that for developing countries, plans should be made to introduce progressive training for testing staff and the necessary testing equipment. The paper also considers, using information current at the time, and the pros and cons of the various types of testing organization, whether they are private or publicly owned and operated.

The UK's Vehicle Inspectorate has been converted to agency status and information available in its Annual Report gives a considerable degree of information that would be valuable in the setting up of a similar institution in other counties. The manuals for vehicle inspection and operation of a testing scheme are also published in the UK by the Stationery Office and are useful. The most useful documents in this sector are listed below: The relevant European Community Directives are EC Directive 77/143/EEC and amendments on the approximation of the laws of member states relating to roadworthiness tests for motor vehicles and their trailers.

2 United Kingdom Vehicle Inspectorate. Cars and Light Commercial Vehicle Testing (ISBN 0 11 551053 2).

3 United Kingdom Vehicle Inspectorate. Motor Cycle Testing (ISBN 0 11 551005 2).

4 United Kingdom Vehicle Inspectorate. Heavy Goods Vehicle Inspection Manual (ISBN 0 11 551063 X).

5 United Kingdom Vehicle Inspectorate. Public Service Vehicle Inspection Manual (ISBN 0 11 551070 2).

6 United Kingdom Vehicle Inspectorate. Ministry of Transport Testing Guide (ISBN 0 11 551056 7). The Stationery Office.

7 Ing Guido. CITA Working Group, "Promotion of the Vehicle Inspection." Paper: "Technical Inspection." CITA absi, Rue de la Technologie 21/25B 1082, Brussels, Belgium. Tel: (32 24) 69070; Fax: (32 24) 690 795.

Items 2-6 can be obtained from Stationery Office Bookshop, P.O. Box 276, London SW8 5DT, UK. Tel: (44 171) 873 0011; Fax: (44 171) 873 8200.

Road Safety Guidelines

for the Asian and Pacific Region

4.10

TRAFFIC LEGISLATION

Asian Development Bank

TRAFFIC LEGISLATION

Traffic legislation regulates the use of public roads and is applicable to the circulation of people, animals, and vehicles on the public highway and related activities. Where possible within the legislative system, the primary legislation should provide the basic features and framework, and the details should be specified within secondary legislation (i.e., through ministerial regulations). This allows flexibility for periodic revision without disturbing the primary enactment. Legislation provides the framework to promote and, where necessary, to enforce safer road user behavior.

Legislation specific to road safety includes as follows:

- driver licensing (criteria for license holders and driving test content);
- vehicle registration and testing (roadworthiness requirements and testing, and registration);
- control of traffic (speed limits, traffic signals, signs and markings, drink-driving, and pedestrians); and
- road authority.

Fixed penalty and penalty point systems should be considered wherever feasible as these have been found to be effective in reducing administration and influencing driver behavior in many industrialized countries. However, they may not always be as effective in the developing world. Areas of legislation directly relevant to road safety should be identified and all traffic laws reviewed and consolidated.

Drinking and driving is a proven cause of accidents. Enforcement of prescribed limit legislation has led to reductions of associated deaths and injuries in many countries. It is recommended that similar legislation prohibiting driving while under the influence of drink or drugs be devised that specifies a quantitative upper limit.

PRIORITY ACTIONS NEEDED

1. Review existing legislation and prosecution patterns to identify areas needing to be revised, and weaknesses in current legal system regarding citations and prosecutions.

2. Where it does not already exist, develop and introduce urgently legislation on drunk-driving limits and enforcement, speed zones and speed enforcement, seat belt and motorcycle safety helmet wearing, and compulsory third party motor insurance.

3. Where it does not already exist, develop and introduce urgently legislation on a national road safety council (NSRC) or similar to oversee coordination and improvement of road safety.

Traffic legislation provides the framework for traffic police and other enforcement agencies to ensure compliance with driving rules and regulations. Existing legislation should be reviewed, updated, and consolidated wherever possible. Legislation on drunk-driving, seat belt and safety helmet wearing, and speed zones where not already existing, should be introduced as a matter of urgency.

1 INTRODUCTION

These sector guidelines on "Traffic Legislation" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

This section cannot cover specific items of legislation in particular countries. It will, however, examine strategic issues that impinge upon road safety so that local legislation can be compared and evaluated to assess the need and practicality of updating it.

2 WHY IS TRAFFIC LEGISLATION NEEDED?

Traffic legislation regulates the use of public roads and provides a framework to promote and, where necessary, to enforce safer road user behavior. This is done by requiring compliance with specified standards for the benefit of all road users.

It is therefore necessary that there be a clearly defined framework of legislation supported by detailed regulations that are appropriate and relevant to the needs of modern traffic, and that permit effective enforcement to be carried out by relevant agencies to ensure safe and orderly use of the public road network.

Unfortunately, much of the legislation now in place in many developing countries of the Asian and Pacific region has evolved from the legislation of the colonial powers. This legislation has in only a few cases been comprehensively updated to meet modern needs. In most cases, however, this has been done simply by ad hoc changes as needed. This often results in confusing mixtures of old and new legislation and resultant ambiguity both for the public and for those enforcing the law. There are often problems and delays in judicial processing of traffic offenders, reducing the effectiveness of enforcement.

Traffic legislation updating is needed in developing countries where motor vehicles have increased rapidly in both numbers and capabilities, and where the existing traffic law no longer meets the needs of modern traffic conditions. As numbers of vehicles increase, it has become increasingly necessary to regulate road users and use of the road to minimize conflicts and to improve road safety.

It is therefore first necessary to consider how existing legislation could be reviewed, updated, and strengthened. This is best done through a systematic revision process, as detailed below:

The specific objective of traffic legislation should be clarified in order to ensure the legislation is written as clearly and effectively as possible and that it is appropriate for the local environment. Legislation can rarely be self-enforcing. It can only be effective if it can and will be enforced and if offenders can be processed by the judicial system. All traffic legislation should be reviewed according to the following criteria:

1) is there a need for the regulation?
2) is the regulation acceptable in principle and of practical application to the majority of the user population?
3) is it framed so as to be clear and unambiguous?
4) is it consistent with other regulations?
5) is the user population aware of it? and
6) is it enforceable?

Given the limited traffic policing resources that are characteristic of developing countries (especially in South Asia where many of the

lower ranks of traffic police personnel are not even authorized to cite traffic violations), these considerations are even more relevant. Traffic regulations should be kept to the basic minimum to increase their chances of being enforced.

Ideally, traffic legislation (passed as a traffic act by government) should provide the umbrella framework, and details should be specified in the regulations that are within a minister's authority and hence are much easier to revise. Examples where such flexibility would be beneficial include: speed limits, traffic fines and penalty points, and blood alcohol limits. These are all areas where standards may change from time to time given accident trends, public opinion, or new developments in equipment, and such regulations should be updatable quickly without the need to alter the main traffic act.

There have been recent moves towards eliminating the traditional legalistic style of writing traffic legislation and framing it so the public can understand. Given the education levels among the road users in the Asian and Pacific region, there is much advantage to be gained in writing traffic legislation in as clear and straightforward style that is readily understood by all.

Traffic legislation will have a much better chance of being accepted if it has been developed by a multidisciplinary team that includes private and public sector interests, as well as traffic police and traffic engineers.

The revision process should be guided by an independent specialist with recent experience in framing or updating legislation. Use of such an informed but neutral independent specialist ensures that best advice is given unconstrained by territorial or organizational loyalties of the key agencies involved in enforcement.

Publicity campaigns should be implemented to inform the public of any proposed changes in legislation and the associated reasons, so that they are fully aware of the new requirements before enforcement commences.

3 KEY COMPONENTS

A number of areas of legislation can have significant effects upon road safety. Legislation is needed on the following key areas:

1) driver-related;
2) vehicle-related;
3) control of traffic;
4) traffic signs and markings; and
5) fines and penalties

Only the most important aspects of legislation are summarized below as many of the elements are covered in the other individual sectors of these guidelines.

3.1 Driver-related Issues

There is no inherent right to drive a motor vehicle on a road. So a motorist must be

Table 1: Typical Safety Issues that Need to be Covered within Traffic Legislation

Driver-related • Driving instructors • Driving schools • Learner licenses • Driving tests – medical – theory – practical • License holders • License categories • Professional drivers		**Highways-related** • Authority • Statutory responsibility • Access/development control • Signs/markings • Speed zones • Traffic calming • Safety audit
Vehicle-related • Condition/construction requirements • Roadworthiness testing • Safety belts/equipment • Dangerous loads • Documents/insurance	**Fines/penalties-related** • Traffic accident Investigation • Penalties • Courts/hearings • Fines	**Traffic control/general safety-related** • Drunk-driving • Seat belts • Speed limits • Pedestrians • Road user education • NRSC

granted permission to drive by way of a license issued by the state, provided certain criteria relating to health, age, and competence to drive are met. Driver training and testing are covered more comprehensively in Sector Guidelines 4.7, but some of the key legislation-related issues concerning licensing are listed below.

a) *Driving instructors and driving schools*

Many countries find it useful to have a registration system for driving instructors and (separately) for driving schools, and no one is allowed to give paid instruction unless a special test is passed to become a registered driving instructor. This ensures that driving instructors have the necessary competence and knowledge not only of driving but also for teaching and instructing learners. The registration of schools ensures that they meet at least minimum standards and criteria on premises, vehicles, teaching aids, and qualified instructors. In some countries (e.g., Fiji) driving instructors are encouraged to take defensive driving courses and to include some of these elements into their training of learner drivers, while driving schools are being encouraged to set industry standards and controls.

b) *Learner licenses*

In many countries, new license holders are constrained in the types of vehicles they can drive by restrictions placed on the driving license. Engine size of motorcycles and cars may be limited. Learner car drivers in most countries usually have to be supervised by an experienced driver at all times until a driving test is passed. Consideration should be given to introducing a requirement that motorcyclists should have had at least four hours of off-road training in basic maneuverability skills before being issued with a learner license (such training can often be provided by motorcycle dealers and driving schools). Driver training regulations should be restricted to those that can be enforced.

Plate 1: Motorcycle training, Singapore.

c) *Driving tests*

A driving test is designed to ensure that at least a minimum standard of competence is achieved by a driver before being allowed unrestricted access to the public roads, subject to other criteria in respect of vehicles or classes of vehicle. Driving test standards vary throughout the world, from minimal vehicle control maneuvering demonstrations to sophisticated multipart tests. The latter may include a medical test to ensure physical fitness to drive and a theory test on road knowledge before the third, **practical** part of the test (a drive of about 30 minutes in varied road conditions accompanied by an examiner). Generally, it is thought that more extensive tests produce better, and therefore safer, drivers.

d) *License holders*

Age is only one consideration in assessing the suitability for a driving license. It is appropriate to set minimum standards of health and eyesight on applications for a license. As such medical conditions may manifest themselves later in life, it is appropriate to require the holder to notify the license issuers of specified medical conditions once aware of them. It would also be appropriate, if a regular license renewal system is in operation, to restate a health warranty at time of renewal. Graduated licensing programs have been used in motorized countries to prevent novice drivers from exceeding their capabilities. This is achieved by restricting motor vehicle choice and driving times. In some countries, novice drivers use a "P" plate to make easier detection of novice driver violations. In Japan, for example, novice motorcyclists are forbidden from carrying passengers for the first year.

Retraining courses are being proposed for drivers convicted of certain driving offenses.

Programs have been introduced in a number of countries (including the Philippines) where drivers caught speeding are required to undergo a day's retraining, but there is little hard evidence as to whether such courses are effective.

e) *License categories*

In most countries, a system will already exist that categorizes vehicles into classes and the license applies to certain types of vehicle depending on the driving tests undertaken. Commercial licenses should also be incorporated within the basic driving license system but require additional criteria related to competence, age, and driving experience.

f) *Professional drivers*

Most countries require a higher minimum standard (e.g., 25 years age and at least five years' driving experience) for eligibility to become a professional driver of heavy goods vehicles (HGVs) and public service vehicles (PSVs). There should also be a requirement to carry out a driving test in the type of vehicle for which such a license is being requested. It should not be permissible to pass a test for a private vehicle and to then, after some time start driving an HGV or PSV. An additional more stringent test must be taken in an HGV or PSV to ensure competence to drive such a vehicle, not only because of the greater skill level required to control the larger vehicles but also the greater potential risk to public safety.

3.2 Vehicle-related Issues

Legislative controls are needed to ensure the roadworthiness and safety of a vehicle at registration and throughout its working life. Vehicle safety standards and inspections are discussed in Sector Guidelines 4.9, but some of the key legislation-related issues concerning vehicles are:

a) *Condition of vehicle*

The enforcement of laws about vehicle condition and operation are the responsibility of traffic police, often working with the land transport department's vehicle inspectorate.

Tires: One of the most common vehicle faults that contributes to road accidents is tire defects. It is recommended that there be requirement of at least 1 millimeter (mm) of tread pattern over the entire width of the vehicle and around the circumference. The limit could justifiably be raised to a higher level, say 1.6 mm, at a later date when general conditions of vehicles improve.

The lack of tread is not the only potentially dangerous defect associated with tires. Failure of the internal ply structures and cuts that expose the ply structure weaken the tire, inviting total failure. Mixing of tires of differing ply constructions is also dangerous as radial and crossply tires have different reactions to physical forces acting on them. When cornering at speed, the difference in grip may be so great as to cause the crossply tire to lose all grip and the vehicle to become uncontrollable.

These defects can easily be incorporated in legislation. It is recommended that a catchall provision be attached to outlaw the use of tires used under "unsuitable" conditions. Such provisions should also be used with brakes and steering.

Lights. Lights are essential for the driver to see the road ahead clearly and be seen by other road users. A minimum standard of front lights, rear lights, brake lights, reflectors, and direction indicators should be defined appropriate to each country and required by legislation. Subsequently, there should be a requirement to maintain the lights in efficient working order.

Glass. Three- or four-wheeled motor vehicles should be required to have a **laminated glass** windscreen at the front that should be maintained to allow a clear and unobstructed view. Thus, cracked or shattered screens would not be lawful and use of vehicles with **toughened** glass windscreens (which can cause much more serious injury in an accident) should not be permitted.

Dangerous condition. In order to cover the unforeseen and to save legislating for every possible safety-related defect on a motor vehicle, a provision to cover using a motor vehicle on a road in a dangerous condition should be considered. Such a section would cover defective shock absorbers or corroded shock absorber mountings, which are directly related to safety, and defects to the structure or chassis from which failure can result.

b) *Testing of vehicles*

In most parts of the world, imported vehicles are "type" tested to ensure they meet local

standards. In addition, all imported and local vehicles are periodically tested by government testing stations or by authorized private testers. Experience in many countries suggests that the poor condition of many vehicles, despite display of a "pass" disc or sticker, must throw into doubt the quality or vigor of testing. The general aims of road safety can be covered by an annual test of vehicles more than three years old, supplemented by random roadside spot checks and technical examinations of vehicles by government vehicle inspectors, the traffic police, or (more usually) both acting in partnership.

Plate 2: Inadequate road worthiness testing results in unsafe vehicles.

It is recommended that powers to prohibit further use of the vehicle, either immediate or subject to conditions, be enacted until the defects have been repaired.

A vehicle defect rectification scheme is increasingly used in industrialized countries ensuring that the vehicle is made roadworthy. In this system, a vehicle is stopped and the appropriate defect identified. The driver is offered a chance to either repair the defect within 14 days and present the vehicle for testing, or go to court.

The vast majority will accept the former option. They have the vehicle tested and submit the certificate of testing, or prove that the vehicle has been scrapped or broken up. Then the matter is closed.

If the offer is not accepted or the certificate of testing is not submitted within 14 days, court proceedings automatically follow. However, the problem in most developing countries is tracing the vehicle. It may be appropriate to confiscate the vehicle documents and driver license until the vehicle is brought back repaired.

Advantages of the scheme are that unroadworthy vehicles are repaired (which cannot always be guaranteed in the case of court proceedings) or broken up. It may also produce revenue for government testing stations, with possibly a fee levied on submission of certificates of testing or breaking up. It also relieves the courts of the burden of dealing with minor offenses unnecessarily.

c) *Dangerous loads*

Another feature common to many countries is the precarious manner in which passengers and loads are carried on the roof or hanging on to the outside of vehicles. Again, an all encompassing provision is recommended to prevent the carriage of a load in such a way as to endanger any person. Further provisions that refer to total gross and axle weights should also be considered.

d) *Safety belts and safety equipment*

Increasingly, traffic legislation includes requirements that safety belts be fitted and sometimes that other safety equipment (e.g., reflective advance warning triangle for use in breakdowns) be carried. It is important that such equipment meets appropriate local criteria and it is often best to base such criteria on those used in other more motorized countries. All major motor manufacturers already manufacture equipment to such standards, making compliance more likely and avoids the risk of substandard equipment being permitted onto the market.

e) *Documents/insurance*

The legislation must always incorporate rules or requirements relating to the use of vehicles. Apart from requiring that the vehicle be in a roadworthy condition, there should be clauses requiring that vehicles be licensed by the relevant authorities, for correct vehicle registration documents to be held by the owner (to prove ownership), and for at least third party motor insurance to have been taken by the owner or driver to cover damage or injury to innocent third parties. If it is made compulsory that vehicle registration, insurance, and roadworthiness certificates have to be shown when licensing a vehicle and at the same time, that vehicle registration, roadworthiness, and license documents must be shown when seeking insurance, a degree of cross-checking can be introduced. This acts as a useful control to deter motorists who might otherwise drive without insurance or without a roadworthiness certificate. For this to work best, it is necessary for all vehicles to be licensed annually, and for the expiry date on annual licenses to be easily seen and checked from outside the

vehicle. This is often done by requiring the certificate to be prominently displayed on the windscreen so that passing police officers can easily see if the certificate is valid.

3.3 Highway-related Issues

a) *Authority*

There needs to be clear-cut indication in the legislation defining who is responsible for what in terms of traffic and use of roads. This might, for example, specify the differing roles and responsibilities concerning traffic of the ministry of transport or public works, provincial governments and municipalities, or national police.

Of particular importance is that it should specify wherever possible a statutory responsibility upon each highway or roads authority (whether national, provincial, or municipal) "**to monitor and improve road safety on their respective road networks.**" Sector guidelines 4.4 and 4.5 cover engineering-related matters and 4.11 covers police traffic law enforcement in more depth, but some of the important legislative issues related to roads and enforcement are given below.

b) *Access and development control*

Each highway or roads authority must be given the right to comment to the planning or development control agency on any proposed land use development on land adjacent to a road and from which access may be required. In particular, they must be given the right and authority to refuse access from such developments unless the access can be provided without causing undue traffic or safety problems. Anyone wishing to create access onto a public road must be required to apply for permission and approval from the relevant roads authority.

c) *Speed zones*

Each highway authority should be entitled to categorize its network in terms of road hierarchy and to specify appropriate speed zones depending upon the function that particular roads or sections of the network is supposed to provide. This may include imposition of lower speed limits, physical speed reduction devices, and traffic calming in residential areas or as rural roads pass through communities straddling the road.

d) *Safety audit*

Highway authorities should be required to systematically check proposed new or rehabilitation road schemes from a safety perspective at preliminary design, detailed design, and just after construction (but before opening) stages. These safety checks should be undertaken by road safety specialists to ensure that the needs of all road users (especially vulnerable road users) have been taken into consideration. This formal process known as "safety audits" is important to ensure development of safer road networks.

e) *Traffic calming*

Traffic calming regulations are made to provide local highway authorities with the necessary powers to construct speed reduction and other measures for traffic calming that are not otherwise clearly authorized. Provision may need to be left for detailed specifications via ministerial regulations.

f) *Traffic signs and road markings*

Traffic signs and markings should be as specified by the relevant ministry for roads, but should be compatible with relevant international conventions.

At present, many traffic signs in developing countries are based on outdated standards and the sign size is often too small for adequate visibility when drivers are traveling at currently permitted speeds.

3.4 Traffic Control and General Safety

Most legal systems consider the manner of driving under two categories:

1) **reckless** where the driver acts in such a manner that serious consequences can be foreseen; and
2) **careless** but nevertheless (for the protection of other road users and the maintenance of an adequate standard of driving) deserving of a sanction.

The consequences may be taken into account if death results and the offense is considered to be more serious if the driver was reckless.

a) *Drink–driving*

Any review of legislation from a road safety perspective should include drinking and driving legislation as a priority. Experience from several countries has shown that road deaths can be reduced by around 15 percent by strict enforcement of this legislation.

This is done by prescribing a limit to alcoholic intake above which a driver commits an offense. Blood alcohol concentration (BAC) levels of between 20 milligrams (mg) and 100 mg of alcohol per 100 milliliters (ml) of blood are typically used in developed countries, with most countries adopting a level of 50 mg/100 ml of blood or lower. It should be noted that accident risk increases markedly with the BAC level. At BAC 50 mg/100 ml, accident risk is twice as high as at zero BAC level, while the accident risk at 100 mg/100 ml is almost eight times as high as at zero BAC level.

The investigation of an offense starts with a power to require a driver to supply a specimen of breath into an alcohol screening device. A positive result (i.e., BAC in excess of some prespecified level) may in some countries be sufficient to prove an offense. In other countries, a further test is carried out on an evidential machine (at a police station) after the driver's arrest. The reading obtained quantifies the level of alcohol in the blood as ascertained from a specimen of breath, which both proves the offense and identifies the seriousness of the transgression. A blood test could be considered as an alternative, but carries severe problems, such as difficulties in ensuring availability of medical staff and keeping the specimen in a satisfactory condition before analysis. Also, continuity of evidence questions may crop up with specimens of blood, so this method should be avoided wherever possible.

It is strongly recommended that an alcohol limit of 30 mg to 50 mg or less be adopted in all countries as a matter of urgency. Random testing should also be adopted so that any driver at any time could be required to give a specimen. Wherever possible, the roadside test using mobile alcohol testing devices should be regarded as sufficient evidence for prosecution in developing countries. This is more affordable when first commencing such a program and avoids, at least in the early years, the high investment that would otherwise be needed to place and maintain expensive evidential machines in all police stations.

Plate 3:
Police spot checks on drunk driving.

From a road safety perspective, the prevention of drinking and driving is vital. Additional provisions may have to be considered where drugs are taken and the effects and safety implications are the same as drinking and driving, but evidence can be obtained only from a laboratory test or a physical examination by a doctor.

b) *Speed limits*

Maximum speed limits should be set for urban and rural areas that allow for lower speed limits near schools, hospitals, or other areas (see Sector Guidelines 4.4 on traffic calming). It is important to stress that speed limits represent maximum limits and police should enforce these strictly, especially where pedestrians and other road users are at risk.

Reduced speeds in urban areas and in designated area-wide zones have proved effective in reducing the number and severity of road accident injuries in many motorized countries. Designation of certain locations as reduced speed zones should be permitted under the traffic legislation.

c) *Following too closely*

Drivers should be required to maintain a safe distance between their vehicle and the rear of the vehicle ahead as the driver in the following vehicle will almost always be held accountable for any accidents with the vehicle in front. This distance will vary according to speed, weather, and road conditions and should be clarified in driver training and in a highway code. However, the law should specify that the driver at the rear in such an accident is automatically considered to be at fault unless extenuating circumstances can be shown.

d) *Give way procedures*

Priority rules should be specified in legislation and properly signposted as a reminder to road users. Give way rules are required to cover intersections, turning movements, parking, approaching emergency vehicles, and entering congested intersections.

e) *Pedestrian rights and requirements*

Given the large share of road accident casualties accounted for by pedestrians in the Asian and Pacific region, traffic legislation must clearly state priority. Drivers should be required to stop for pedestrians at formal pedestrian crossings and parking or overtaking near a pedestrian crossing should not be allowed. When turning, drivers must be required to give way to pedestrians already crossing.

Pedestrians can be legally required to use nearby pedestrian crossings and to walk on the footpath when it is provided.

f) *Motorcycle helmets*

Mandatory motorcycle helmet usage in rural areas was required as far back as 1970 for Singapore but as late as 1995 for Viet Nam. It should be introduced nationwide in all countries. Available accident data generally will provide evidence that motorcycle and passenger head injuries are occurring and that mandatory motorcycle helmet wearing will save lives and injuries. Exemptions for wearers of turbans is usually necessary. However, the capacity for enforcement must be taken into account and it is essential that a safe standard is specified for helmets and that efforts are made by government to ensure such helmets are readily available from many outlets and suppliers at an affordable price.

g) *Seat belts*

Introduction of legislation requiring wearing of seat belts and effective enforcement has resulted in significant reductions in road deaths in many developed countries (e.g., 23 percent reduction in the United Kingdom (UK) when first introduced) so it can certainly be justified. Seat belts have been required on a partial basis (e.g., on expressways only) in some Asian and Pacific countries for a number of years. The proportion of car drivers and passengers killed or injured in the Asian and Pacific region is much less than in the industrialized countries, and seat belts will therefore have a much less significant impact in countries where pedestrians and motorcyclists form the majority of traffic deaths. Nevertheless, it is a measure likely to save many lives.

Seat belt legislation normally needs to be introduced in stages: first making **seat belt fitting** compulsory on all cars being imported or manufactured, and **seat belt wearing** compulsory when seat belts are available. Later the requirement for fitting can be extended to all cars less than five years old and eventually to all cars of any age capable of carrying at least one passenger. Police must have strong powers of enforcement and must exercise them if the full benefits are to be achieved.

h) *Nonmotorized vehicles*

Although traffic regulations are assumed to apply to all road users, pedestrians, bicycles, and other nonmotorized vehicles (NMVs) are ignored in the traffic legislation in some countries. Traffic regulations should apply fairly to all those using public roads and should not discriminate against slow-moving and NMVs. Given the very large numbers of vulnerable road users involved in road accidents in the Asian and Pacific region and the high proportion of nonmotorized traffic in many countries of the region, much more should be done to recognize the legitimate needs and requirements within the traffic stream. Legislation could, for example, be drafted to give priority to NMVs in certain situations and to provide protection for NMVs in their conflicts with motorized vehicles in the traffic stream.

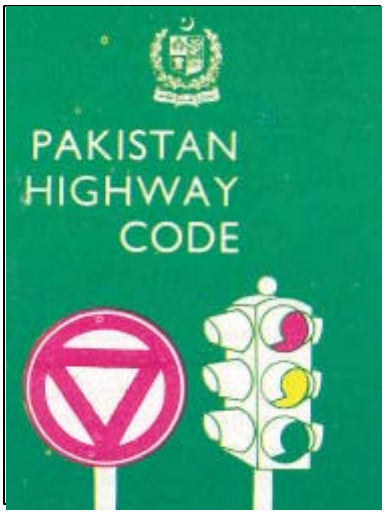
i) *Postaccident requirements*

All injury accidents should be reported to the police and providing assistance to the injured should be a requirement of all those involved. However, given the threat of danger in some societies to those perceived as responsible for accidents, developing countries may also want to consider making it a specific crime for bystanders to harm those involved in road accidents, although the difficulty in enforcing this must first be considered.

j) *Highway code*

There should be provision for a highway code to be produced by the relevant department. In most countries, highway codes are only advisory whereas in the UK, where the word "must" is used, the *Highway Code* refers to actual legal requirements. In Malaysia, the *Highway Code* was published as regulations in 1959 and the Sri Lankan *Highway Code* is also supported by regulations.

The highway code should provide an overview in nontechnical language of traffic rules and obligations of all road users.



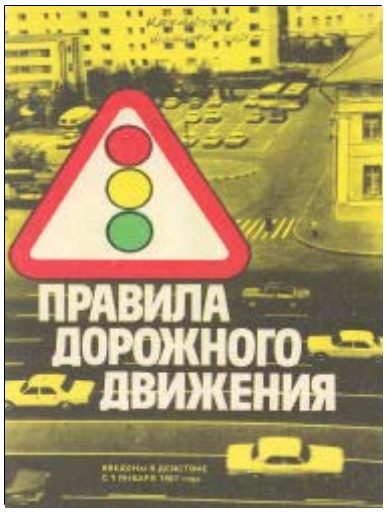


Plate 4: Highway codes are used in many countries.

k) *NRSC*

An NRSC should be constituted with statutory powers to oversee road safety improvements. Ideally the NRSC should be established directly under the prime minister's office because many ministries are involved. Legislation should also specify powers, provide for funding and establish a permanent secretariat to implement, follow up, and coordinate NRSC decisions. More information on NRSCs is provided in Sector Guidelines 4.1.

l) *Insurance requirements*

Third party insurance should be made mandatory for all drivers, whether driving a private, commercial, or government-owned vehicle, and motorists should have to show registration documents and a roadworthiness certificate before insurance is awarded. Conversely, for annual vehicle registration a roadworthiness certificate and a valid insurance certificate should be required.

A levy on third party insurance premiums should be dedicated to funding an NRSC and its operations. The authority to impose such a levy should be granted in the legislation, with the specific amount and consultation process (to set the amount) determined by ministerial regulations.

3.5 Fines and Penalties

a) *Level of fines and fine collection*

Studies in motorized countries have shown **risk of detection** to be a stronger deterrent than **high penalties**. If encouragement of compliance with regulations is the primary objective, then this suggests it would be better to be giving many smaller penalties rather than fewer high-priced ones.

"On-the-spot fines" are useful for minor offenses but problems with accountability can prevent these quick and simple penalties from being used in many developing countries. In several Asian countries, including the Philippines and Viet Nam, to overcome such "accountability problems," traffic fines cannot be paid directly to the traffic police but must be paid at a separate authority such as a national bank or post office. The delay incurred in being stopped and the inconvenience and time involved in paying a fine should encourage the road user to comply with the traffic regulations, and so the method is worth considering.

The penalty system should consider the optimal division of responsibility between the traffic police and the courts that will be unique to each country. Court-imposed penalty systems can sometimes overwhelm civil courts to the point that judgments become delayed, tending to reduce the deterrence effect of the enforcement system.

Fixed penalty notices are used where proceedings are commenced by police but settled on payment of a fixed penalty or fine, or combination of fine and penalty point (see below). They relieve the courts of burdensome minor matters and generate revenue. They have been used to sanction drivers for noncompliance offenses, disobeying signals, excess speed, and other safety-related offenses. Thus even though traffic volumes and the number of offenses increase, no increases are required in judicial or prosecution resources.

b) *Penalty point system*

Penalty point systems have existed in legislation for many years but have rarely been implemented effectively in developing countries. Driving convictions can be marked on the driving license but this practice is rarely enforced in developing countries. Penalty point systems have proven successful in industrialized countries where driving license details are computerized, accurate, and up to date. In most developing countries, accurate computerized records are rarely available but such systems should be introduced when feasible.

c) *Disqualification of license holder*

While often included in traffic regulations, many countries at present lack the administrative support to cancel driving licenses **and** ensure new driving licenses are not obtained. Absence of a central driver records register means that drivers often simply go to another province and get a new license, so the threat of disqualification becomes less powerful. Efforts should be made to establish a single master list of driving licenses (computerized) as quickly as possible, and provision retained within legislation for penalty points systems and disqualification.

d) *Fines used to finance traffic police*

Several countries (including Malaysia and the Philippines) have recently allowed a percentage of the traffic fines collected to be used to fund traffic police enforcement equipment, traffic police activity, or traffic police welfare. It is particularly appropriate where new and additional income is generated from use of new equipment (e.g., speed detectors or alcohol testing devices) or from new legislation such as seat belt wearing or drink-driving. While the arrangement may seem improper and encourage unrestrained fines being imposed, it does offer a way to increase funding for traffic police enforcement without having to rely solely on availability of government funds and provides incentives to the police to carry out enforcement. An alternative approach is used in the UK where the recent Sponsorship Act allows private sector funding to go directly to the traffic police rather than to general revenue.

4 STAGES OF DEVELOPMENT

Stage 1: Colonial/Outdated System

Traffic legislation in many developing countries is still heavily based on colonial motor vehicle codes and has been outdated and inappropriate for controlling traffic and improving road safety for years.

Such legislation was developed when there were few cars, traffic conflicts were not a serious issue, and before the onset of modern traffic control devices such as traffic signals, or modern enforcement equipment such as radar speed detectors and alcohol detectors. NMVs may not be included, insurance requirements insufficient, and speed limits inadequate. Road signs may be in sizes too small for current speeds and in individual and unfamiliar designs.

While the inadequacies of the traffic legislation are clear in such circumstances, what is less well known is how to correct these deficiencies in the most effective manner. Instead, piecemeal amendments are often added to the old base as needed, and the result is often confusing and ineffective.

A typical amendment might be the requirement of motorcycle helmets for riders (but not always passengers) and perhaps seat belt wearing in certain areas only (e.g., rural highways).

Stage 2: Legislative Revision

With the inadequacy and problems of ad hoc amendments realized, traffic police and transport authorities begin pressing for legislation revision. For convenience sake and lack of an alternative, the existing regulations may be used as the foundation for the revised traffic regulations.

However, the individuals assigned to rewrite the legislation (sometimes only one person and often without relevant training as such skills are not always readily available) are often within the ministry of transport, and negotiations with other ministries can go on for years. Traffic legislation revision has taken more than a decade in Indonesia and Pakistan because of interministerial rivalries and revision has also been ongoing for the past few years in Bangladesh.

In Nepal, traffic legislation was updated in 1993, but the traffic police were not allowed to contribute to the revision process even though they have to enforce it. Much confusion has resulted both in what is required by road users and how the legal proceedings are to be settled.

Stage 3: Working Group Committees

To help ensure that the traffic legislation produced will be acceptable to the public, a

working group should be formed with participants from within the government as well as outside, and should include private and public sector transport operators as well as transport specialists. This is often best done under the nonpartisan and neutral umbrella of the NRSC as it minimizes ministerial rivalries. It is imperative that the traffic police are included in the traffic legislation revision committee to ensure practical experience is used and to obtain their support. With the assistance of specialists (technical assistance may be needed from abroad), the traffic legislation should specify blood alcohol limits and testing procedures, seat belt requirements, and the optimal distribution of responsibility as appropriate for that country between individual ministries, and between traffic police and the courts.

Stage 4: Standardization and Automation

The desired situation is attained when traffic regulations are streamlined with optimal distribution between legislation and regulations, and regional standardization achieved. Provision for use of modern automated techniques of traffic control, such as red light cameras and modern enforcement equipment, should be covered under the traffic regulations. A legal requirement will have been imposed on every road authority to try to improve road safety on its road network and traffic calming regulations will have been specified.

5 BENEFITS AND EFFECTS

Traffic legislation provides the legal framework for traffic police enforcement and specifies the requirements for safe road user behavior that will benefit all road users. Modern traffic legislation should contain a safety focus rather than the old-fashioned administrative and document-related concerns characteristic of older, outdated legislation.

When properly developed, traffic legislation and regulations must include not only information about road use but also a streamlined punishment system with an adequate deterrence effect upon road users. Compliance with the traffic regulations results in increased predictability and uniformity of behavior of road users, reducing the risk of road accidents.

6 EXAMPLES OF GOOD PRACTICE

In the Asian and Pacific region, the **State of Victoria, Australia**, can lay claim to concise and clear traffic regulations. The last major revision was in 1988[1] although such articles as drink-driving limits have been strengthened since then.

For regional code standardization, two sources, although both from outside the region, could prove useful.

The Uniform Vehicle Code[2] in the **United States** (US) provides a guide for harmonization of traffic legislation between the 50 states. In the last decade, a model traffic statute was also produced for **Southern Africa** (along with a *Highway Code* and *Road Signs and Markings Manual*[3,4]). This may offer a base mode that could be adapted.

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Road Safety Guidelines

for the Asian and Pacific Region

4.11

TRAFFIC POLICE AND LAW ENFORCEMENT

Asian Development Bank

4.11

TRAFFIC POLICE AND LAW ENFORCEMENT

Traffic law enforcement is needed to encourage safer road use and an orderly traffic flow.

Most traffic police forces in the Asian and the Pacific region are characterized by insufficient training, minimal enforcement equipment or vehicles, and a high turnover in staff. Lack of mobility often results in a preoccupation with traffic control at junctions and inadequate attention has been given to the use of accident data in identifying enforcement priorities and targeting moving violations. Although staffing levels are often high, the lack of trained and experienced officers reduces substantially the potential effectiveness of such traffic police personnel.

Training is needed in many areas, including traffic management, accident investigation, highway patrolling, motorcycle riding and car driving, and management skills. Traffic police must be trained in both the technical tasks of policing and in how to set an example for the general public. Where possible, a career structure should be available in traffic policing to allow officers to specialize and make maximum use of their additional training. Control systems should be established to allow for the empowerment of junior level police officers while minimizing potential for abuse of power.

Modern enforcement equipment such as alcohol testing devices and radar speed detectors should be acquired. Traffic police personnel should be trained in their use and in related tactics and enforcement strategies.

PRIORITY ACTIONS NEEDED:

1. Traffic policing should be based on analysis of accident data and targeted to the roads and locations where accidents occur most frequently, and on the associated unsafe driver behaviors and moving offenses.

2. Traffic police training should be expanded and improved to create a specialist traffic police force skilled in use of modern enforcement equipment, tactics, and strategies, and with the ability to conduct targeted and effective enforcement campaigns.

3. Efficiency and activity indicators should be adopted to monitor performance, including the frequency of use and prosecutions resulting from modern enforcement equipment, such as alcohol testing devices and radar speed meters.

Traffic police must focus their attention on preventing road accidents. This is best done by having a well-trained, efficient organization that is adequately equipped with modern equipment and vehicles, and by concentrating on moving offenses and preventing unsafe driver behavior.

1 INTRODUCTION

These sector guidelines on "Traffic Police and Law Enforcement" are from a set of Guidelines on Road Safety for the Asian and Pacific Region policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

The main objective of traffic policing is the safe and efficient flow of traffic, achieved through means of persuasion, prevention, and punishment.

2 WHY ARE TRAFFIC POLICE AND LAW ENFORCEMENT NEEDED?

As motor vehicles increase in numbers and in their power and capability, traffic conditions become harder for the average police officer to control. Specialized training is needed to ensure traffic police officers have a practical understanding of how best to achieve safety and an orderly flow of traffic on the road.

Traffic police training is expensive and it is not cost-effective to supply it as a part of basic training to all police officers. The duties of a traffic officer — dealing with fatal and serious road accidents, and reporting traffic offenses — do not appeal to all police officers. Furthermore, police driver training is a skill that, taken to high levels, is not within the capability of all police officers.

In industrialized countries, traffic enforcement has become the province of a nucleus of highly-trained specialist officers whose duty is solely the prevention of accidents, and the maintenance of smooth and orderly traffic flow. However, in developing countries, traffic police are largely untrained, unequipped, and poorly paid.

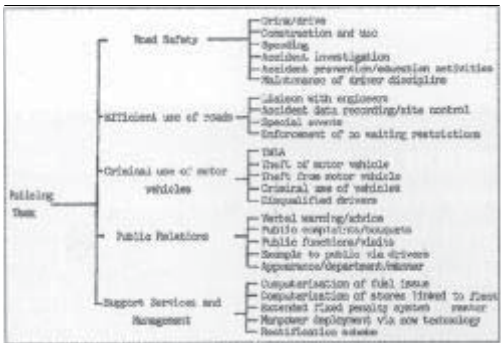

Figure 1: Traffic police sectors and activities.

There is an even greater need for trained and effective traffic police in developing countries due to the competing demands on scarce road space, a populace largely lacking in road safety awareness, and insufficient guidance provided to road users by road signs, markings, and facilities. On the streets, the traffic police are expected to compensate for any deficiency in traffic engineering while balancing different road use demands as diverse as child pedestrians and handcarts, overloaded trucks, and modern land cruisers. Specialized training becomes a necessity as the traffic police are held responsible for ensuring a safe and efficient road network under such challenging circumstances.

3 KEY COMPONENTS

The five key components are: organization, policy, training, vehicles, and equipment.

3.1 Organization

In industrialized countries, traffic police typically account for 8-10 percent of the total police budget and in the countries where traffic policing is particular strong (e.g., Japan), traffic police may account for 14-16 percent of the total police budget. In most developing countries, traffic police are often underfunded and underresourced, and are rarely allocated even 5 percent of police budgets. Limited resources require the efficient organization of the traffic police to maximize potential effectiveness.

Force strength is not usually a constraining factor as staffing, readily available in developing countries, is often used to compensate for lack of equipment and vehicles.

Organizational structure in the traffic police forces of developing countries has tended to be bottom heavy at the lowest levels, with many police officers not even empowered to cite traffic violations. Middle management, where analysis would normally be conducted, is often minimal and operational decisions often come from top management based on professional judgment alone rather than on systematic analysis of data.

In many countries, traffic police are transferred after two to three years and there is limited opportunity to advance or use any specialist training received. Career tenure has been introduced in some countries that allows officers to specialize in traffic policing and helps create a nucleus of experienced traffic police officers who become a valuable resource for their country.

In most countries, traffic police salaries are tied into the civil servants' pay scales and do not properly reflect the hazardous and demanding nature of the work. Traffic police are required to work long shifts on point duty in tropical climates, often for seven days a week. Leave entitlement is often restricted, which contributes to a high sick leave rate. Too much temptation and opportunity for corruption can exist within traffic policing and woefully inadequate salaries do not help.

3.2 Policy

With the wide range of traffic regulations and the limited amount of traffic police resources available, traffic enforcement efforts must be prioritized to suit local problems. A recommended order of offenses for consideration is as follows:

1) safety: offenses that could lead to a road accident, i.e., speeding, signal violations, drunk-driving violations, and pedestrian crossing violations by drivers;
2) traffic management: offenses that while not inherently dangerous do not facilitate smooth movement of traffic, i.e., illegal parking or buses loading and unloading passengers within a junction;
3) equipment: offenses such as lighting or tire defects that could contribute to an accident but have a much lower correlation with accidents than do the safety offenses; and
4) administrative: paperwork offenses such as improper vehicle registration or transfer of ownership.

Safety violations, or "moving" violations as they are sometimes called, should be targeted to focus enforcement efforts at actions most closely connected with road accidents. High-risk accident sites should also be targeted. As traffic regulations usually specify the maximum fine for each violation, safety violations should incur the maximum fine to highlight the seriousness of the offense.

3.3 Tactics

a) *Strategic plans and selective enforcement*

Enforcement priorities need to be clearly identified in a policy document such as a strategic plan. In recent years, strategic plans have been used to specify police forces' objectives and the actions intended to help achieve the stated objectives. Target deadlines should also be provided to allow monitoring of the work undertaken.

Selective enforcement, whereby safety violations are identified through accident data analysis and professional judgment, should provide the basis for staff deployment. Targeted enforcement campaigns, either stationary or mobile, should be undertaken with specified objectives and agreed methods of evaluating the effectiveness of the campaigns. Experience has shown many enforcement campaigns, such as holding a "Traffic Week," are too short and unfocused to have any lasting effect. Traffic police frequently underestimate the amount of time and effort it takes to educate road users.

b) *Verbal warnings*

Verbal warnings should be used, especially in the early stages of an enforcement campaign, when education and regulation compliance are the objectives rather than punishment. In motorized countries, the majority of traffic police interactions with the public result in verbal warnings with embarrassment and inconvenience seen as adequate deterrents. The aim should always be to deter bad behavior rather than to punish it.

c) *Staffing deployment*

The actual deployment of traffic police will be dictated by the numbers of vehicles available. The main traffic police functions are point duty, mobile patrolling, accident investigation, and road safety education.

In many developing countries, the vast majority of traffic police are assigned to stationary point duty for traffic control and management. However, much can be achieved by beat officers if they are stationed at high-risk sites. In countries where pedestrian accidents are a problem, traffic police could be used more effectively at pedestrian crossings to help platoon the pedestrians, as well as requiring vehicles to stop for pedestrians crossing.

Another example of how point duties could be used more effectively is through the staffing of shifts. Due to the physical demands, point duty is broken into several shifts over the day. But in many countries the staffing level is constant throughout the day. Additional traffic police should be timetabled to operate during busier hours and stationed at point duty during the peak hours for accidents and traffic congestion. This is now done in Nepal.

While a typical level of patrol coverage in the United Kingdom (UK) is shown in Table 1, the relative scarcity of patrol vehicles available in developing countries results in much larger patrol routes being assigned so police presence and hence deterrence effects on motorists are lower. Mobile patrolling, even with the vehicles available, is not always used to maximum effectiveness with general patrolling and crime-related duties often taking priority. As with point duty assignments, mobile patrolling should not be uniformly distributed throughout the day and over the network but should target roads and road sections that are most prone to road accidents.

Table 1: Traffic Patrol Coverage

Area	Road class	Time period	Level of patrol coverage
Urban	Trunk and 'A' Class	08.00- 00.00	One car and two motorcycles for every 20 miles (32 kilometers) of carriageway.
		00.00- 08.00	One car for every 30 miles of carriageway.
	Other	All	One car for every 200 miles of carriageway.
Rural	Motorways	08.00-00.00	One car for every 10 miles of road (20 miles of carriageway).
		00.00-08.00	One car for every 20 miles of road (40 miles of carriageway).
	All-purpose trunk roads	08.00-00.00	One car and one motorcycle for every 20 miles of route.
		00.00-08.00	One car for every 40 miles of route
	Other A and B Class	08.00-00.00	One car for every 80 miles of route
		00.00-08.00	One car for every 160 miles of route

Accident investigation responsibility is usually assigned to senior officers, if not a specialized unit. While accident investigation is conducted by general police in a few countries, it is desirable that this function is carried out by the traffic police so that they are able to give expert evidence in court cases involving serious accidents. They can and should be trained in accident investigation techniques and accident reconstruction methods[1].

Road safety education advice is usually a supplemental role for the traffic police and involves occasional talks and visits to schools. This should preferably be carried out in a complementary way to other road safety education efforts.

3.4 Training

Police in any country reflect the society in which they live and the traffic police in developing countries are no exception. Moreover, in many countries, traffic police are the general public's primary if not exclusive contact with the police force and the image of the police force relies on how well the traffic police conduct themselves. Training programs need to be capable of producing not only technically qualified but also professional officers with integrity who can present a good public image.

Lack of appreciation for the skills required by traffic policing has led to insufficient priority being given to training needs. Lack of training occurs at all levels and senior police officers are frequently transferred into traffic policing without receiving any previous traffic training. This approach is slowly changing as police officers realize that a small but well-trained police force empowered and capable of conducting focused enforcement campaigns is much more effective than a large force of limited use. It is also easier to expand upon a trained base.

Training courses should be provided in traffic management and control (junior and senior level courses), traffic law, accident investigation, highway patrolling, speed control, and the use of breathalyzers. Driver and rider training, including basic maintenance, should be provided for all patrol officers. Traffic police training should provide courses in public relations and management skills. Sections 6 and 7 of these Sector Guidelines offer advice on the types and locations of courses that are undertaken by traffic police in developing countries.

Plate 1: Appropriate vehicles must be used for traffic enforcement.

3.5 Vehicles

Selection of motor vehicles for traffic patrol work should be on the basis of suitability for the task. An example of unsuitability would be the use of a high-powered saloon motor car, designed for performance on smooth surfaced roads, to undertake a general patrol on poorly maintained roads or unmade tracks. The suitability of solo motorcycles should also be considered with respect to the nature of the roads on which they are to be deployed.

Bicycles should be considered particularly for patrolling around town as they are more affordable (about one-hundredth the price of a patrol vehicle) and provide the patrol officer with the view from the nonmotorized perspective (in many Asian countries, nonmotorized vehicles are the predominant vehicle type). During most hours, cycle patrol speeds would be comparable to motorized vehicles, while response times could be increased or decreased depending on traffic congestion. Cycle patrols are common in some motorized countries and can be used to complement motor vehicle patrols.

Due to the benefits of having a conspicuous vehicle, it is recommended special standard colors and uniforms be adopted using contrasting shades, in colors appropriate to the area patrolled. Furthermore, it is recommended, that the uniform of the officers employed on traffic patrol duties be readily visible in order to increase conspicuity. This enables the public to see enforcement being undertaken and is a safety feature for the officer. In particular, it is recommended that fluorescent and reflective material be worn in poor weather and especially at night. To complement the contrasting colors of the marked vehicle, it is suggested that a flashing bar light or similar feature be fitted to the vehicle roof. This would display lights of the color associated with the police in the country concerned.

Patrol vehicles should also be equipped with accident rescue tools (to assist in the freeing of trapped victims), fire extinguishers, suitable articles to remove debris from the road surface, collapsible warning signs, and flashing beacons. Local decisions must be taken to evaluate what is the most necessary equipment for a given environment and any potential impact on the speed and handling of the vehicle.

3.6 Equipment

The safety of traffic police officers is paramount. The nature of their work is that they are always in a potentially dangerous environment in close proximity to moving traffic. Precautions must be taken to minimize risk of injury. An essential item is a highly conspicuous uniform, or at least one with which a high visibility vest can be worn in comfort.

Other items, such as smog masks, illuminated or reflective batons, and shading for officers engaged in lengthy periods of traffic control, will vary according to local conditions. Senior officers are urged to consider the needs and welfare of subordinates and supply the articles that are reasonably required for the conditions.

a) *Speed detection equipment*

Apart from protective clothing to ensure that they are not exposed to unnecessary danger when attending accidents or controlling traffic, traffic police also need to have modern equipment if they are to be able to do their job properly. This will include enforcement equipment, such as alcohol testers and radar speed guns. Some of the more sophisticated enforcement equipment is discussed below.

A wide variety of speed measuring equipment is available in varying degrees of sophistication. The enforcement of speed limits is a necessary road safety function, especially near locations where an accident problem has been identified with speed as a significant cause.

The simplest and cheapest method of measuring speed is to use a stopwatch and time a vehicle over a premeasured distance between two points. By applying the formula:

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

either by calculator or prepared time and distance tables, the speed can be calculated. This method is cost-effective, as the only requirement is a stopwatch and a suitable measuring device — either a tape measure or a measuring wheel — to set up the fixed site. It should be stressed that this method increases in accuracy as the measuring distance increases and a minimum of 100 meters (m) is recommended. As the distance increases beyond about 300 m (depending on the accurate depth of vision by the operator), the accuracy decreases. So the method is best used for measuring over fixed distances of 100 m to 300 m.

Speed offenses can also be detected by a radar gun, which is easily operated by one officer and gives a direct reading of a vehicle's speed. The inbuilt safety features ensure accuracy and prevent the device from giving a reading when more than one vehicle is within the beam. Used in appropriate circumstances and by appropriately trained personnel, the handheld radar is an effective speed detection tool.

There are various systems available (e.g., speed master, truvelo) that can be used as roadside fixed distance systems with a built-in timer that automatically records the time that the front wheels cross between two loops. The time value is compared automatically against the known distance to produce a speed value. The system is automatic and does not rely on human operation, so potential for operator error is eradicated. The device is suitable for level roads in good repair but not when the road surface is likely to destabilize the vehicle on the approach or between the timing loops, or on unmade tracks. A camera may also be attached to record the vehicle as it activates the loops.

Laser devices, such as the Laser 2000, produce a low intensity laser beam that can be aimed at approaching vehicles. The pinpoint of laser light is concentrated, not spread out as in radar devices. It is also visible through the device viewfinder, removing all doubt as to the identity of the target whose speed is being measured. It is possible to use this equipment in heavy traffic flows that would render the radar system inaccurate.

The types of equipment outlined above can, if vehicle resources are insufficient, be effectively operated by traffic personnel adopting a high-profile team approach where several police officers are deployed on foot in a small area in highly visible clothing and are seen to be undertaking accident prevention tasks such as speed detection and vehicle condition checks.

Where a vehicle suitable to undertake speed detection is available, speed enforcement can be undertaken by the method known as pursuit where the police vehicle follows the target vehicle at a fixed distance for a minimum distance (100 m or greater, depending on the distance that local courts and legislation are prepared to accept as proof). Evidence is presented by the officer that the speed of the followed vehicle was between the maximum of X kilometers per hour (km/h) and a minimum of Y km/h (the latter figure being in excess of the speed limit). It should be remembered that local legislation or legal precedent may require evidence to be given that the speedometer of

Plate 2 (above): Police spot checks on drunk-driving, note the reflective jackets worn for safety.

Plate 3 (right): Radar being checked before use.

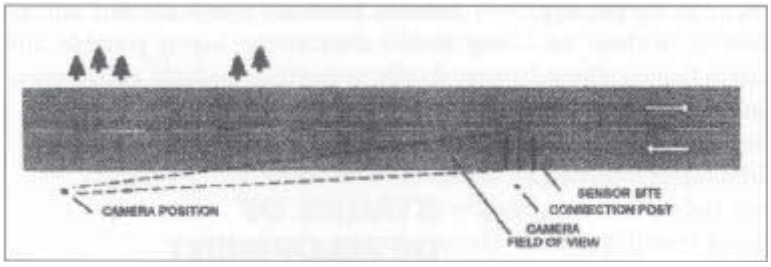

Figure 2:
Radar being checked before use.

Plate 4:
VASCAR system.

the police vehicle was accurate before and after the check. Some method of periodically checking the vehicle speedometer might be required, e.g., a rolling road (an expensive item to install and maintain).

The replacement of cable-driven speedometers with a type driven by electrical impulse allows the installation of a Visual Average Speed Computer And Recorder (VASCAR) type of device. This equipment can be easily calibrated by the driver of the police car by running the vehicle from stationary at a fixed point to a halt at another fixed point a known distance away. By imputing the distance into the device it can be recalibrated to ensure accuracy. Speeds can still be detected by pursuit, but a fixed distance is not required.

In developed countries, VASCAR and other similar devices can also provide inputs to video cameras mounted on police vehicles. These recorders run constantly while the police vehicle is in motion, recording the traffic scene in front of the police vehicle. In speed detection situations the vehicle is not only filmed but a real-time speed value is displayed. The recording of other serious driving offenses can also be recorded and the video used to support police evidence. It is also a useful road safety tool in that motorists can be stopped for poor driving and the video of the incident shown to highlight the deficiencies of driving style or the potentially dangerous situation entered into by the motorist.

b) *Automatic detection cameras*

These cameras are presently being introduced in many industrialized countries, either in 35 millimeter color film format or using electronic digital imaging. The use of these devices is usually a partnership between the highway authority, which provides and maintains the installation, and the police, who operate the system. The cameras are mounted in such a way as to observe the roadway at appropriate points. Offenses that can be detected are the failure to comply with a red traffic signal, either at a road junction or at a pedestrian crossing, or speed at a length of road where speed has been identified as a major cause of accidents. Such cameras can be positioned in front of or behind the site to record oncoming or receding traffic. The distance of the camera from the sensor site is determined by the camera optics used (see Figure 2).

The camera system cannot function efficiently without a satisfactory method of identifying the driver. As an alternative to prosecution, a conditional offer fixed penalty notice system may be used. In countries that have adopted red light enforcement cameras at road junctions with historically bad accident records, satisfactory fatal and serious accident reduction figures have been obtained. In one particular case, a before and after survey showed a reduction of red light running of 57 percent and a similar reduction in injury accidents.

Although such camera equipment has been successful in industrialized countries, its relevance to the needs of most developing countries at this stage is debatable as it is expensive, requires a capability to maintain sophisticated equipment, requires an ability to trace vehicle owners, and an efficient judicial processing system. Apart from a few major cities, these conditions do not exist in most Asian and Pacific countries. Consequently, countries should think carefully before investing in such equipment.

c) *Blood alcohol screening devices*

Where a drinking and driving problem and consequent accident problem exists, it is ap-

propriate to consider publicity as the primary means of deterrence. However, without enforcement, such measures have limited effects. In developed countries drinking and driving has been a problem for many years. Deaths and injuries caused by drinking and driving can be significantly reduced and therefore are suitable targets for focused traffic police enforcement. Measurable results can be obtained, either by quantifying the number of police breath tests administered or other means, such as an analysis of alcohol-related accidents as a proportion of overall accident figures.

Considerable inroads have been made into the problem in developed countries through a combination of vivid publicity and high-profile enforcement.

Public attitudes have changed over the last 20 years to such an extent that drinking and driving is no longer seen as acceptable social behavior by the majority of the population. There, however, remains a residual group within the motoring public that has traditionally been unmoved by publicity. While many agencies may have a part to play in reducing drink-related accidents, traffic police must play a leading role through enforcement.

With regard to the Asian and Pacific region, the problem of drinking and driving varies, some countries having no particular problem while in others it is a matter for considerable concern.

Where a suitable legal framework is provided, and an alcohol-related driver problem is identified, conspicuous enforcement campaigns are recommended.

This has two effects. Most obvious is when the drinking driver receives personal attention of police with the associated legal consequences. Less obvious, but nevertheless valuable, is the police being seen by the motoring public to be enforcing the drink-drive laws. This discourages similar behavior by reinforcing the publicity and enforcement message.

Plate 5: Roadside alcohol testing site in Fiji.

Ideally, enforcement of alcohol restrictions should be simple and advice is provided on prescribed alcohol limits and offenses in Sector Guidelines 4.10.

Suitable handheld breath alcohol screening devices are accurate, highly portable, and easy to use at random roadside enforcement checks (see Plate 5).

4 STAGES OF DEVELOPMENT

Traffic policing evolves with motorization and the increase in road accidents. Four basic stages are summarized below, describing the gradual awareness of the specialized requirements of traffic policing and the need for optimal use of limited resources.

Stage 1: Traffic police staffing strength is often used to compensate for lack of training, equipment, and mobility. Traffic control is all that is expected from the majority of traffic police and they are often stationed at traffic signals to provide backup support. Overwhelmed and underresourced, traffic police earn little respect from the public.

Stage 2: Training begins to be improved (especially in the capital city where population pressures exacerbate traffic and safety concerns) and the number of mobile traffic police enforcement patrol teams is increased. A strategic plan may be developed and begin to help focus resources.

Stage 3: Increased awareness of the mismatch between needs and capabilities leads to an overhaul of the national traffic police training program. Overseas technical assistance is often required for guidance. With specialized training introduced, career tenure is allowed and junior police officers are empowered under trial programs of training and auditing. The strategic plan starts to be monitored and progress is regularly assessed. Enforcement campaigns are based on accident factors and the effectiveness of such campaigns is evaluated rather than assumed.

Stage 4: Traffic policing tasks are divided between human resources and automation. There is minimal duplication of effort with police rarely supplementing signals.

5 BENEFITS AND EFFECTS

Effective traffic policing should reduce the number and severity of road accidents as hazardous locations and high-risk actions will be

targeted. Traffic conflicts should also be reduced, which would not only facilitate orderly traffic flows and optimize road space use but also reduce the uncertainty and perceived risk of traffic movements at dangerous locations. The traffic police will also begin to report road accidents accurately and comprehensively so as to allow analysis and engineering investigations to occur in addition to legal prosecution.

6 EXAMPLES OF GOOD PRACTICE

Hong Kong, China and Singapore stand out as centers of excellence in the region. Both are well-equipped and have a defined management structure that is sympathetic to the role undertaken. While there may be some subtle differences in style or structure, and this is to be expected, broadly the deployment and management are as outlined earlier. Elsewhere, Australia and the UK, among others, have well-developed red light camera systems. These forces, which are using the most up-to-date technology in red light and speed cameras, also have sophisticated training schemes appropriate to the needs of operational traffic police officers.

Training courses specifically for traffic police officers from developing countries are available in more motorized countries. The National Police Agency in Japan has provided training in traffic control technologies for traffic police from many Asian countries, including People's Republic of China, Indonesia, Singapore, and Thailand.

The No. 6 (2) Region Police Driving School in Wiltshire, UK, has trained officers from more than 35 countries and since 1987 has offered an 11-week Overseas Traffic Officers Course. Longer and specialized courses have also been offered as well as in-country training. In 1989, a six-month training program was organized for five senior officers from the Indonesia National Traffic Police that focused on developing instructional skills in all aspects of traffic policing. An inspector was seconded to the National Traffic Police Training Centre for further assistance. Engineers from Indonesia's Ministry of Transport have also been trained in plating, testing, and weighing systems of heavy good vehicles and senior inspectors of the former Royal Hong Kong Police have attended an Instructors' course in VASCAR/Autovision.

Northwestern Traffic Police Institute, United States (US), offers national and correspondence courses in Accident Investigation, Traffic Law and Law Enforcement. Its Accident Investigation Manual[4] was first published in 1940 and is now in its eighth edition. Monash University in Melbourne, Australia, has a Department of Police Studies and offers courses of various types on traffic policing topics.

Each of these training establishments has slightly different areas of emphasis, so a selection of the relevant parts of several of these courses may be of best use to interested traffic police forces. In order to provide access to some of the training materials used in these courses, the following section includes information not only on references and key documents, but also contact addresses for some of the more important training establishments that specialize in traffic policing. Note that items 4 and 5 are available from Reference 2, and items 6, 7, and 8 are available from Reference 1.

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Road Safety Guidelines

for the Asian and Pacific Region

4.12

EMERGENCY ASSISTANCE TO ROAD ACCIDENT VICTIMS

Asian Development Bank

4.12

EMERGENCY ASSISTANCE TO ROAD ACCIDENT VICTIMS

Although there is great diversity in application, there is general agreement on the principles of an effective emergency medical service. The essential functions of such a service are as follows:

- the provision of first aid and medical care to the casualties at the roadside;
- the transport of the casualty to a hospital; and
- the subsequent provision of more definitive treatment.

The typical components of an ambulance service in a developed country are as follows:

- a notification and communication system;
- central control and coordination of operations;
- effective rescue and medical aid at the scene; and
- transport to a hospital and the provision of definitive care in an emergency department.

In many countries, the absence of organized ambulance systems may mean that accident victims must rely on being transported to a hospital by the first available vehicle passing the site (often called scoop and run). In such locations, efforts should be made to educate the public in the basic four or five actions that can be taken to preserve life, and the need to transport the victim to the nearest medical facility as quickly as possible.

To ensure accident victims get the best emergency medical treatment practically possible, there should be a review of the local situation to provide information on the available resources and current usage patterns; i.e., how casualties arrive at the hospital and how long a time at the scene and in transit. With data from a study of crashes and injuries, and transport to hospitals, short- and longer-term plans can then be made for the development of a system suited to local situations.

PRIORITY ACTIONS NEEDED

1. Provide basic first aid information on treatment of accident victims (how to stop bleeding, choking, etc.) to all drivers (e.g., at the back of the highway code and through targeted publicity campaigns).

2. Train police, fire, and any other emergency service personnel in basic first aid.

3. Develop local and regional trauma plans based on study of postaccident assistance and consequences for road traffic accident casualties.

The key principle is to provide initial stabilization of the injured party during the “golden hour” (i.e., the first hour after injury). The general driving public should be made aware of simple actions that can be taken to preserve life.

1 INTRODUCTION

These sector guidelines on "Emergency Medical Services" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

The role of emergency medical services in minimizing the consequences of road traffic crashes lies immediately after the crash. The functions of an emergency medical service can be defined as:

1) the provision of first aid and medical care to accident victims at the roadside;
2) the transport of the victim to a hospital; and
3) subsequent provision of a more definitive treatment.

While the quality of care provided by the emergency wards in hospitals is clearly of critical importance, it is beyond the scope of these brief sector guidelines and the focus here is on the care and transport of road traffic accident victims from the accident scene until reaching the hospital emergency ward or the nearest medical facilities.

2 WHY IS EMERGENCY MEDICAL ASSISTANCE NEEDED?

The benefits of providing treatment to the injured as soon as possible were first recognized about 200 years ago during wars in Europe when "flying ambulances" or light horse-drawn carriages were introduced to carry the wounded from the battlefield. Since that time, there has been a slow but steady increase in the sophistication of emergency medical services, often accelerated by the requirements of wartime situations. Mortality rates dropped from 4.5 deaths per 100 casualties in World War II to less than one in recent times. This reduction was due, at least in part, to a reduction from hours to minutes in the time required to reach medical care and to the provision of effective care "at the scene" by trained paramedical personnel. Increasing efforts are being made to provide similar standards of care in the civilian realm, particularly for injuries resulting from road accidents.

About 50 percent of road traffic deaths happen within 15 minutes of the accident as a result of injuries to the brain, heart, and large blood vessels. A further 35 percent die in the next 1-2 hours of head and chest injuries, and 15 percent over the next 30 days from sepsis and organ failure. The time between injury and initial stabilization is the single most important factor in patient survival, with the first 30-60 minutes being the most important.

The most serious injuries resulting from traffic accidents are head, spinal, and internal soft tissue damage to vital organs. Early treatment and stabilization of these typical accident injuries can enhance a patient's timely and full recovery. Delay or well-intentioned but inappropriate first aid, can result in death or permanent disability. Medical experience around the world has demonstrated that stabilization of the injured person and hospitalization to a specialist center, within what they describe as the "golden hour," increases the patient's potential for survival and full recovery.

Ambulance services are intended to meet the following needs:

1) rapid response to life threatening or serious incidents;

2) preservation of life at the scene;
3) prehospital life support and patient stabilization; and
4) reduction in death and serious injury for accident victims

Ambulance services may not be as appropriate or effective in developing countries and a more flexible approach to emergency medical services needs to be considered because of:

1) lack of an effective communication network prevents ambulance services from being notified of road traffic accidents;
2) public unwillingness to give priority to ambulances as ambulances are more usually used for nonemergency trips such as transferring patients and hospital staff between hospital and home; and
3) lack of data that prevents the need for ambulance services from being identified.

Given the often crowded streets of cities in the region, it is difficult to see how an ambulance could reach the scene of a crash and transport the victim to hospital faster than the ad hoc arrangements now operating in some cities. In New Delhi, India, for instance, the times taken for patients to reach hospital approximate those reported in cities in Europe and the United States (US). However, the standard of medical care provided in a formal first aid and transport system would be higher; e.g., the care of airway obstruction and bleeding would be improved.

3 KEY COMPONENTS

3.1 Alternative Approaches

There are two general philosophies in the "**formal**" provision of emergency medical care. One of these formal approaches is to provide immediate first aid and emergency care at the scene of the incident, then to transport the injured person to the emergency department as fast as possible. It is there to supply skilled and definitive care, the so-called scoop and run philosophy. This approach is taken in countries such as Australia, New Zealand, United Kingdom (UK), and parts of the US.

The alternative is to carry the skilled care to the site of the incident and, there provide appropriate treatment. This approach is taken in France, Germany, and Russia, where well-equipped vehicles carry skilled doctors to the scene. Unfortunately, there is no evidence to show that one approach produces better results than the other, although both have their ardent supporters. An intermediate step is to use personnel with advanced training in diagnosis and resuscitation (paramedic), but again there is no evidence to show differences in outcome, although there may be differences in cost.

A third approach, an **"informal system,"** is found in many situations in countries in the Asian and Pacific region. Since there is often no organized ambulance service, the injured are picked up by bystanders or passing motorists and carried to the nearest emergency department by whatever transport is available, usually without any treatment or first aid at the scene. This results in rapid transport to the emergency department but without any resuscitation measures. The outcome of this system depends to some extent on the capacity of the emergency department to deal with these severe cases and to provide effective treatment on arrival.

The essential components of an organized emergency medical care system, are given below:

3.2 Formal Emergency Ambulance Systems

a) *An effective notification and communication network*

There should be a single, convenient method of notifying the ambulance service of the location and nature of the emergency. In many countries this is a telephone number such as 999, 000, or 111, which operates throughout the country and provides telephone access to all emergency services, police, fire, and ambulance. Ideally, these calls should also be without charge. An additional requirement for this to work is that there must be a way of identifying the exact location of the incident. In urban areas this is done usually with street names and intersections, but there can be difficulty where street names are not used or where there are a few landmarks, as in rural areas.

b) *Central control and coordination*

There should be a central control center for receiving calls from the public and from

other emergency services, and for coordinating the despatch of vehicles and crew, even though the vehicles may be based at out-stations strategically placed in relation to the anticipated demands.

Plate 1: Command and control screen.

Communication by radio between control center and vehicle is essential, as are radio and telephone links between control center and out stations and with hospital emergency departments.

Easy communication between the emergency department of the receiving hospitals and the ambulance service allows ambulances to radio ahead giving details of injuries and any special medical treatment needed.

Plate 2: Typical ambulance used in developed countries.

This helps to ensure that casualties are speedily dealt with on arrival. There should also be cooperation between the ambulance service and hospital in training of staff, and planning, development, and evaluation of operations.

c) *Effective rescue and medical aid at the scene*

The most important factor relating to the successful recovery of the accident victim is the initial first aid treatment provided to the injured person within the golden hour after the injury. Stabilization of the patient and/or, prevention of choking or bleeding to death can prevent permanent injury or premature death.

d) *Effective and appropriately equipped transport vehicles*

Ambulance vehicles used for patient transport should be clean, comfortable, possess enough room for treatment to be provided to the patient, and be capable of traversing the local terrain. This should carry a range of basic first aid equipment, as appropriate, depending upon the training of the crew.

e) *Training and evaluation of staff performance*

Training for emergency medical services personnel is commonly provided at basic and advanced levels. Basic level training provides for control of bleeding, preservation of a clear airways, cardiorespiratory resuscitation, and the stabilization of fractures. Advanced training includes intravenous therapy and cardiac defibrillation.

f) *Documentation*

It is essential that records be kept of all operations and treatment given, for medico-legal reasons, and to provide a basis for the evaluation of the efficiency and effectiveness of the service. Records should include the time of initial response, time spent at scene, and the time of transport to hospital to determine the overall efficiency as well as the time associated with each stage in order to identify potential time savings. It is also important to record that the victim was injured or killed in a road accident and to use the E codes (in the ICD-9 coding system) to provide statistics for planning purposes and to permit comparisons with police data to assess underreporting.

3.3 Informal Systems

While the term scoop and run originally applied to the practices in developed countries where ambulances were used for rapid transport and not providing medical treatment on site, it now also refers to the common practice in developing countries where the first available vehicle (almost always a passing private vehicle) is used to transport the injured to hospital.

With the absence of ambulances and limited mobility of the police in many developing countries, passing vehicles are often the only chance a road accident victim has of reaching proper medical care quickly. There are three basic requirements for such systems to operate effectively. These are that:

1) drivers of private vehicles have to be willing to transport road accident casualties;
2) road users need basic first aid knowledge; and
3) publicity campaigns and programs need to be undertaken to help achieve the first two requirements.

While a regulation requiring passersby to assist road accident victims is commonly found in the traffic legislation of many developing countries, it is rarely enforced. In many cases, payment must be collected first from donations at the road accident scene. There is also a disincentive to help as people fear being blamed for the accident by police and crowds who may become hostile. There is also reluctance to carry someone who is bleeding badly in case it damages car upholstery and clothes.

Timely transport may be important, but according to recent research conducted in India and elsewhere, in many cases, only basic first aid is required to sustain life. Accordingly, basic first aid teaching should be incorporated into as many driver oriented resources as possible, including highway codes, driver training programs, and driving tests.

Publicity measures should be used to remind the driving public of their legal responsibilities as well as the importance of helping as it could mean the difference between life and death for the victim. The general public will also need to be convinced that there are norisks or disadvantages (apart from the inconvenience) from assisting the injured.

In some Asian countries, well-meaning but misguided local perceptions can sometimes aggravate a patient's condition (e.g., making an injured person drink water in the belief this will help). Publicity campaigns should consider current local practice as well as recommended practices, especially if local practices need to be discouraged or modified.

Hospital locations will also need to be publicized and countries should consider requiring private hospitals and clinics to treat road accident victims.

In many developing countries, road accident victims will often be taken to the main public hospital where treatment is free, even when other hospitals are closer. The delay in treatment may result in more serious injury.

4 STAGES OF DEVELOPMENT

4.1 Emergency Medical Services Committee

Under the national road safety council, an intersectoral committee should be set up to review the provision of emergency medical services and the fate of victims of road traffic crashes. The membership of this committee could include representatives of the health, transport, public works, and police departments, hospitals with emergency departments, existing ambulance services, and possibly the insurance industry.

The tasks of this committee would include a review of the present situation and the resources available

This could include a survey of hospital attendances from road traffic crashes to establish the range of times from the crash to reaching hospital, and the method of transport to hospital.

This information, plus the nature and severity of injuries and their outcomes, would be valuable in establishing a baseline against which to measure the result of any future changes.

This review would also include an examination of the situation with regard to:

1) notification and communication systems, e.g., the capacity and coverage of the telephone system, the availability of radios, and a system of identifying the location of events;
2) personnel available, their level of expertise, and need for training;
3) systems for control and coordination of operations, including the coordination of emergency department and prehospital activities. Is there capacity within the existing emergency services or the hospitals to run a control center?
4) transport, the provision of appropriate vehicles, their operation and maintenance. What vehicles are available? Are they suitable? What type of vehicle would be appropriate?
5) emergency wards and medical staff at the hospitals; and
6) systems for documentation, review, and evaluation of operations. Are there any records available?

The first aid, transport, and hospital emergency department should be considered as parts of a whole emergency medical care system, but with different priorities

The results of this review will provide the information necessary to develop short- and long-term development strategies and action plans.

4.2 Short-term Action Plan (1-2 Years)

In the short term, in countries where there is no emergency ambulance, it may be more effective, given limited resources, and as a first step, to encourage informal scoop and run by:

1) providing basic first aid training to police, fire service, and other rescue personnel;
2) providing information (via highway code, publicity, etc.) to all drivers and riders (and especially professional drivers) on the four or five basic steps to stop a road accident victim bleeding or choking to death;
3) provide information and guidance on how to carry and transport injured persons to the nearest hospital; and
4) provide a mechanism (from insurance companies) to cover any minor expenses incurred in bringing the injured victim to hospital (e.g., cost of taxi fares [insurance companies could save money if victim reaches qualified medical care earlier]).

Hospital emergency departments should be upgraded with regard to equipment and the training of medical, nursing, and paramedical staff. There is little point in developing means of rapid notification and transport if the emergency department remains underequipped, understaffed, and undertrained. It is unlikely that there would be any improvement in outcomes; the place of death would merely be transferred from the road to hospital.

Until a more formal national emergency ambulance system can be established under the ministry of health, it is often possible to develop reasonable coverage by placing ambulances under the control of police highway patrols or fire stations. These emergency services often already have effective communications and disciplined staff who can be trained in basic first aid procedures. They can provide some emergency cover until a more comprehensive system can be established.

4.3 Medium-term Action Plan (3-5 Years) (or in the short term where some components of an emergency medical system already exist)

The main focus during this stage should be on the following aspects:

1) improving communications;
2) training personnel;
3) obtaining or upgrading vehicles and equipment;
4) developing a notification, despatch, and control system; and
5) developing a record system that can be used to monitor and evaluate performance of the system.

The action plan should include the appointment of a person, under the emergency services committee, to organize implementation of the improvements and to coordinate the activities of the agencies in providing the necessary resources.

If it is felt that the ambulance system should be improved, this is best done by appointing a professional manager to build up a new ambulance service. The manager's duties could include:

1) defining the ambulance needs for the country;
2) responsibility for finances;
3) ensuring staff resources are adequate in numbers; and
4) coordinating all interested bodies.

The financing of the manager's post and the ambulance service will depend upon government policy, but possible sources include:

1) legislation to provide levy from vehicle insurance, fuel, or highway tolls;
2) improved central funding of existing agencies; and
3) development banks and aid agencies for certain aspects, including studies and pilot projects.

The manager should prepare plans for the next one or two years together with a longer term strategy over perhaps five years.

Areas that could be improved within a one- or two-year period in the whole country (if small) or in a trial area (if a large country) include:

1) funding mechanism;
2) suitably equipped fleet of vehicles;
3) trained crews;
4) training level of staff;

5) first aid equipment;
6) liaison between agencies;
7) communication systems; and
8) response times.

In the longer term, the development of plans to upgrade communication and notification systems, to train personnel, and to obtain effective and appropriate vehicles can proceed. In urban areas and where distances to medical centers are short, skills to apply effective airway management, control of bleeding, and immobilization of the spine (e.g., a basic level of training) may be sufficient.

It is important that these developments take place on a regional basis, coordinating the actions of hospital emergency departments, and the first aid and emergency transport services. It has been found that improvements in prehospital care, a systematic approach, categorization of hospitals into levels of trauma care capability, the development of systems of review of trauma management within hospitals and within regions, and regionalization of emergency care have been shown to contribute to decreases in preventable trauma deaths.

5 BENEFITS OF EMERGENCY ASSISTANCE TO ROAD ACCIDENT VICTIMS

Estimates of the potential number of lives that could be saved by improved emergency services depend heavily on assumptions made on the availability of levels of care and their effectiveness, the methods of evaluation employed, and the level of services available in the particular region under study. In less developed countries there is little data available, but estimates range from 20 percent in Papua New Guinea to 5 percent in Melbourne, Australia. The figure of less than 5 percent for Australia may well represent a lower limit for deaths potentially influenced by improvements in first aid and transport.

6 EXAMPLES OF GOOD PRACTICE

In each state of **Australia**, and in **New Zealand**, ambulance services are provided by independent, nonprofit services under the supervision of the state health departments. In addition to its role in providing emergency service, in both of these countries, the major role of the ambulance service is to provide a routine transport service transferring patients between hospital and home. Most services have crews with advanced as well as basic training, and vehicles with advanced equipment. There is a large degree of standardization of vehicle design across Australia. Some centers in both countries have developed trauma plans which categorize hospitals and increase coordination with the ambulance service. In **Japan** the ambulance service is provided by the fire service, with which its operations are closely linked. In **Singapore** the service is provided by the Civil Defence Force, which is closely allied with the fire service.

In **Kazakstan**, the ambulance system in the capital city of Almaty operates 116 ambulances and reported transporting 50 percent more road traffic accident victims than were reported by the police in 1996.

Australia, **Malaysia**, and **New Zealand**, each have a dedicated telephone number for all emergency services. **Singapore** has a single number for the police, while the ambulance and fire services share another number. Ambulance services in the **People's Republic**

Plates 4 and 5: Typical ambulances in Asia.

of China (PRC) are in the process of development. They are the responsibility of each municipality. Beijing and Shanghai have efficient services in which each ambulance is manned by a driver, a doctor, and a nurse, and there is central radio control and a number of out-stations. The Beijing service has its own emergency hospital. Other cities, e.g., Chongqing and Shenyang, have smaller, less well-equipped services.

In other countries, there is limited ambulance service. In **Papua New Guinea**, where the service is provided by the Order of St. John, service is confined to the major city. In **Indonesia** the service is provided by the Indonesian Surgeons Association, and in **Malaysia** by the Red Crescent organization. In **Viet Nam**, there is a small ambulance service in Hanoi.

The traffic police in Madras, **India,** introduced the Golden Hour Scheme in late 1994 where passersby were encouraged to help road accident victims and private hospitals were to treat road accident victims. The Police Commissioner requested all medical practitioners and private hospitals to provide all possible assistance to road accident victims and announced the police would be restricted from harassing those offering help to road accident victims. Several countries are improving their emergency ambulance systems. **Fiji**, for example, has implemented a pilot project to extend existing ambulance services and is considering basing ambulances at fire stations around the country.

In **Thailand,** the Ministry of Health is improving the emergency ambulance system by training paramedics and ambulance crews to be able to offer assistance.

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Road Safety Guidelines

for the Asian and Pacific Region

4.13

ROAD SAFETY RESEARCH

Asian Development Bank

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ROAD SAFETY RESEARCH

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. Accurate and comprehensive accident data is required to provide a base comparison for identifying problems, evaluating any changes, and assessing the effectiveness of any countermeasures adopted. Consequently, improving the accident database is frequently one of the first priorities when seeking to establish a road safety research program.

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. 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.

Efforts should be made to identify the factors involved in road accidents and to monitor effectiveness of any countermeasures implemented. Of particular importance is the development and monitoring of low-cost engineering countermeasures so that immediate improvements can be made at known hazardous locations.

PRIORITY ACTIONS NEEDED

1. Identify and prepare a consolidated list of all road safety research undertaken in the country and the researchers and institutes involved.

2. Target future research at accepted priority areas or in improving the accident data system if accident data is inadequate to provide an accurate baseline assessment of the road safety situation.

3. Coordinate research with the national road safety council (NRSC) and the lead road safety agency in the country to ensure road safety research is relevant and findings can be applied.

Road safety research has proven beneficial in documenting the road accident problem and has provided the means to develop and evaluate countermeasures. It has contributed greatly to the accident reduction in industrialized countries.

1 INTRODUCTION

These sector guidelines on "Road Safety Research" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

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:

1) greater understanding of the situation and the identification of problem areas;
2) development of countermeasures for problem areas; and
3) the evaluation of the effectiveness of any remedial action undertaken.

These sector guidelines outline why road safety research is needed, a possible framework for research, the stages of development, and the benefits and examples of good practice.

2 WHY IS ROAD SAFETY RESEARCH NEEDED?

The study of the causes and prevention of road accidents is justifiable not only on humanitarian grounds, as road accidents are a major cause of death and injury but also on an economic basis, as road accidents are known to amount to between 1 percent and 3 percent of a country's gross domestic product (GDP) per annum.

Earlier work in the Asian and Pacific region by the authors included reviewing all aid-funded (multilateral and bilateral) and (national or local) road safety research in the Asian and Pacific region.

It was found that, apart from a few notable exceptions, relatively little research had been undertaken by countries in the region. Furthermore, while the international agencies were providing substantially increased support for funding specific safety projects or ensuring that major highway or urban transport projects contained a safety component, relatively little funding was provided for pure research. One notable exception has been the United Kingdom's (UK's) Overseas Development Administration (ODA), which for more than 20 years has funded much of the Transport Research Laboratory's (TRL) road safety work in developing countries.

As motorization is increasing, dramatically so in many Asian countries, road accident numbers are bound to increase and the need for road safety research will become stronger. Measures that have been successful in developed countries may not always be as successful in the developing world because of the different social culture and economic circumstances in developing countries. It is, therefore, necessary to carry out country-specific research to identify measures that may be useful in the developing world.

3 KEY COMPONENTS

3.1 Program Content

Road safety research in developed countries is usually carried out in a number of parallel streams. Typical sectors of activity and their aims are usually as follows:

1) **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;

2) **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;
3) **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
4) **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.

The sectors covered in these guidelines are involved in virtually every transport problem and so offer a convenient framework against which to develop comprehensive research and development programs. When considering the general area of road safety, problems in each sector can be used to suggest specific areas for comprehensive research work in this field, as shown in Figure 1.

3.2 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. In India, the Indian Institute of Technology (IIT) has seven experienced staff members working in road safety, while the Central Road Research Institute in New Delhi has about ten road safety researchers.

Training needs should be covered by university courses, short in-house courses, and overseas training. A career path is also needed to ensure road safety researchers are motivated to remain in the field. Several research institutes around the world have been privatized in recent years and the uncertainty of continued work has consequently affected workers' morale. 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.

At TRL, one third of the total turnover of approximately £32 million (US$51 million) per annum is allocated to road safety research. However, road safety research is not always adequately funded even in developed countries. In the United States (US), transport advisory boards argue that the road safety research budget should be increased by 50 percent because, in terms of years of productive life lost, road safety research receives only one eighth that of heart disease and only one seventeenth of that allocated to cancer.

3.3 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. Failure can provide as many lessons as success and, despite the inevitable disappointment and reluctance when such failures occur, research institutes should publicize all results. Most research institutes, such as the Central Road Research Institute in India, publish annual reports that summarize the research and development work for the previous year[1]. IIT recently produced a review of its injury control research efforts[2] that spanned the years 1991-1995. Research findings can also 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.

4 STAGES OF DEVELOPMENT

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

1) **identify previous research conducted.** Early road safety research tends to be conducted by individuals from the academic or medical sector and will need to be centrally collected and organized. Individuals and organizations, most likely engineering universities or teach-

ing hospitals, should be listed on a central database;

2) **target priority areas identified and ensure reliable accident database.** An objective and scientific approach to road safety requires an accurate and comprehensive accident database. Road safety research's first objective of problem assessment requires scrutinization of accident data for accuracy before they can be used. While the accident data system is being improved, other perceived key areas such as pedestrians or nighttime accidents can be addressed;
3) **NRSC/lead road safety agency to guide research and promote dissemination and application of findings.** Road safety research needs to be incorporated into any action plan or strategy developed with research focus reflecting the lead agency's priorities;
4) **effectiveness of road safety remedial measures evaluated by road safety researchers.** Road safety research should be promoted and expanded byundertaking evaluation work of road safety remedial measures, both foreign funded and locally financed;
5) **establish links with other road safety research institutes in other countries.** While research findings are not always transferable, the lessons learned and approaches used should help minimize instances of "reinventing the wheel," which countries cannot afford. Annual research publications lists should be circulated between research institutes, and twinning arrangements and exchange programs developed;
6) **solicit private sector commissioned road safety research.** More than half the countries surveyed indicated no central government funds were available for road safety research. Transport-related industries, i.e., insurance companies and automobile manufacturers, need to be targeted for research funding. Road safety research will need to be directly relevant; and
7) **establish (within an existing institute) a road safety research center with full-time researchers.** Road safety research will eventually need to be undertaken by specially trained professionals.

5 BENEFITS AND EFFECTS

Road safety research produces many benefits, which can be categorized into the following main divisions listed below. Specific examples of these benefits are also provided.

5.1 Problem Assessment

Before developing any action plan, an accurate assessment of the road safety situation is required. 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. While the police will be responsible for tallying reported road accident numbers and casualties, research should query the accuracy of such figures and what they indicate about the national and local road safety situation.

Much of the early overseas road safety research work undertaken by TRL's Overseas Centre was instrumental in documenting the growing problem of road accidents in developing countries. Despite low levels of motorization, accident rates were found to be many times greater (per vehicle) than in motorized countries (see Figure 1).

Road accident casualties tended to affect the younger population to a much greater extent (partially due to the age distribution) and pedestrians were found to comprise a much larger proportion of road accident casualties than in countries with a much higher rate of motorized vehicle travel.

These findings of high accident rates and the vulnerability of pedestrians and children have influenced road safety policies around the world and helped determine subsequent road safety research and policy in developing countries.

To address the lack of accurate and comprehensive accident data, TRL's Overseas Safety Research Team developed a Microcomputer Accident Analysis Package (MAAP)[1,2] which is now either in use or being tested by the relevant authorities in many developing countries around the world as well as in several UK police authorities.

Countries, provinces, or research institutions can modify the standard data collected on each road accident according to their own needs.

5.2 Development of Countermeasures

A good accident data system also enables safety authorities to plan effective countermeasures and campaigns. It also serves as a research aid to enable problem areas to be identified, and remedies devised and tested in a scientific manner. To encourage the latter, the TRL MAAP package has been offered free to developing countries under license on condition that the results are made available to TRL for research.

In the area of road environment, many measures have been developed related to road traffic management and increased understanding of road user behavior. These include improved junction design techniques, urban safety management studies, and better road surfaces. The most significant results of research, however, are perhaps linked to issues such as seat belt wearing and reduction in drinking and driving. The financial benefits of these research studies are listed below in Section 5.4.

5.3 Evaluation

Good intentions do not guarantee successful results and road safety countermeasures and programs need to be evaluated to determine their effectiveness, particularly in relation to cost. International resource scarcity requires that all resources be used effectively.

The *Annual Report* of TRL 1992/1993 provided an estimate of the monetary benefits obtained from examples of its research work. These were selected as places where it was considered possible to place value on most of the benefits. These estimates were understandably approximate and were expressed as the monetary benefits to the community in the year of the *Annual Report*. Benefits from UK road safety research-based projects are shown below and provide an illustration of the value of carrying out effective research programs:

	Cost of research (as at 1993) £ million	***Annual benefit £ million***
Seat belt wearing	*8.5*	*650*
Junction accident studies	*1.1*	*5*
Urban safety management schemes	*5.3*	*17*
Drink and drive studies	*3.0*	*60*
Road texture and accident rate	*15.0*	*15*

The production cost of the highly-acclaimed safety-conscious road design guide for developing countries, *Towards Safer Roads*[3], has been estimated at £250,000 (US$400,000) while the annual benefits from the safe design could reach £10 million (US$16 million) per annum.

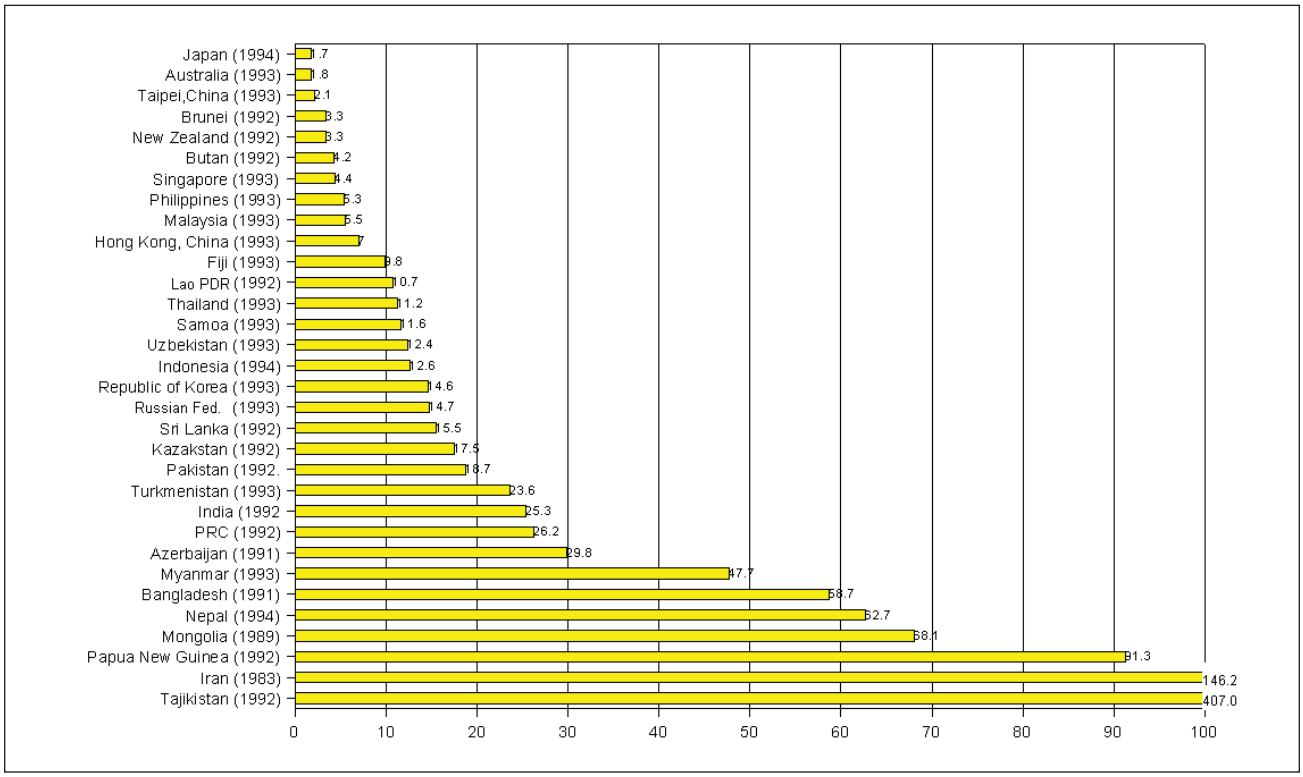
5.4 Scientific Approach

Because of the complexity of road accident causation factors, the many organizations involved, and the emotional nature of road accidents, there is temptation to embark on policies and countermeasures that are visible but superficial and with little ultimate effect on the level of road safety. Road safety research should help road safety policy to be based on an objective and informed basis. Indeed, without relevant local research it is likely that countries wishing to invest more resources in road safety will look only at results from other countries and may well adopt measures inappropriate for their own conditions, thereby wasting those valuable resources. Effective road safety research provides the framework against which informed decisions can be made, and it is essential that every developing country should have some local research activity on road safety issues to aid decision making.

6 EXAMPLES OF GOOD PRACTICE

National transport research centers exist in a number of countries within the region covered by the ADB and United Nations Economic and Social Commission forAsia and the Pacifc (UN/ESCAP). Most of these spend a reasonable proportion of their time and budget on safety-related issues. In particular, the following locations can be identified and are gaining wider recognition for their work in the safety field:

- **Central Road Research Institute**, New Delhi, India;
- **Institute for Road Engineering** Bandung, Indonesia;
- **Korean Transport Research Institute**, Seoul, Republic of Korea;
- **Institute Kerja Raya Malaysia**, Kuala Lumpur, Malaysia; and
- **National Transport Research Centre**, Islamabad, Pakistan.



Source: RETA project data.

Figure 1: Fatality rates in developing countries (deaths/10,000 vehicles).

Although details are not available on all of these organizations, the following few examples illustrate that some excellent research work and potential exists in the region.

1) The **Central Road Research Institute's** traffic and safety environment unit was established in 1986, as an offshoot of the traffic and transport department in order to give road safety greater emphasis. The main objective of the Institute's road safety research was to create road safety awareness among the decision makers in India, with much of the early work dedicated to the analysis of accident data.

Economic constraints have now led the Institute to focus research efforts into areas where funding is available, either from the public or private sector. The Ministry of Surface Transport gave the Institute a grant in the early 1990s to provide traffic police training and private sector firms have cosponsored and jointly organized research into driver testing (visual and psychophysical assessment systems).

At present, the Institute's road safety research covers a wide range of areas, including nonmotorized vehicle safety, motorcycle helmet usage, design standards and construction practices, medians, road safety education and safety in schools, and driver evaluation methods.

2) The **Institute of Road Engineering** was founded in 1984 as the primary research organization for research in the highway sector in Indonesia, and six years later, it began collaborating with SweRoad in road safety research. Its early work in the identification of hazardous locations led to the realization that the improvement of the accident database was its first priority.

It adapted TRL's MAAP system, but the Indonesian version known as 3-L (Lahta Laka Lantas) has been introduced in only a few areas of Indonesia. While the Institute continues to seek Government commitment for introducing the 3-L system nationwide, it also aims to continue its work in evaluating the effectiveness of remedial measures at hazardous locations and accident costing updates, as well as developing road safety audit capability.

The Institute is keen to enter into collaboration agreements with nearby countries and is part of a twinning arrangement with the Bangladesh Road Research Laboratory and TRL.

In addition, a number of universities in the region has a reputation for carrying out valuable road safety research. These include:

Bangladesh University of Engineering and Technology, Dhaka, Bangladesh;
University of Bangalore, Bangalore, India;
IIT, New Delhi, India;
Accident Research Unit, University Pertanian, Serdang, Malaysia; and
Chulalongkorn University, Bangkok, Thailand.

As with the research institutes, detailed information is not available on specific activities in all of these teaching institutions. However, the research being undertaken at IIT is particularly extensive so it is summarized below to illustrate the quality and range of research being undertaken in teaching centers.

IIT's Centre for Biomedical Engineering was recognized for its outstanding work in the field of injury control when it was established as one of the world's 13 World Health Organization (WHO) collaborating centers in 1991. The Institute has targeted the area of vulnerable road users and has undertaken research into vehicle design (safer fronts), motorcycle helmet design, and emergency medical assistance. It has also conducted much research into accident reporting and has developed an accident report form that has been recommended by the Indian Roads Congress. In mid-1995, the Institute proposed the establishment of a transportations systems research program with staff from the transportation planning and engineering department, statistics, biomechanics, and safety engineering. It envisioned the research program to be self-sufficient within three years of starting, with half of the funding expected to come from industry and the other half from public sector contracts, including aid agencies.

All of the above organizations can be praised for undertaking valuable road safety research, but, in general, funding from their respective governments has been limited. Limited resources reinforce the need to share information and to avoid cases of duplication.

Plate 1: MAAP in use.

Over the past two decades, TRL has collaborated on research with several countries; including Egypt, Indonesia, Malaysia, Pakistan, and Papua New Guinea, while the Republic of Korea has sent several road safety researchers to work at TRL.

Both TRL and the Road Engineering Association of Asia and Australasia (REAAA) have produced lists of references relevant for widespread usage in the developing world. In addition to the development of MAAP, ODA has sponsored the previously mentioned *Towards Safer Roads in Developing Countries*, a compilation of best practice, in safety-related engineering matters suitable for developing countries. Following its publication in 1991, it has rapidly become the standard reference work for road safety engineering in developing countries. REAAA has compiled a valuable inventory of road safety resources for developing countries that provides many references as well as contact names and addresses. As is the case with *Towards Safer Roads*, the REAAA inventory is free of charge (see Appendix A).

TRL has also had formal and informal close working relationships with several of the research institutes in the Asian and Pacific region. This has led to staff exchanges and collaborative research. Such contacts and links are an effective way to stimulate and develop road safety research activities in developing countries.

The Institute of Transport Economics in Norway has also (as part of its overseas research programs) produced several standardized publications for regional use in Southern Africa, including a highway code, a road traffic signs manual, a road traffic model statute, and a manual for learner drivers. Although these were produced for application in Africa, they form useful basic documents, for the region. There is a need to consolidate and disseminate such information and research results among Asian and Pacific countries and recommendations are being made within ADB and UN/ESCAP regional studies on how this could best be done.

7 REFERENCES AND KEY DOCUMENTS

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Road Safety Guidelines

for the Asian and Pacific Region

4.14

ROAD ACCIDENT COSTING

Asian Development Bank

4.14

ROAD ACCIDENT COSTING

With the high growth of road accidents throughout the developing world, it is essential that adequate sums of money are spent in dealing with the problem. In the absence of an estimate of accident-related economic issues, it is difficult to identify the sums of money that should be invested each year on road safety counter-measures. The first need for accident cost valuations, therefore, is at the level of national resource planning to ensure that road safety is given adequate priority in terms of investment in its improvement.

A second need for road accident cost figures is to ensure that the best use is made of any investment and that the best (and most appropriate) safety improvements are introduced in terms of the benefits they might generate in relation to their cost.

Various methods exist for costing road accidents but the method currently recommended for use in the developing world is the gross output or human capital approach. The method takes into account the loss of current resources such as vehicle damage, medical treatment, police and administration costs, and damage to street furniture. It also attempts to cost the loss of future resources by considering the loss to society of a person's output when that person is killed or injured.

In using the gross output method, a sum is usually included to reflect pain, grief, and suffering of the accident victim and to those who care for the victim.

Accidents are usually costed by degree of severity so that separate values are determined for fatal, serious, slight, and damage-only accidents. The national cost of road accidents is then determined by multiplying the costs by accident severity by the number of those accidents taking place each year.

Once the total extent of the human casualty toll and economic costs of road accidents is known, the road safety situation will be better appreciated by politicians and decision makers and the case made for increased road safety investment. Road accident costs can then begin to be used to justify safety measures, and be considered along with construction and maintenance costs in the cost benefit analysis of road improvement projects.

PRIORITY ACTIONS NEEDED

1. Until local estimates are available, assume 1-2 percent of national gross domestic product (GDP) is lost annually through road accidents.

2. Prepare interim local estimates of the costs of road accidents by severity using the approach recommended by the Transport Research Laboratory (TRL) of the United Kingdom (UK).

3. Set in motion a research project at a university or economic research institute to prepare accurate valuations of road accident costs by severity using the gross output method.

An estimate of the total national cost of road accidents will help Governments realize the heavy economic losses (typically between 1 percent and 2 percent of gross domestic product [GDP]) being incurred annually). This will encourage them to invest in road safety improvements to reduce these losses and to see expenditure on road safety as an investment and not as a cost.

1 INTRODUCTION

These sector guidelines on "Road Accident Costing" are from a set of *Road Safety Guidelines for the Asian and Pacific Region* policymakers, developed as part of a regional technical assistance project (RETA 5620: Regional Initiatives in Road Safety) funded by the Asian Development Bank (ADB).

Road traffic accidents (RTA) are commonly viewed in terms of individual personal losses or as general statistics. Unlike aviation or rail accidents (where frequently, many persons may die in a single accident), the large-scale economic and social impact of road accidents is rarely appreciated, as road accident deaths and casualties normally only happen in ones and twos. Road accident costing attempts to estimate the annual cumulative losses incurred by a country as a result of road accidents.

Several different methods exist for costing road accidents, including court awards and life insurance contracts, but the two most common are the gross output method and the willingness to pay method. The gross output method (also referred to as the human capital approach) is based on assessing the economic consequences of road accidents, usually supplemented by a notional sum to reflect pain, grief, and suffering for those involved and also for family and friends of those killed and injured, as a proxy for accident costs. The willingness to pay method estimates the amount of money people affected by a particular measure would pay to avoid an accident and produces a much higher valuation of accident costs.

Since the late 1980s willingness to pay has increasingly been applied for accident costing in industrialized countries. However, the gross output method has been the most commonly used method in most countries over the past few decades. This method is recommended for developing countries as its primary objective, increasing a country's wealth, is thought more appropriate to their needs. Many assumptions are required in accident costing and, whenever alternative values or uncertainties present themselves, a conservative approach is recommended thus ensuring that a indisputable minimum value is obtained of road accident costs in a country. If investment can be justified on such a minimum value, it will certainly be justified on any other value.

2 WHY IS ROAD ACCIDENT COSTING NEEDED?

Accident costing highlights the socio-economic burden of road accidents. Developing countries face many challenges and have many resource needs. Road safety tends not to receive due consideration because not all road accidents and casualties are reported to the police and there is usually no other system of estimating road accidents and the corresponding casualties nationwide.

There is also a problem with the perception that road accidents are random, unintentional, or predestined; i.e., unavoidable. Road accidents are too often accepted as inevitable negative side effects of motorization. However tragic the personal losses, road accidents are rarely perceived as a serious drain on the economy and this leads to complacency towards road safety issues. This view is totally wrong. Road accidents have been shown to cost annually between 1 percent and 3 percent of GDP in developing countries. The gross national product (GNP) is often more readily available than the GDP figure and although usually slightly higher than the GDP, can be substituted for it for the purposes of rough estimation. These are large sums that few countries — especially de-

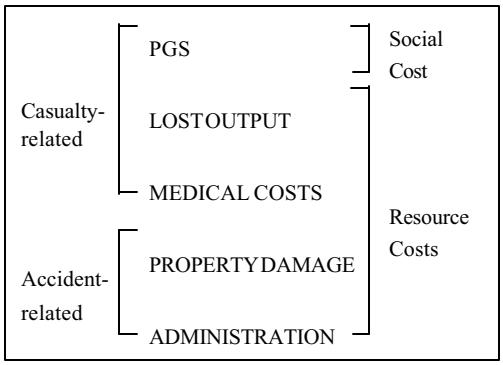

Figure 1: Road accident cost components

veloping countries — can afford to lose, year after year.

Knowledge of accident costs allows safety impacts to be economically justified. Road safety measures have been frequently ignored or downplayed in cost benefit analyses on the grounds that the associated costs and benefits are too intangible. Where road safety is included in cost benefit analyses of road improvements, it is often only factored on a subjective basis and so does not get applied in the consistent manner required for project comparisons. So road safety has generally been severely underfunded as it is not possible to prove its cost-effectiveness without the use of road accident cost values.

3 KEY COMPONENTS

The key components that need to be considered when examining this sector relate largely to the various cost components. These can be classified into **casualty-related costs** (lost output, medical costs, and the pain, grief, and suffering value), **accident-related costs** (property damage and administration), and **accident data**. As shown in Figure l, all are resource costs, except for the pain, grief, and suffering component.

The cost of an accident is the sum of the casualty-related costs, plus the accident-related costs, while the total cost of accidents in a country is the number of accidents by severity multiplied by their respective accident cost.

3.1 Accident Data

To calculate total accident costs, the number of accidents and casualties by severity must be known. While accident data is often taken for granted in industrialized countries, in developing countries with little road safety awareness, accident data may be incomplete and inconsistent.

To permit cost estimation, casualty figures need to be provided separately by the traffic police for each accident severity type, as shown in Table 1.

While the internationally accepted definition of a road accident death includes all related deaths within 30 days of the accident, many countries report only deaths occurring at the scene or within a few days. Adjustment factors* should, therefore, be applied when making international comparisons. Published ministry of health figures, when available, should be compared with police reported figures to ensure that an accurate assessment of total road accidents and casualties is achieved.

Serious injuries are defined as those that require hospitalization (at least one night) while slight injuries require medical treatment but no overnight stay in a hospital. In many countries, the number of police-reported road accident injuries is often unrealistically low and in such cases hospital surveys should be conducted to identify the actual number of serious and slight injuries, based on police or insurance company data.

Damage-only accidents are even less well documented than injury accidents, as few developing countries require damage-only accidents to be reported. Early accident costings in the UK assumed a damage-only accident ratio of six to every one injury accident. Subsequent insurance company surveys increased this ratio and a recent postal survey has concluded that the damage-only ratio should be more than 17 times that of injury accidents in urban areas of the UK. A nationwide average of 15 damage-only accidents to each injury accident is now used in the UK for cost estimation. The

Table 1: National Accident Data Requirements

Accident type	Accidents (No.)	Casualties (No.)		
		Fatality	Serious injury	Slight injury
Fatal	✓	✓	✓	✓
Serious	✓	0	✓	✓
Slight	✓	0	0	✓
Damage only	✓	0	0	0

* Corrections to convert different definitions of road deaths to 30 day deaths:
within four hours (+30 percent);
within three days (+15 percent);
within six days (+9 percent);
within seven days (+8 percent); and
within one year (-3 percent).

importance of estimating the number of damage-only accidents is shown by the fact that in the United States (US), the cost of damage-only accidents is estimated to be higher than the cost of all fatal accidents.

In order not to disregard the cost of damage-only accidents, their frequency will need to be estimated and a conservative ratio (five or six damage-only accidents for every injury accident) can be used in the interim until more accurate data is available. In Nepal, a ratio of 5:1 damage-only accidents to injury accidents was recently used for urban areas and a lower ratio of 2:1 was accepted for rural areas. The average cost of a personal injury accident is used in cost benefit analysis in the UK, but this cost also includes expected damage-only accident costs. In developing countries, the average injury accident cost may need to be factored to compensate for unreported injury accidents as well as unreported damage-only accidents.

3.2 Lost Output

Lost output refers to the contribution RTA victims were expected to make to the economy with future earnings weighted to present value (with an inflation rate currently in use in the country). The contribution is usually measured by the average earnings plus any nonwage payments (e.g., national insurance contribution or rent subsidy).

Average wage rates are frequently used with assumptions required to reflect the amount of agricultural labor and employment rates. Accident victim surveys have been conducted in some countries but are generally on a small scale and often have had conflicting results. Urban pedestrian deaths are commonly often assumed to be persons of low income yet a recent accident costing exercise in Kerala, India, estimated victims' income to be three times that of the local average per capita income[1].

The "lost output" of RTA deaths is calculated as the average earnings multiplied by the number of working years lost (i.e., average retirement age minus the average RTA fatality age) and then weighted at the accepted government rate to a present day value. Unlike other major causes of death in developing countries, road accidents strike down those in the prime of life (average RTA fatality age is usually between 28 and 31 years), when they are arguably of the most productive value to society.

Lost output for serious and slight injuries is the daily earning rate multiplied by the number of days off work. This is usually derived from hospital and victim surveys. Cost is not normally assigned to the amount of increased travel time caused by road accidents.

3.3 Vehicle Damage Costs

While all property-related damage costs should be valued (e.g., street furniture, guardrails, and walls), vehicle damage costs are often the only property item valued in developing countries. Vehicle damage costs include the repair or replacement cost (minus salvage value) insurance claim, surveyor fees, and any business lost due to the vehicle being out of commission (although this is rarely counted in developing countries). As the cost to society is being measured, vehicle damage costs should be calculated net of import duties and sales tax. In the gross output method, vehicle damage costs are often the largest cost component in analyses.

Insurance claims are the traditional source for vehicle damage costs, but the low rate of insurance coverage in many developing countries raises questions as to how representative accident claims are. Compensation is often less than damage costs, as policy coverage may be restricted, with the owner usually paying the first portion (say US$100) or more of any damage. Insurance claim surveyor reports, although still limited to insured vehicles, have the advantage of estimating vehicle damage costs regardless of coverage limitations and often they will report the present value of the car, any remaining salvage value, and will itemize the cost of labor and replacement parts separately. Where they are available they provide a good source for estimating damage costs.

Vehicle fleet operating companies can also be contacted for cost data but poor record keeping practices and low levels of safety awareness frequently limit cost data availability. Vehicle fleet companies should be contacted, however, to estimate the amount of business lost during postaccident repair time.

Vehicle damage costs can also be collected from accident victim surveys, but this is a slow process. Surveys were attempted in Nepal, with motorcyclists asked about accident damage costs, but the results were disappointing. Repair workshops in Nepal were also contacted for accident repair costs but little data was collected over three months.

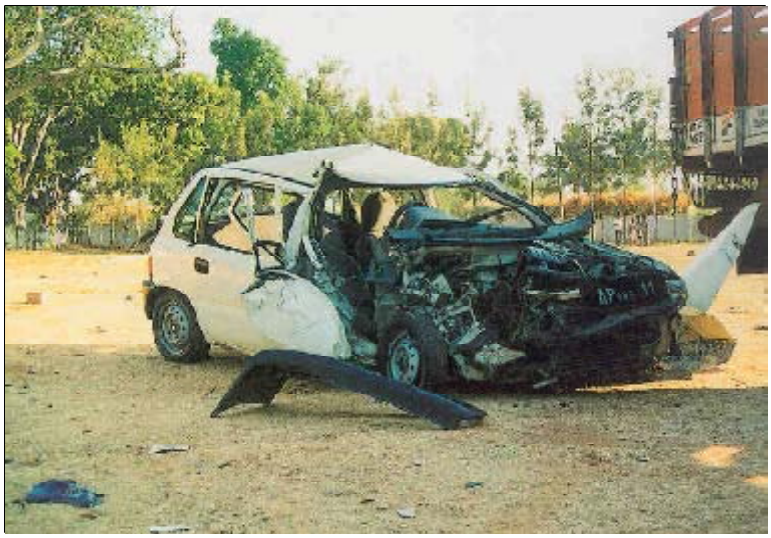

Plate 1: Damaged vehicle.

Average vehicle damage costs should not be assumed to apply equally to all vehicles involved in accidents. While pedestrian accidents are a serious problem in many developing countries and contribute significantly to casualty figures and costs, pedestrian accidents often involve little or no vehicle damage. Accident reporting systems such as the Transport Research Laboratory's (TRL) Microcomputer Accident Analysis Package (MAAP) can be configured to include data on vehicle damage and can provide the number of reported accidents incurring no vehicle damage.

3.4 Medical Costs

Medical costs include emergency medical services, both inpatient and outpatient care, prescription costs, service fees (X-rays and operations), and rehabilitation costs (including artificial limbs). Medical costs are a difficult area in which to collect data. As they rarely account for more than 5 percent of accident costs, data collection can be kept to a minimum, as even gross errors have relatively little effect on the overall accident costs.

Often, neither health ministries nor individual hospitals are able to estimate the cost of an inpatient stay (per night) or an outpatient visit. Bed charges should not be used as they refer only to the patients' charge (and for partial service) and do not reflect the amount of subsidy received or the true cost incurred. As a last resort, a hospital's annual expenditure can be divided by the number of inpatient days and outpatient visits. Outpatient visit cost can be assumed to be a quarter that of an overnight stay, although this does not reflect capital costs. In developing countries, medical costs do not reflect the reality of the situation, as scarce resources limit the hospital beds and medical services available. The medical costs alone do not necessarily reflect the actual opportunity costs.

3.5 Administration Costs

Administration costs from road accidents are incurred by the police and the insurance companies. The situation is complicated, however, by the number of accidents not reported to the police and those accidents not involving insured vehicles. The responsibility for accident reporting may also be divided between several police forces or divisions, as in Bangladesh where traffic police report damage-only accidents and general duty police report injury accidents.

Many developing countries for convenience adopt the ratios determined by research in the UK and assume administration costs to represent 0.2 percent of the total resource costs in a fatal accident, 4 percent of serious accidents, 14 percent of slight accidents, and 10 percent of damage-only accidents. An alternative method is to assume a token amount for those accidents involving police and/or insurance involvement.

3.6 Pain, Grief, and Suffering Component

Early estimates of road accident costs focused exclusively on the direct economic costs and did not attempt to consider pain, grief, and suffering. With the onset of social cost benefit analysis in the 1970s, a notional value for pain, grief, and suffering was included in industrialized countries to reflect societies' and the individual's aversion to death. The original value for pain, grief, and suffering of a RTA death was determined by the amount required to ensure all lives (no matter what age and what remaining productivity) received a positive value under the net output method.

In the UK, pain, grief, and suffering values were increased several times throughout the 1970s and 1980s and ended at 38 percent of resource costs of a RTA death, 100 percent of a serious injury, and 10 percent of a slight injury. While many developing countries have

used these values, the accident costings in India and Nepal have used 20 percent of lost output costs.

With the increasing introduction of the willingness to pay method, the human costs are almost twice the resource costs in the UK[10]. This method is inappropriate to apply in developing countries, but does indicate that the calculation and use of a value based on gross output method perhaps still underestimates the real cost of road accidents in a country.

4 STAGES OF DEVELOPMENT

In order to produce accurate estimates of road accident costs and to incorporate these estimates into cost benefit analyses, a developing country usually needs to proceed through a number of stages. The major milestones of introducing and applying road accident costing are provided below, along with the activity involved:

1) **Accept 1 percent of annual national GDP as a minimum estimate of annual road accident costs.** This working estimate should be used to highlight the costs of road accidents incurred annually and to emphasize the overall national cost of road accidents that are usually considered as individual cases with separate financial and personal losses;
2) **conduct accident costing exercise based on gross output method**. Accident cost components can be estimated with economic indicators available for lost output calculations and vehicle damage costs derived from insurance company and surveyor data. Medical and administrative costs can be assumed (small percent of total costs) and a conservative estimate initially used for estimating pain, grief, and suffering (10 percent to 20 percent lost output). Pain, grief, and suffering estimate should be agreed by a national road safety council or those involved in road accident consequences; i.e., insurance company representatives, police, doctors, and legal experts. While some technical assistance may be required for initial accident costing calculations, a local research institute could be trained to conduct accident costing updates and revisions. TRL Road Note 10[5] provides guidance on how to carry out costing in developing countries;
3) **assess extent of underreporting of injury and damage only accidents.** If RTA injury is believed to be underreported, hospital surveys should be conducted to produce a more accurate estimate of accident injuries. Key hospitals along major highways should be surveyed using admission registers (assuming RTA is listed as cause of admission). Table 2 shows the minimal data required by such hospital surveys. Surveys of insurance and fleet companies should be undertaken to determine frequency and average cost of vehicle damage in damage-only accidents;
4) **estimate total annual road accident costs and average accident costs.** These estimates will be determined locally and reflect both reported and unreported accidents, i.e., an average reported injury accident cost would also include the costs of unreported injury and damage-only accidents. These costs would replace the GDP percentage estimate as the annual national cost of road accidents and should be used in road safety programs and campaigns;
5) **conduct accident victim surveys**. Accident victim surveys should be conducted to check the accuracy of cost estimates. Further research on accident costs can be conducted by following up a random sample (say 100 or so) road accidents by having researchers obtain from police records the names of those involved in the selected accidents. These individuals or their families can be followed up to identify how long the victim was in hospital, how many days' work were missed, average salary, and cost of vehicle repairs. Such surveys

Table 2: Hospital RTA Casualty Survey

	Inpatient	Emergency-room only	Brought in dead
Jan.			
Feb.			
March			

have been used in Sichuan, the People's Republic of China (PRC); and Karachi, Pakistan. Pain, grief, and suffering can be reconsidered and victim stories considered for publicity and educational campaigns;

6) **introduce accident costs in project cost benefit analyses**. Safety impacts should be evaluated based on accident costs and engineering judgment on the predicted accident change; i.e., effect of road widening on road accidents. Eventually, accident cost savings should be refined according to before and after-accident findings;
7) **target road safety funding to percentage of national road accident costs.** The target of road safety funding should be based on the national road accident cost estimate with anywhere between 10 percent and 50 percent requested for road safety (note that until recently, Japan allocated 0.6 percent of its annual GNP to road safety after calculating that accidents cost 1.3 percent of annual GNP; i.e., safety funding allocation was about 50 percent of annual losses); and
8) **regularly revise estimates and consider willingness to pay method.** Road accident costs should be recalculated every three to four years and updated annually during the interim period by the per capita GDP growth. Given the difficulty in adopting the willingness to pay method, countries should first carry out a pilot project if they are considering moving towards such an approach, as complex surveys are involved.

5 BENEFITS AND EFFECTS

5.1 Road Safety Awareness

In order to estimate the total cost of road accidents nationally, all accidents and related casualties (i.e., police reported and unreported injury, and damage-only accidents) need to be considered. Reported RTAs can be only an underestimate of the actual total that occurs each year. While underreporting exists in all countries, the severity indices found in developing countries indicate a much more serious problem exists in the developing world. Road accident costing offers an opportunity to overcome underreporting as hospital surveys often identify casualty totals much higher than police RTA figures (for example, in the PRC, Ministry of Health statistics show 111,000 road accident deaths whereas official police statistics for the same year [1994] show 66,362 road accident deaths). Similarly, with so few vehicles insured in developing countries, insurance company accident claims may represent only a fraction of the total vehicle damage costs incurred in the country.

By identifying the total impact of road accidents, road accident costing reveals the true extent of the problem in both the human casualty toll and also in economic terms. Road accidents pose a serious drain on scarce financial resources and medical services. RTA victims mainly belong to the most productive age range and have often just begun to pay back their debts to society.

5.2 Road Safety Funding

Once the total cost of road accident losses is known, an optimal safety budget can be determined and adequate resources can start to be justified for road safety. If the results are publicized, a road accident costing procedure should also be able to galvanize public and political support and generate private sector support for road safety. Road accidents will be shown to have many more victims and much wider and serious economic consequences than is commonly realized. The economic losses to the country are often viewed more seriously by governments than the thousands of persons killed or crippled each year. Being able to estimate the economic losses provides a means of attaining political interest in and support for road safety initiatives. It also tends to galvanize press and media support for safety initiatives to reduce such losses.

5.3 Promotion of Cost-effective Road Safety

With average accident costs estimated, road safety can now begin to be factored in a consistent manner on the same basis as construction and maintenance in cost benefit analyses of road projects and vehicle safety products;

e.g., seat belts, motorcycle helmets, and reflective stickers.

Safety engineering measures in developed countries have proven to have high rates of return and road safety expenditures can be promoted as an investment rather than purely as a cost. Safety measures can be shown to be cost-effective, a basic requirement in this era of scarce resources.

6 EXAMPLES OF GOOD PRACTICE

India has conducted several road accident costing studies with the first dating back to 1978. In recent years, the road accident costs have been regularly updated rather than revised, but individual localities have begun conducting their own accident costing exercises[1]. However, it would be better if a single value could be derived for each accident type and these values be applied throughout India. This should facilitate more consistency in decision making when considering alternative road safety initiatives.

Both the Indian Institute of Technology and the Central Road Research Institute[2] have conducted surveys of accident victims in an effort to learn more about road accident deaths.

Overseas Development Administration (ODA) of the UK has recently undertaken a study in several countries to determine the socioeconomic characteristics of accident victims. This study[3] has shown those injured in road accidents to have higher-than-average wage rates.

The Republic of Korea has carried out extensive research on accident costs and a valuation is now available for use in cost benefit analysis of proposed safety interventions.

Road accident costing was introduced recently in **Nepal** where the lack of national accident data required many assumptions to be made.

Detailed instructions were produced to guide the Nepal Department of Roads in updating the accident cost estimates in future years until a reliable national accident database is developed and accident cost estimates can be revised.

Nepal is fortunate to have a good source for medical costs, as the United Mission Nepal operates four hospitals and can provide average inpatient costs per night and outpatient visit costs, which are borne to a large extent (almost 80 percent) by the patients.

Both **Australia** and the **UK** have put much effort into researching road accident costs, with Australia producing estimated costs of various accident types while the latter has documented the transition from gross output method to the willingness to pay method. In the **US**, the National Highway Traffic Safety Administration has produced recommended average accident costs, but the individual states use their own calculations which are much lower than the Administration's.

Under the European Commission Cooperation in the field of Scientific and Technical Research (COST) program, 13 countries, including the UK, participated in a study[4] on the socioeconomic costs of road accidents. Over the past several years, road accident costing models and methods have been compared and assessed in terms of theoretical validity and general practicality.

7 REFERENCES AND KEY DOCUMENTS

In 1995, TRL published an *Overseas Note on Road Accident Costing*[5], which provided both background and a case study, while an earlier attempt at accident costing in India is well-documented in the *Road User Cost* study[2]. A summary of the recent accident costing exercise in Kerala is also available[1].

In Australia, one of the few motorized countries to still employ the gross output method, the Australian Road Research Board has produced many reports on accident costing[6], while the UK has documented much of its accident costing work in published TRL reports. The final report of the European Commission's research into the socioeconomic costs of road accidents was published in 1995[4].

A good reference for the application of road accident costs is *Safety and Highway Investment*, published by the University of Iowa (1994)[7]. This reviews the different costing methods used by the state highway departments in the US.

The UK method of valuation and current values are summarized periodically in UK Department of Transport Highways Economic Notes[8]. A review of current valuations used in different countries is given in a recent article by Elvik[9].

1. Chand, M. 1995. "Cost of Road Accidents in India — with Special Reference to Kerala." Pune, India: *Indian Journal of Transport Management*, July 1995.
2. Central Road Research Institute. (CRRI). 1982. *Road User Costs*. New Delhi, India: CRRI.
3. Ghee C. E., et al. 1997. *Socio-Economic Aspects of Road Accidents in Developing Countries*. UK: TRL Report TRL247.
4. Alfaro, J. L., M. Chapuis and F. Fabre (eds.). 1994. *Cost 313 Socio-Economic Costs of Road Accidents*. Final Report. European Commission, 200 Rue de la Loi, BU 31 5/33, Brussels, Belgium.
5. TRL. 1995. *Costing Road Accidents in Developing Countries*. Overseas Road Note 10. UK: TRL.
6. Andreassan, D. 1993. *Road Accident Costs and Their Use.* Victoria, Australia: Australian Road Research Board Special Briefing.
7. Forkenbrock, D., N. Foster, and T. Pogue. 1994. *Safety and Highway Investment*. US: University of Iowa.
8. Department of Transport. 1994. "Valuation of Road Accidents." *Highways Economics Note No. 1 1994*. UK: Department of Transport.
9. Elvik, R. 1995. "An Analysis of Official Economic Valuations of Traffic Accident Fatalities in 20 Motorized Countries." *Accident Analysis and Prevention*, Vol. 27, No. 2, 1995. US.
10. Department of Transport. 1995. *Road Accidents Great Britain 1994*: *The Casualty Report*. UK: The Stationery Office (see also 1968-1991, and 1993).

Road Safety Guidelines

for the Asian and Pacific Region

Appendix A

USEFUL DOCUMENTS WORTH ACQUIRING

Asian Development Bank

Many useful documents, guidelines, and manuals exist in industrialized countries that would be worth acquiring by road safety professionals in developing countries of the Asian and Pacific region. Some of the more important and relevant of these are indicated below. The Road Engineering Association of Asia and Australasia (REAAA) guide (Reference 7) provides an excellent overview on other road safety resources available from around the world.

1. Guidelines for Accident Reduction and Prevention (International Edition). Institution of Highways and Transportation. 1990.
   Available (in English) from Institution of Highways and Transportation, 6 Endsleigh Street, London WC1H 0DZ, United Kingdom
   Tel: (44 171) 387 2525
   Fax: (44 171) 387 2808

2. Guidelines for the Safety Audit of Highways. Institution of Highways and Transportation. 1996.
   Available (in English) from 6 Endsleigh Street, London WC1H 0DZ, United Kingdom
   Tel: (44 171) 387 2525
   Fax: (44 171) 387 2808

3. Guide to Traffic Engineering Practice: Part 4 — Road Crashes. 1988.
   Available (in English) from National Association of Australian State Road Authorities (NAASRA), Austroads,
   P.O. Box 659, Haymarket, New South Wales 2000, Australia
   Tel: (61 2) 218 6218
   Fax: (61 2) 281 7458

4. Organisation for Economic Co-operation and Development (OECD) Road Research Reports
   Various reports and publications including:
   - Targeted Road Safety Programmes (1994);
   - Road Infrastructure Rehabilitation and Safety Strategies in Central and East Europe (1995);
   - Improving Road Safety by Attitude Modification (1994); and
   - Marketing of Traffic Safety (1993).

   These are available (in English) from OECD Road Transport Research Programme, 2, rue André-Pascal, 75775, Paris Cedex 16, France
   Tel: (33 1) 4524 8200
   Fax: (33 1) 4524 8176

5. Road Safety Engineering Manual. 1992.
   Available (in English) from the Royal Society for the Prevention of Accidents (RoSPA), Cannon House, The Priory Queensway, Birmingham BA 6BS, United Kingdom
   Tel: (44 21) 200 2461
   Fax: (44 21) 200 1254

6. Road Safety Handbook. Institute of Transport Economics. 1982.
   Available (in Norwegian and Russian) from Institute of Transport Economics, P.O. Box 6110 Etterstad, M-0602, Oslo, Norway
   Tel: (47 2) 257 3800
   Fax: (47 2) 257 0290

7. Road Safety Resources for Developing Countries (A guide to what is available from whom). REAAA. 1992.
   Prepared on behalf of REAAA, by and available (in English) from Australian Road Research Board, 500 Burward Highway, Vermont South Melbourne, Victoria, Australia
   Tel: (613 3) 881 1555
   Fax: (613 3) 887 8104

8. Safer Roads: A Guide to Road Safety Engineering. Ken Ogden, Monash University, Melbourne, Victoria, Australia. 1996.
   Available (in English) from Avery Press, Gower House, Aldershot, Hampshire GU1N 3HR, United Kingdom

9. Towards Safer Roads in Developing Countries (a guide for planners and engineers). Ross Silcock/Transport Research Laboratory (TRL). 1991.
   Available (in English and Spanish) from TRL Overseas Centre, TRL, Old Wokingham Road, Crowthorne, Berkshire RG11 6AU, United Kingdom
   Tel: (44 1344) 773 131
   Fax: (44 1344) 770 358

10. Towards Safer Roads in Developing Countries (a slide pack and instructor manual that can serve as a teaching aid based upon 9. above). Ross Silcock/TRL. 1992.
    Available (in English) from TRL Overseas Centre, TRL, Old Wokingham Road, Crowthorne, Berkshire RG11 6AU, United Kingdom
    Tel: (44 1344) 773 131
    Fax: (44 1344) 770 358

11. The Traffic Accident Investigation Manual: At the Scene Investigation and Technical Follow Up, 9th Edition. 1986.
    Available (in English) from North Western University Traffic Institute, P.O. Box 1409, Evanston, Illinois 60204, United States

12. Traffic Calming in Practice: County Surveyors Society, Department of Transport, and others. 1994.
    Available from Landar Publishing, Ltd., Quadrant House, Kennington Lane, London SE11 5RD, United Kingdom
    Tel: (44 171) 587 1681
    Fax: (44 171) 735 1299

13. The Traffic Safety Toolbox: A Primer on Traffic Safety. Institute of Transportation Engineers. 1993.
    Available in English from Institute of Transportation Engineers, 525 School Street, SW, Suite 410, Washington, DC 20024-2797, United States
    Tel: (1 202) 554 8050
    Fax: (1 202) 863 5486

14. Vulnerable Road Users in the Asian and Pacific Region (produced as part of the same regional technical assistance project [RETA 5620: Regional Initiatives in Road Safety] funded by the Asian Development Bank [ADB] as these guidelines, this book focuses on the problems and facilities for road users most at risk in the region). 1998.
    Available in English (later in Chinese and Russian) from ADB, P.O. Box 789, 0980 Manila, Philippines
    Tel: (63 2) 632 6803, 632 6463
    Fax: (63 2) 636 2423

Road Safety Guidelines

for the Asian and Pacific Region

Appendix B

INTERNATIONAL CONTACTS AND ORGANIZATIONS

Asian Development Bank

This Appendix lists some of the more important road safety practitioners and specialists in the Asian and Pacific region in order to encourage international exchange of information, experiences, and networking This is preceded by addresses of some of the more important organizations involved and active in road safety in the region and who may be of interest to decision makers in the developing world.

1. International and funding organizations active in supporting road safety

Asian Development Bank (ADB)
P.O. Box 789, 0980 Manila
PHILIPPINES
Tel: (63 2) 632 6803/632 6463
Fax: (63 2) 636 2423

The World Bank
1818 H Street NW
Washington, DC 20433
UNITED STATES
Tel: (1 202) 477 1234
Fax: (1 202) 477 6391

United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)
(Transport, Communications and Tourism Division)
Rajadamnern Avenue
Bangkok 10200
THAILAND
Tel: (66 2) 288 1234
Fax: (66 2) 288 1000

World Health Organization (WHO)
(Injury Prevention Programme)
Avenue Appia 20
United Nations Building
ch-1211 Geneva 27
SWITZERLAND
Tel: (41 22) 791 2111
Fax: (41 22) 791 0746

2. Bilateral aid agencies most active in the Asian and Pacific region on road safety

Australian Agency for International Development (AusAid)
G.P.O. Box 887
Canberra, ACT 2601
AUSTRALIA
Tel: (61 6) 278 4000
Fax: (61 6) 276 4880

Overseas Development Administration (ODA)
94 Victoria Street
London SW1E 5JL
UNITED KINGDOM
Tel: (44 171) 917 0588
Fax: (44 171) 917 0016

Japan International Cooperation Agency (JICA)
P.O. Box No. 216, 48/F Shinjuki Building,
1-1, Nishi-Shinjuku 2-Chome Shinjuku-ku
Tokyo, 163-04
JAPAN
Tel: (81 3) 3346 5197
Fax: (81 3) 3346 5094

3. International technical organizations with safety interests

Institute of Transportation Engineers
525 School Street SW
Suite 410
Washington, DC 20024-2797
UNITED STATES
Tel: (1 202) 554 8050
Fax: (1 202) 863 5486

International Road Federation (IRF)
525 School Street SW
Washington, DC 20024-2797
UNITED STATES
Tel: (1 202) 544 2106
Fax: (1 202) 479 0828

Organisation for Economic Co-operation and Development (OECD)
2 Rue Andre Pascal
F-75775 Paris
Cedex 16
FRANCE
Tel: (33 1) 4524 9594
Fax: (33 1) 4524 7960

Permanent International Association of Road Congress (PIARC)
27 Rue Gueneguad
75006 Paris
FRANCE
Tel: (33 1) 4633 7190
Fax: (33 1) 4633 8460

Prevention Routier International
75 Rue de Mamer
L-8081
LUXEMBOURG
Tel: (35 2) 31 8341
Fax: (35 2) 31 1460

Road Engineering Association of Asia and Australasia (REAAA)
Chairman REAAA Technical Committee
c/o Burwood Highway
Vermont South
Victoria 3133
AUSTRALIA
Tel: (61 3) 9881 1555
Fax: (61 3) 9887 8104

4. Research institutes and organizations undertaking road safety research of relevance to developing countries

ARRB Transport Research Ltd.
500 Burwood Highway
Vermont South
Victoria 3133
AUSTRALIA
Tel: (61 3) 9881 1555
Fax: (61 3) 9887 8104

Federal Highway Administration
Office of International Programs
US Department of Transportation
400 Seventh Street SW
Washington, DC 20590
UNITED STATES
Tel: (1 202) 366 0111
Fax: (1 202) 366 9626

Institute for Road Safety Research
P.O. Box 170
2260 AD Leidschendam
THE NETHERLANDS
Duindoorn 32
Tel: (31 70) 320 9323
Fax: (31 70) 320 1261

International Association of Traffic and Safety Sciences (IATSS)
6-20-2 Yaesu
Chuo-ku
Tokyo 104
JAPAN
Tel: (81 3) 3273 7884
Fax: (81 3) 3272 7054

Swedish National Road & Transport Research Institute (VTI)
S-581, 95 Linkoping
SWEDEN
Tel: (46 13) 203 000
Fax: (46 13) 141 436

Technical Research Centre of Finland (SVOV)
Road, Traffic, and Geotechnical Laboratory
Traffic Section/Safety Team
Sahkomiehentie 3
FIN-02150 ESPOO
FINLAND
Tel: (35 8) 0456 4591
Fax: (35 8) 046 4850

Institute of Transport Economics
P.O. Box 6110
Etterstad
N-0602 Oslo
NORWAY
Tel: (47 22) 573 800
Fax: (47 22) 570 290

Transport Research Laboratory (TRL)
Overseas Centre
Old Wokingham Road
Crowthorne
Berkshire RG11 6AU
UNITED KINGDOM
Tel: (44 1344) 773 131
Fax: (44 1344) 770 3056

Institut National de Recherch (INRETS)
Sur les Transports et leur Sécurité
2 Avenue du Général Malleret-Joinville
94114 Arcueil Cedex
FRANCE
Tel: (33 47) 407 163
Fax: (33 45) 475 606

5. Research organizations in the region active on road safety issues

Central Road Research Institute (CRRI)
P.O. CRRI
Mathura Road
New Delhi 110020
INDIA
Tel: (91 11) 691 2268
Fax: (91 11) 684 5943

National Tansport Research Centre (NTRC)
Ministry of Communications
Sector H-8/3
Islamabad
PAKISTAN
Tel: (92 51) 253 676
Fax: (92 51) 253 651

Indian Institute of Technology (IIT)
New Delhi 110016
INDIA
Tel: (91 11) 685 8703
Fax: (91 11) 686 2037

Traffic Management Research Institute (TMRI)
Public Security Ministry
1 Qianxiang Lane 1
Qianrong Road
Wuxi, Jiangsu
PEOPLE'S REPUBLIC OF CHINA
Tel: (86 510) 551 6123
Fax: (86 510) 551 5315

Institute of Road Engineering (IRE)
Jl Raya Timur 264
P.O. Box 2 UJB
Bandung 40294
INDONESIA
Tel: (62 22) 780 2251
Fax: (62 22) 780 2253

Transport Engineering Design Incorporation (TEDI)
Ministry of Transport and Communications
278 Ton Duc Thang
Hanoi
VIET NAM
Tel: (84 4) 851 8366

6. Others/individuals

European Transport Safety Committee (ETSC)
Rue du Cornet 34
B-1040
Brussels
BELGIUM
Tel: (32 2) 230 4106, 4004
Fax: (32 2) 230 4215

Global Traffic Safety Trust International (GTST)
c/o Royal Australasian College of Surgeons
Spring Street
Melbourne
Victoria 3000
AUSTRALIA
Tel: (61 3) 622 1033
Fax: (61 3) 663 4075

7. NETWORK OF ROAD SAFETY PROFESSIONALS ACTIVE IN THE ASIAN AND PACIFIC REGION BY COUNTRY AND ORGANIZATION

ARMENIA

Papik Karchikian, The First Deputy of Director General of Armenian Road Directorate, 21 Koriun Street, Yerevan 375009. Tel: (374 2) 582 712; Fax: (374 2) 151 830; E-mail: hpiu@arminco.co

Hakob Petrossian, Road Safety and Planning Coordinator, the World Bank, Armenian Highway PIU, 21, Koriun Street, Yerevan 375009. Tel: (374 2) 582 712; Fax: (374 2) 151 830; E-mail: hpiu@arminco.co

AUSTRALIA

David Anderson, General Manager Road Safety, V1C Roads, 4/F, 60 Denmark Street, Kew,Victoria 3101. Tel (work): (61 3) 9854 2700; Fax: (61 3) 9854 2668

John Catchpole, Senior Research Scientist, ARRB Transport Research Ltd., 500 Burwood Highway, Vermont South, Victoria 3133, Tel: (61 3) 9881 1626; E-mail: jophnca@arrb.org.au

Phil Charles , Executive Director, Road Strategies and Services, Mains Roads Western Australia, Don Aitken Centre, Waterloo Crescent, P.O. Box 6202 East Perth 6892. Tel: (61 9) 323 4161; Fax: (61 9) 323 4547

Paul Duignan, Leader, Vehicle Safety Standards, Roads and Traffic Authority, 260 Elizabeth Street, Sydney, NSW 2000. Tel: (61 2) 9218 3669

Jim Jarvis, Professor of Civil Engineering, Monash University, Melbourne. Tel (work): (61 3) 9881 1580; Fax: (61 3) 9887 8104; Tel (home): (61 3) 9853 5909; E-mail: jimj@arrb.org.au

Ian Johnston, Executive Director, ARRB Transport Research Ltd. (Member of Steering Committee), 500 Burwood Highway, Vermont South, Victoria 3133. Tel (work): (61 3) 9861 1555; Fax: (61 3) 9887 8104

Merv Lane, Former Superintendent NSW Police, 18 Spruce Street, Blacktown, NSW 2148. Tel: (02) 9622 1795

Peter Makeham, Director, Federal Office of Road Safety, GPO Box 594, Canberra ACT 2601. Tel: (61 6) 274 7447; Fax: (61 6) 274 7922

Frank McDermott, Chairman; Consultative Committee on Road Traffic Accidents, Victoria, College of Surgeons, Road Trauma, Spring Street, Melbourne. Tel: (61 3) 9249 1200

Robert Ramsay, Manager Information, Roads and Traffic Authority, 260 Elizabeth Street, Sydney, NSW 2000. Tel: (61 2) 9218 6464; E-mail: Robert_Ramsay@rta.nsw.gov.au

G. A. Ryan, Director, Road Accident Prevention Research Unit, Department of Public Health, University of Western Australia, Nedlands, WA 6907. Tel (work): (61 9) 380 1301; Fax: (61 9) 380 1199; Tel (home): (61 9) 388 2679; Fax: (61 9) 388 2679; E-mail: tryan@quokka.epidem.uwaedu.au

Ray Taylor, Research Director, ARRB Transport Research Ltd., 500 Burwood Highway, Vermont South, Victoria 3133. Tel: (61 3) 9881 1660; E-mail: rayt@arrb.org.au

Peter Waugh, Manager Road Safety Strategy, Main Roads Western Australia, Don Aitken Centre, Waterloo Crescent, P.O. Box 6202, East Perth, WA 6892. Tel: (61 9) 323 4309; Fax: (61 9) 323 4629; E-mail: e5885@wa.wa.gov.all

BANGLADESH

Muhammad Ali, Member (Curriculum), National Curriculum and Textbook Board, 69-70 Motijheel Commercial Area, Dhaka. Tel (work): (880 2) 955 6445; Fax: (880 2) 956 5724; (Home) Tel: (880 2) 869 345

Abdul Alam Bhuiyan, Director (Engineering), Bangladesh Road Transport Authority, Allenbury, Old Airport Road, Tejgaon, Dhaka. Tel (work): (880 2) 911 5544 ; Fax: (880 2) 911 6163; Tel (home): (880 2) 896 822

A. F. M. Ruhal Haque, Director, Professor and Head of Orthopaedic Surgery, Rehabilitation Institute and Hospital for Disabled (Orthopaedic Hospital and Institute) Sher-E-Bangla, Nagar, Dhaka. Tel (work): (880 2) 814 812, 314 075; Fax: (880 2) 814 812; Tel (home): (880 2) 814 388, 818 133; E-mail: rhaque.trauma@dhaka.agni.com

Alhaj Mockbul Hossain MP, President, Bangladesh Sarek Paribahan Samity (National Road Transport Owners Association of Bangladesh) 12/1 Tajmohal Road, Mohammadpur, Dhaka. Tel: (880 2) 912 0999; Fax: (880 2) 813 393

Alamgir Mojibul Hoque, Professor, Bangladesh University of Engineering and Technology (BUET), Department of Civil Engineering, Dhaka 1000. Tel (work): (880 2) 864 640/4, Ext 303; Fax: (880 2) 863 026; Tel (home): (880 2) 860 444; E-mail librarian.buet@drik.bgd.toolnet.org

M. D. Mazharul Hoque, Bangladesh University of Engineering and Technology (BUET), Department of Civil Engineering, Dhaka 1000. Tel (work): (880 2) 864 640/4 Ext 316; Fax: (880 2) 863 026, 863 046; Tel (home): 864 640/4 Ext 207; E-mail: Librarian.buet@drik.bgd.toolnet.org (currently at University of Southampton, United Kingdom)

A. N. Hussain, Chairman, Bangladesh Road Transport Authority, Allenbury, Old Airport Road, Rejgaon, Dhaka. Tel (work): (880 2) 811 400; Fax: (880 2) 911 6163; Tel (home): (880 2) 872 232

Quazi Zakaria Islam, Senior Technical Officer, Development Design Consultants Ltd., 23 New Eskaton Road, Dhaka. Tel (work): (880 2) 885 761, 871 075; Fax: (880 2) 883 713; Tel (home): (880 2) 803 561.

M. D. Abdul Jalil, Additional Deputy Police Commissioner, Traffic Division, Dhaka Metropolitan Police, 10 Circuit House Road, Shantinagar, Dhaka. Tel (work): (880 2) 409 513; Tel (home): (880 2) 329 864; Fax: (880 2) 838 210

C. G. Karim, Superintendent Engineer, Roads and Highway Department, "Sarak Bhaban," Ramna, Dhaka 1000. Tel (work): (880 2) 955 7756; Fax: (880 2) 955 7756; Tel (home): (880 2) 891 781

Mohammad Rafi Khan, Member, National Road Safety Council, Chairman, Accident Management Subcommittee, International Centre for Disease, 128 Dhan Mondi R/A Road 3, Dhaka. Tel (work): (880 2) 83344; Fax: (880 2) 863 326; Tel (home): (880 2) 869 299

Mustaque Hossain Khan, C.O. (Superintendent of Police) Armed Police Battalion, Dhaka. Tel (work): (880 2) 894 325, 891 314; Fax: (880 2) 894 325; Tel (home): (880 2) 822 270.

Nur Mohammad, Deputy Police Commissioner, Traffic Division, Dhaka Metropolitan Police, 10 Circuit House Road, Shantinagar, Dhaka. Tel (work): (880 2) 412 127; Tel (home): (880 2) 383 931; Fax: (880 2) 838 210

Mohiuzzaman Quazi, Program Officer, Transportation, World Bank Office, 3A, Paribaeh, Dhaka 1000. Tel (work): (880 2) 861 056; Fax: (880 2) 863 220; Tel (home): (880 2) 324 297

M. Abdur Rab, Assistant Director (Engineering) Bangladesh Road Transport Authority, Allenbury, Old Airport Road, Tejgaon, Dhaka. Tel (work): (880 2) 324 478; Fax: (880 2) 911 6163; Tel (home): (880 2) 894 488

Tofazzal Hossain Sarker, Research Officer, National Curriculum and Textbook Board, 69-70 Motijheel Commercial Area, Dhaka. Tel (work): (880 2) 956 3686; Fax: (880 2) 956 5724; Tel (home): (880 2) 314 543

Lutfar Rahman Talukder, Deputy Secretary, Roads and Railways Division, Ministry of Communications, GOB, Building No. 7 Room No. 824, 8/F, Bangladesh Secretariat, Dhaka. Tel (work): (880 2) 868 296; Fax: (880 2) 866 636; Tel (home): (880 2) 841 700

CANADA

Francis P. D. Navin, Professor of Civil Engineering, University of British Columbia, 2324 Main Mall, Vancouver, BC V6T 124. Tel: (1 604) 822 3158; Fax: (1 604) 822 6901

PEOPLE' S REPUBLIC OF CHINA

Chen Guosheng, Senior Engineer of China Highway Engineering Consultant and Supervision General Co., No. 7 Building, Hua Yan Li, Chao Yang, Beijing 100029. Tel: (86 1) 6204 5312; Fax: (86 1) 6204 0678

Hua Yong Hong, Assistant of Road Safety Research, Traffic Management Research Institute of Public Security Ministry, Qianxiang Lane 1, Qianrong Road, Wuxi, Jiangsu. Tel: (86 5) 1055 16123; Fax: (86 5) 1055 15315

Jia Ping, Deputy Division Chief, Ministry of Public Security, Science and Technology Division, Traffic Management Bureau, Beijing. Fax: (86 1) 6204 0678

Xu Kang Sheng, Director, Traffic Management Research Institute of Public Security Ministry, Qianxiang Lane 1, Qianrong Road, Wuxi, Jiangsu. Tel: (86 5) 1055 15645; Fax: (86 5) 1055 15315

Liu Xiaming, Professor of Transport Engineering, Graduate School, Beijing Polytechnic University, Beijing 100022. Tel: (86 1) 673 91458; Fax: (86 1) 6739 1458; E-mail: lxming@solaris.bjpu.edu.cn

FIJI

Vuetasu N. Buatoka, Department Secretary (Planning and Design), Ministry of Works, Infrastructure and Transport, PWD Ganilau House, Suva. Tel (work): (679) 315 133; Fax: (679) 301 198; Tel (home): (679) 370 860

Qalo Bulatiko, Assistant Commissioner of Police Operations, Fiji Police Force, Box 239, Police Headquarters, Suva. Tel: (679) 312 999; Fax: (679) 303 1999

Sefanaia Koroi, Chief Education Officer Primary, Ministry of Education, Women and Culture, Marela House, Government Buildings, Suva. Tel (work): (679) 314 477; Fax: (679) 303 511; Tel (home): (679) 320 127

Michael O' Leary, c/o World Health Organization, P.O. Box 113, Suva. Tel: (679) 302 529; Fax: (679) 300 462; E-mail: mjol@is.com.fj

Peni D. Qarau, Chairman, National Road Safety Council, Fiji, P.O. Box 7125, Nasinu. Tel: (679) 314 400; Fax: (679) 302 664; Tel (home): (679) 362 451

Chandra Shekhar, Executive Director, National Road Safety Council, P.O. Box 7125, Nasinu. Tel (work): (679) 394 886; Fax: (679) 393 253; Tel (home): (679) 387 680

Inia Tamani, Controller of Road Transport, Road Transport Department, P.O. Box 6677, Nasinu. Tel: (679) 392 166; Fax: (679) 395 474

Isoa G. Tamani, Assistant Controller of Road Transport, Department of Road Transport, Box 6677, Nasinu. Tel: (679) 392 166; Fax: (679) 395 474

Raphael Warwick-Smith, Senior Engineer, Roads (Traffic and Planning) Ganilau House, Private Mail Bag, GPO, Suva. Tel (work): (679) 315 759; Fax: (679) 301 193; Tel (home): (679) 340 575

HONG KONG, CHINA

H. L. Cheng, Chief Engineer, Road Safety and Standards Division, Transport Department, Room 3501, 35/F Hopewell Centre, 183 Queen's Road East, Wanchai. Tel: (852) 2529 8338; E-mail: hlcheng@td.gcn.gov.hk

W. K. Kwok, Senior Engineer, Road Safety and Standards Division, Transport Department, Room 3501, 35/F, Hopewell Centre, 183 Queen's Road East, Wanchai. Tel: (852) 2529 8232

P. J. Smith, Hong Kong School of Motoring, Che Kung Miu Road, Tai Wai, Shatin, New Territories. Tel: (852) 2604 6123; Fax: (852) 2694 8472

Robert T. W. Yeoh, Road Safety Manager, Hong Kong School of Motoring, Che Kung Miu Road, Tai Wai, Shatin, New Territories. Tel (work): (852) 2604 6123; Fax: (852) 2694 8472; Tel (home): (852) 2692 0232; Fax: 852 2603, 1734

INDIA

A. P. Bahadur, Director, Indian Roads Congress, Jamnagar House, Shahjahan Road, New Delhi 110 011. Tel (work): (91 11) 338 4543; Fax: (91 11) 338 1649; Tel (home): (91 11) 551 2294

R. D. Mehta, Chief Engineer (Traffic and Transportation), Government of India, Ministry of Surface Transport, Parliament Street, New Delhi 110011. Tel: (91 11) 371 9998; Fax: (91 11) 371 0236

Dinesh Mohan, Head, Indian Institute of Technology Delhi, Centre for Biomedical Engineering, Hauz Khas, New Delhi 110016. Tel: (91 11) 685 8703; Fax: (91 11) 685 8703, 686 2037; E-mail: dmohan@cbme.iitd.ernet.in

S. Padam, Director, Central Institute of Road Transport, Bhosari, Pune-411 026. Tel (work): (0212) 779 177; Fax: (0212) 779 426; Tel (home): (0121) 779 090 E-mail: cirt/pune@dartmail.dartnet.com

M. N. Reddi, Director, Karnataka Government Computer Centre, C-22, IST Cross, 8th Main, Vasanthnagar, Bangalor 560 052. Tel (work): (91 80) 226 3206; Fax: (91 80) 226 3206; Tel (home): (91 80) 225 9753

T. S. Reddy, Head, Traffic and Transportation Division, Central Road Research Institute, P.O. CRRI, Mathura Road, New Delhi 110020. Tel (work): (91 11) 691 2268; Fax: (91 11) 684 5943; Tel (home): (91 11) 683 4739; E-mail: CRRI@sirnetd.ernet.in

S. C. Saluja, General Manager, National Highways Authority of India, Ministry of Surface Transport, 1 Eastern Avenue, Maharani Bagh, New Delhi 110065. Tel (work): (91 11) 692 4381; Fax: (91 11) 692 4383; Tel (home): (91 11) 2434 3555

P. K. Sikdar, Professor, Transportation Systems Engineering, Civil Engineering Department, Indian Institute of Technology, Powai, Bombay. Tel (work): (91 22) 578 2545, 578 6530, 578 3557 Ext. 2314; Fax: (91 22) 578 3480; Tel (home): (91 22) 578 2545, 578 6530, 578 3557 Ext. 4314; E-mail: pksikdar@gemini.civil.iitb.ernet.in

Mathew Varghese, Consultant Orthopaedic Surgeon, St. Stephen's Hospital/IIT Delhi, St. Stephen's Hospital, Tees Hazari, New Delhi 110054. Tel (work): (91 11) 251 1488; Fax: (91 11) 686 2037; Tel (home): (91 11) 225 1315; Fax: (91 11) 293 2412; E-mail: dmohan@cbme.iitd.ernet.in

INDONESIA

Ir. Iskandar Abubakar, Director, Directorate of Urban Transport and Traffic System (BSLLAK), Directorate General of Land Transport, Ministry of Communications, Jalan Jenderal Sudirman No. 77 Jakarta 12199. (021) 570 6618; Fax (62 21) 570 6648

Ir. Tjokodrde Gde Agung, Head of Subdirectorate of City Traffic, Directorate of BSLLAK, Directorate General of Land Transport, Ministry of Communications, Jalan Jenderal Sudirman No. 77 Jakarta 12199. Tel (work): (62 21) 570 6618; Fax: (62 21) 570 6648; Tel (home): 586 2647

Ir. Moh. Anasaly, Director, Directorate of Engineering, Directorate General of Highways, Ministry of Public Works, J. L. Pattimura 20, Kebayoran Baru, Jakarta 12110. Tel (work): (62 21) 724 7389; Fax: (62 21) 724 5002; Tel (home): (62 21) 769 0860)

Sony Baksono, Director, Directorate of Road Transport and Traffic (LLJ), Directorate General of Land Transport, Ministry of Communications, Jalan Jenderal Sudirman No. 77 Jakarta 12199. Tel: (62 21) 570 6618; Fax: (62 21) 570 6648

Suyono Dikun, Head, Transportation Bureau, National Planning Board (BAPPENES), Jalan, Taman Suropati No. 2 Jakarta 10310. Tel/Fax: (62 21) 314 8550

Gandhi Harahap, Director, Bina Jalan Kota, Directorate General of Highways (Bina Marga) Jl Pattimuna No. 20, Jakarta. Tel (work): (62 21) 724 4045; Fax: (62 21) 724 6973; Tel (home): (62 21) 799 6174

Ir. Hikmat Iskandar, Researcher, Institute of Road Engineering (Ire) Ministry of Public Works, Jalan Raya Timur 264 Ujung Berung Bandung, 40294, West Java. Tel: (62 21) 781 1881; Fax: (62 21) 780 2112

Pepen Muhamad, Head of SubdirectorateTraffic and Road Safety, Directorate of LLAJ, Directorate General of Land Transport, Ministry of Communications, Jalan, Jenderal Sudirman No. 77 Jakarta 12199. Tel: (62 21) 570 6618; Fax: (62 21) 570 6648

Robert Senduk S. H., Head of PRC Centre, Directorate of Traffic, MABES POLRI, Jalan MT Haryono Kav 36; 37 Jakarta 127700. Tel (work): (62 21) 798 9702; Tel (home): (62 21) 460 0625

Heru Sutomo, Course Director and Lecturer, Master Program in Transport, Gadjah Mada University, JL Grafika 2, Yogyakarta 55281. Tel: (62 274) 902 245/48 Fax: (62 274) 512 796; E-mail: mstt_ugm@yogya.wasantara.net.id

Anton Tampubolon S.H., Head of Subdirectorate of Road Traffic, Directorate LLAJ, Directorate General of Land Transport, Ministry of Communications, Jalan Jendderal Sudirman No. 7 Jakarta 12199. Tel: (62 21) 570 6618; Fax: (62 21) 570 6648

M. Harlem Tobing, Head of Subdit Jianma, Director of Traffic, MABES POLRI, Jalan MT Haryono. Kav 36-737, Jakarta 12770. Tel (work): (62 21) 798 9702; Tel (home): (62 21) 460 0547

M. Yusuf, Head of Directorate of Safety and Means Engineering, Directorate General of Land Transport, Jl Jend Sudirman 77, Jakarta 12190. Tel: (62 21) 570 6667; Fax: (62 21) 570 6667

IRAN

Farshid Faribourzi Araghi, Deputy Director of Planning Department, Ministry of Roads and Transportation/TTO, 169/1 Taleghani Avenue, Tehran. Tel: (98) 646 7750; Fax: (98) 640 2147

Majid Reza-Nariman Morady, Senior Expert, Deputy of Transportation Department, Ministry of Roads and Transportation/TTO), 169/1 Taleghani Avenue, Tehran. Tel: (98) 640 2145; Fax: (98) 641 9451

Yousef Elahi Shakib, Technical Consultant of Traffic and Transportation, 12th Frauoin Complex, Vanaksq, Tehran. Tel: (98) 225 3039; Fax: (98) 225 3028

JAPAN

Takekazu Iwata, Deputy Director, Traffic Safety Policy Office of Japanese Prime Minister's Office, 3-1-1 Kasumigaseki, Chiyoda-ku, Tokyo 100. Tel (work): (81 3) 3581 9482; Fax: (81 3) 3506 1942; (Home) (81 43) 243 7867

Akira Kobayashi, Assistant Manager, Planning Department, Japan Highway Public Corporation, 3-3-2 Kasumigaseki, Chiyoda-ku, Tokyo 100. Tel (work): (81 3) 3506 0259; Fax: (81 3) 3506 0346; Tel (home): (81 474) 308 017; Fax: (81 474) 308 017

Masaki Koshi, President, International Association of Traffic and Safety Sciences, 2-6-20 Yaesu, Chuo-ku, Tokyo 104. Tel (work): (81 3) 3273 7884; Fax: (81 3) 3272 7054; Tel (home): (81 3) 3320 1799; Fax: (81 3) 3320 1789; E-mail: nad02356@niftyserve.or.jp

KAZAKSTAN

Gulmira T. Akberdina, Senior Specialist, Division of Road Safety, Department of Roads, Ministry of Transport and Communications, 86 Gogol Street, 480091 Almaty. Tel (work): (7 3272) 323 769; Fax: (7 3272) 322 679; Tel (home): (7 3272) 611 554

Gennadij P. Baklaikin, Manager, Division of Road/Technical Supervision of State Automobile Inspection, Ministry for Interior Affairs, 185 Baytursynov Street, 480013 Almaty. Tel: (7 3272) 676 932; Fax: (7 3272) 322 679

Alexandr A. Denisenko, Manager, Division of State Policy on Road Transport, Department of Road Transport, Ministry of Transport and Communications, 458 Seifullin Pr, 480083 Almaty. Tel (work): (7 3272) 393 573; Fax: (7 3272) 322 679; Tel (home): (7 3272) 627 753

Vladimir Ch. Lim , Senior Specialist, Division of Road Maintenance, Department of Roads, Ministry of Transport and Communications, 86 Gogol Street, 480091 Almaty. Tel (work): (7 3272) 323 769; Fax: (7 3272) 322 679; Tel (home): (7 3272) 543 392

Amangeldy N. Yelgonov, Deputy Director, Department of Roads, Ministry of Transport and Communications, 86 Gogol Street, 480091 Almaty. Tel: (7 3272) 324 769; Fax: (7 3272) 322 679; Tel (home): (7 3272) 323 089

Salmassay Almukhambetov, Senior Transport Inspector for Taldy-Dorgan Region, State Transport Inspection, Ministry of Transport and Communications, 86 Gogol Street, 480091 Almaty. Tel (work): (7 3282) 240 761; Fax: (7 3272) 322 679; Tel (home): (7 3272) 32822, 61047

REPUBLIC OF KOREA

Hong Doo-Pyo, Section Chief, Black Spots Team, 171 Sindang Dong, Jung-Ku, Seoul. Tel (work): (82 02) 230 6066; Fax: (82 02) 2316 0171; Tel (home): (82 02) 982 4509 E-mail: kyw1234@unitel.co.kr

Jang Jung-Shik, Manager, Korea Highway Corporation, 293-1 Kumto-dong, Sujong-ku, Songnam-shi, Kyonggi-do. Tel (work): (82 2) 230 4282; Fax: (82 2) 230 4604

Joo Hyung-Choi, Director General, Bureau of Public Roads, Ministry of Construction and Transportation

Shin Hyun-Deok, Manager of International Cooperation Division, Korea Highway Corporation, 2293-1 Kumto-dong, Sujong-ku, Songnam-Shi, Kyonggi-do. (82 2) 230 4232; Fax: (82 2) 230 4308

Sigon Kim, Director, Road and Rail Transport Studies, The Korea Transport Institute, Ildong Bldg, 968-5 Daechi-Dong, Kangnam-Gu, Seoul 135-280. Tel (work): (82 2) 538 1458; Fax: (82 2) 538 1391; Tel (home): (82 2) 598 3938; E-mail: sigonkim@CIS.Koti.re.kr

Yoo Kyong-Soo, Research Director, Korea Highway Corporation, 293-1 Kumto-dong, Sujong-ku, Songnam-shi, Kyonggi-do. Tel: (82 2) 230 4855; Fax: (82 2) 230 4608

LAO PEOPLE'S DEMOCRATIC REPUBLIC

Dauphet Bouapha, Director, Vientiane Prefecture, Department of Communication, Transport, and Construction, Vientiane Municipality Box 2787. Tel (work): (856 21) 212 630; Fax: (856 21) 212629; Tel (home): (856 21) 313 260

Thongsavath Bounsack, Director, Division of Vehicles Monitoring and Road Safety Management, Department of Transport, Ministry of CTPC, Lane Xang Avenue, Vientiane

Xay Somphone Banchoephanith, Deputy Director of National Road and South Construction Project, Ministry of Communication, Transport, Posts and Construction, Communications Department, Lanexang Avenue, Vientiane. Tel: (856 21) 414 743; Fax: (856 21) 41432

Thongvanh Phan-Rajasavong, President, Vientiane Urban Development and Management Committee (VUDMC), Vientiane Prefecture. Fax: (856 21) 212 629

Prathoumvan Saisana, Vice-president, Vientiane Urban Development and Management Committee, Vientiane. Tel (work): (856 21) 212 104; Tel (home): (856 21) 214 923

Math Sounmala, Deputy Director, Ministry of Communication, Transport, Post, and Construction, P.O. Box 2158, Vientiane. Tel (home): (856 21) 412 781

MALAYSIA

Mohamed Supian Bin J. K. Amat, Federal Traffic Chief, Federal Headquarters, Royal Malaysia Police, Jalan Bukit Aman, 50560 Kuala Lumpur. Tel (work): (60 3) 235 7401; Fax: (60 3) 273 4086

Halimahtun Mohd. Khalid, Dean, Centre for Applied Learning and Multimedia, University Malaysia Sarawak, 94300 Kota Samarahan, Sarawak. Tel (work): (60 82) 672 311; Fax: (60 82) 672 312; Tel (home): (60 82) 570 780; E-mail: hali@calm.unimas.my

R. Krishnan, Associate Professor, University of Malaysia, Department of Primary Care Medicine, 50603 Kuala Lumpur. Tel (work): (60 3) 750 2306; Fax: (60 3) 757 7941; Tel (home): 60 3 7560748; E-mail: rajamk@medicare.med.am.edu.my

Norliah Saidin, Highway Planning Unit, Ministry of Works Malaysia, Jalan Sultan Salahuddin, 50580 Kuala Lumpur. Tel: (60 3) 440 6466; Fax: (60 3) 293 3875

Ir. Shamsuddin Sabri, Highway Planning Unit, Ministry of Works Malaysia, Jalan Sultan Salahuddin, 50580 Kuala Lumpur. Tel: (60 3) 440 6466; Fax: (60 3) 293 3875; E-mail: shamsuddin@hq.jkr.gov.my

Radin Umar Radin Sohadi, Accident Research Unit, Faculty of Engineering, University Pertanian Malaysia, VPM 43400, Sorday. Tel (work): (60 9) 486 101-2037; Fax: (60 9) 488 939; Tel (home): (60 9) 484 532; E-mail: Radinumx@eng.upm.edu.my

Aminuddin Yusof, Principal Assistant Director, Highway Planning Unit, Ministry of Works, Jalan Sultan Salahuddin, 50580 Kuala Lumpur. Tel (work): (60 3) 440 6459; Fax: (60 3) 293 3875; Tel (home): (60 3) 773 703

NEPAL

Ram Badan Joshi, Education Consultant, Private Boarding School Organisation, Katmandu; c/o Frances Holmes, Roughton and Partners, P.O. Box 4075, Katmandu. Fax c/o Frances Homes (work): (977 1) 412 572; Tel (home): (977 1) 526 756

Mohan Bahadur Karki, Director General, Department of Roads, Ministry of Works and Transport, Babar Mahal, Kathmandu. Tel (home): (977 1) 221 675; Fax: (977 1) 225 993; Tel (home): (977 1) 472 668

Sagar Thapaliya, Deputy Superintendent of Police, Traffic Control Division, Police Headquarters, Naxal, Kathmandu, PB NG 407. Tel (work): (977 1) 411 569; Fax: (977 1) 420 542; Tel (home): (977 1) 415 736; Fax: (977 1) 413 819

S. K. Regmi, Deputy Director General, Department of Roads (Design), Ministry of Works and Transport, Babar Mahal, Kathmandu. Tel: (977 1) 211 377; Fax: (977 1) 225 993

NEW ZEALAND

Ian Appleton, Transfund New Zealand, P.O. Box 2331, Wellington. Tel: (64 4) 495 3271; Fax: (64 4) 499 0733

A. Bliss, Land Transport Safety Authority, 7-27 Waterloo Quay, P.O. Box 2840, Wellington. Tel: (64 4) 494 8600; Fax (64 4) 494 8601

Andrew Hearn, Manager, Strategy and Planning, Land Transport Safety Authority, 7-27 Waterloo Quay, P.O. Box 2840, Wellington. Tel: (64 4) 494 8600; Fax: (64 4) 494 8601

Bill Robertson, Manager, Education and Community Programmes, Land Transport Safety Authority, 7-27 Waterloo Quay, P.O. Box 2840, Wellington. Tel: (64 4) 494 8600; Fax: (64 4) 494 8601

Gavin A. Robins, Accident Rehabilitation and Compensation Insurance Corporation, P.O. Box 242, Wellington. Tel: (64 4) 473 8775; Fax: (64 4) 471 1688

Roger Toleman, General Manager Policy, Ministry of Transport, 38-42 Waring Taylor Street P.O. Box 3175, Wellington. Tel: (64 4) 472 1253; Fax: (64 4) 373 3697

Phil Wright, Assistant Commissioner: Traffic Safety, New Zealand Police National Headquarters, P.O. Box 3017, Wellington. Tel: (64 4) 474 9499; Fax: (64 4) 474 9446

PAKISTAN

M. A. Iqbal, Director (Roads and Transport), MoC, Pakistan Secretariat, D Block, Islamabad. Tel (work): (92 51) 920 2711; Fax: (92 51) 221 300; Tel (home): (92 51) 920 7486

M. S. Qureshi, Deputy Chief (NTRC) Ministry of Communications, Sector H-8/2, Islamabad. Tel (work): (92 51) 255 670; Fax: (92 51) 253 651; Tel (home): (92 51) 254 626

Iftikhar Rashid, Inspector General of Police, Ministry of Communications, IGP Enforcement, Block D, Secretariat, Islamabad. Tel (work): (92 51) 218 224, 210 765; Fax: (92 51) 920 1355; Tel (home): (92 51) 216 347

M. Sadiq Swati, Senior Chief (NTRC), Ministry of Communications, Sector H-8/2, Islamabad. Tel (work): (92 51) 253 676; Fax: (92 51) 253 651; Tel (home): (92 51) 253 412; E-mail: ntrc@paknet1.ptc.pk

Malik Zaheer-ul-Islam, Director, Traffic Engineering Bureau (KDA), 8th Floor, Civic Centre, Karachi-5, PC 75300. Tel (work): (92 21) 493 3719; Fax: (92 21) 493 3719, 4993; Tel (home): (92 21) 498 5488, 497 4885; Fax: (92 21) 722 8253

PAPUA NEW GUINEA

Ayabian Bannah, Assistant Director Road Safety and Traffic Management, Department Transport and Works, P.O. Box 1489, Port Moresby. (675) 325 4436; Fax: (675) 325 4091

Gariga Gabi, Assistant Director (Highway System Engineering) Department of Transport and Works, P.O. Box 1108, Boroko, National Capital District. Tel (work): (675) 324 1289; Fax: (675) 324 1170; Tel (home): (675) 326 0605

Henry Saiyo Parakei, Acting Director (Policy, Planning and Research Development), Department of Transport and Works, P.O. Box 1489, Port Moresby. Tel: (675) 320 0949; Fax: (675) 320 0236

V. M. Puvanachandran, Associate Professor in Transportation Engineering, Department of Civil Engineering, PNG University of Technology, Private Mail Bag, LAE. Tel (work): (675) 434 602; Fax: (675) 457 215; Tel (home): (675) 457 146

PHILIPPINES

Manuel M. Bonoan. Assistant Secretary for Planning, Department of Public Works and Highways, 3/F DPWH Building, Bonifacio Drive, Port Area, Manila. Tel: (63 2) 527 5618; Fax: (63 2) 527 5618

Primitivo C. Cal, Undersecretary of Transport, Department of Transportation and Communications, Ortigas Avenue, Pasig, Metro Manila. Fax: (63 2) 632 9985

Ernesto L. Camarillo, Director for Transport and Traffic, MMDA, EDSA corner Orense Street, Makati City, Metro Manila. Tel: (63 2) 819 1285; Fax: (63 2) 819 0408

Solita V. Genota, Engineer IV, Planning Service, Department of Public Works and Highways, 3/F, DPWH Building, Bonifacio Drive, Port Area, Manila. Tel (work): (63 2) 527 4121; Fax: (63 2) 527 4121; Tel (home): (63 2) 281 7313

Daisy Jacobo, Regulations Officer, Traffic Safety Division, Quezon City, Metro Manila. Tel: (63 2) 921 9058

Delfin T. Justiniano, Director, Philippine Motor Association, 683 Aurora Boulevard, 1117 Quezon City. Tel: (63 2) 723 0808; Fax: (63 2) 785 878

Rey M. T. Luna, Technical Advisor to the Metro Manila Development Authority, TEC Building, R. Magsaysay corner Valencia Street, Sta. Mesa, Metro Manila. Tel (work): (63 2) 715 1551/58; Fax: (63 2) 714 0701; Tel (home): (63 2) 816 4577; E-mail: 101474.3631@compuserve.com

Romeo B. Maganto, Executive Director, Metro Manila Development Authority, Metro Traffic Force, Orense Street, Guadalupe, Makati City, Metro Manila. Tel (work): (63 2) 816 7878; Fax: (63 2) 818 8490; Tel (home): (63 2) 816 7862

Prospero I. Oreta, Chairman, Metro Manila Development Authority, Orense Street, Guadalupe, Makati City, Metro Manila. Tel (work): (63 2) 818 2224; Fax: (63 2) 819 0408; Tel (home): (63 2) 932 3102; Fax: (63 2) 932 7892

RUSSIA

Boris B. Anokhin, Head of Road Safety Division, Traffic Safety Department of the Ministry of Transport of Russian Federation, 10 Sadovo; Samoteychnaya str. 101433 Moscow. Tel: (7 95) 200 2702; Fax: (7 95) 151 0331; E-mail: vvs@iaaree.madi.msk.su

Yuri Olkhovnikov, Chief of Road Traffic Safety Research Center, Ministry of Internal Affairs of Russian Federation, 15 Prospect Mira, 129090 Moscow. Tel: (7 95) 971 6277; Fax: (7 95) 971 6444

Valentin V. Silyanov, Vice-rector, Moscow State Automobile and Road Technical University (MADI-TU), 64 Leningradskyi Prospect, 125829 Moscow. Tel (work): (7 95) 151 5241; Fax: (7 95) 151 033; Tel (home): (7 95) 159 3066. E-mail: vvs@iaaree.madi.msk.su

SAMOA

Paul Phillips, Acting Chief, Civil Engineering, Public Works Department, Apia. Tel (work): (685) 20865, 21611; Fax: (685) 21927; Tel (home): (685) 24915

Isikuki Punivalu, Director of Works, Public Works Department, PWD Private Bag, Apia. Tel (work): (685) 20865, 21611; Fax: (685) 21927; Tel (home): (685) 22760.

SINGAPORE

V. Anantharaman, Senior Consultant, Singapore General Hospital, Outram Road, 169608. Tel: (65) 321 4100

Choong Khoon Seng, Manager, 815 Bukit Batok West Avenue 5, 659085. Tel: (65) 561 1233; Fax: (65) 561 1266

Chin Hoong Chor, Director and Chairman, Road Safety Committee, Department of Civil Engineering and Centre for Transportation Research, National University of Singapore, 10 Kent Ridge Crescent, 119260. Tel: (65) 772 2550; E-mail: cvechc@nus.sg

Long Say Gee, Manager for Vehicle Engineering, Land Transport Authority, No. 10 Sin Ming Drive, 575701. Tel: (65) 553 5260

A. S. P. Rozlan Giri, Traffic Police Department, Republic of Singapore Police, Ministry of Home Affairs, Maxwell Road, 0106 Tel: (65) 221 0000; Fax: (65) 225 4208

No Guat Heng, OC Testing, Queenstown Test Centre, 15 Commonwealth Avenue, 149725. Tel: (65) 472 8016

Tee Eng Peng, Head Operations and Training, Traffic Police Department, Maxwell Road, 069114. Tel: (65) 420 4120

Lee Wing Sung, Senior Manager, Traffic Manager, Land Transport Authority, #19-00 PSA Building, 460 Alexandra Road, 119963. Tel: (65) 375 7066

Thomas Tan, General Manager, Automobile Association of Singapore, 336 River Valley Road, #03-00 AA Centre, 0923. Tel: (65) 737 2444; Fax: (65) 733 5094

Milton Tan, President, The National Safety Council of Singapore, Tan Boon Liat Building, 315 Outram Road, #10-09A, 169074. Tel (work): (65) 235 5688; Fax: (65) 732 1402; Tel (home): (65) 732 3955; Fax: (65) 223 7568; E-mail: remi@pacific.sg

Wong Lan Yang, OC Road Safety, Traffic Police Department, Maxwell Road, 069114. Tel: (65) 420 4140

SRI LANKA

Camillus R. Abeygoonewardena, Sri Lanka Police, No. 3 Mihindu Mawatha, Columbo 12. Tel: (94 1) 326 006; Fax: (94 1) 44633

D. M. T. B. Dissanayake, Deputy Inspector General of Police, Office of the DIG Police Colombo, 1/F, New Sec Building, Colombo 1. Tel (work): (94 1) 431 428; Fax: (94 1) 32 8874; Tel (home): (94 1) 587 540

Don Somaweera Edirisinghe, Commissioner Motor Traffic, Ministry of Transport, Environment and Women's Affairs, Colombo 5. Tel (work): (94 1) 698 717; Fax: (94 1) 694 338; Tel (home): (94 1) 684 378

M. B. S. Fernando, Chairman, Road Development Authority, Sethsiripaya, Battaramulla, Colombo. Tel (work): (94 1) 862 767; Fax: (94 1) 864 801; Tel (home): (94 1) 732 867

Jayantha Aluthgama Guruge, Superintendent Engineer (Traffic), Colombo Municipal Council, Municipal Engineers Department, Townhall, Colombo 7. Tel: (94 1) 686 605; Fax: (94 1) 696 264, 684 290; Tel (home): (94 1) 508 943

K. Haputantri, Senior Assistant Secretary, Ministry of Transport, Environment and Women's Affairs, Colombo 10. Tel (work): (94 1) 687 127; Fax: (94 1) 687 284; Tel (home): (94 1) 605 475, 607 927; Fax: (94 1) 635 237

Amal S. Kumarage, Senior Lecturer, Head/Traffic Engineering Division, University of Moratuwa, P.O. Box 8, Katubedda, Moratuwaa. Tel (work): (94 1) 647 567; Fax: (94 1) 647 622; Tel (home): (94 1) 646 702; E-mail: amal@civil.t.ac.ik

S. Senanayake, Project Officer, National Road Safety Secretariat, 5/F, Sethsiripaya, Battaramulla, Colombo. Tel: (94 1) 255 010

Hemal de Silva, Assistant Commissioner Technical, Department of Motor Traffic, Colombo 8. Tel: (94 1) 694 331; Fax: (94 1) 694 338

SWITZERLAND

C. J. Romer, Chief, Safety Promotion and Injury Control (Member, Steering Committee), World Health Organization, Geneva 27. Tel: (41 22) 791 2111; Fax: (41 22) 791 0746

Boris Conunov, Chairman of International Road Traffic Organization (IRTO) General Assembly's Chief of Staff, IRTO, 15 Chemin Louis Dunant, POB19, 1211 Geneva 20. Tel (work): (41 22) 919 6267; Fax: (41 22) 919 6248; Tel (home): (41 22) 733 3325

Julia de Massey, Expert Assistant, IRTO, 15 Chemin Louis Dunant, POB19, 1211 Geneva 20. Tel: (41 22) 919 6246; Fax: (41 22) 919 6248

THAILAND

Kitipol Asaparporn, Director of Traffic Engineering Division, Department of Highways, 51 Ayutthanya Road, Bangkok 10400. Tel (work): (66 2) 245 5268; Fax: (66 2) 246 7766; Tel (home): (66 2) 521 5917

Preecha Choosub, Chief of Transport Safety, Environment and Efficiency Development Subdivision, Ministry of Transport and Communications, Ratchadamnoen Nok Avenue, Bangkok 10100. Tel (work): (66 2) 281 1174; Fax: (66 2) 280 4257; Tel (home): (66 2) 411 1073

Sriprabha Kerdkrune, Planning Analyst, Office of the Permanent Secretary, Ministry of Education, Dusit, Bangkok 10300. Tel: (66 2) 282 8585, 281 0061; Fax: (66 2) 282 7837, 281 9413; Tel (home):(66 2) 519 4557

Kriangsak Kongpolporm, Director, Transport Safety Division, Land Transport Department, Bangkok 10900. Tel: (66 2) 279 2959, 272 3258; Fax: (66 2) 272 3258

Boonsong Panichantra, Deputy Commander, Highway Police Department, Si Ayutthya Road, Ratchatevi, Bangkok 10400. Tel: (66 2) 245 8090; Fax: (66 2) 247 7752

Vichit Punyahotra, President, Thai National Safety Association, 469/77 Benjasri Building, Briayudhayn Road, Bangkok 10400. Tel (work): (66 2) 529 3749; Fax: (66 2) 529 4833; Tel (home): (662) 247 5879; Fax: (662) 206 8048

Athiporn Siriwat, Director Bureau of National Safety Council of Thailand, Government House, Bangkok. Tel: (66 2) 271 7755

Tairjing Siriphanich, Director, Medical Institute of Accident and Disaster, 6/2 Suthisarn Soi 1, Bangkok 10400. Tel (work): (66 2) 248 2222; Fax: (66 2) 245 0844; Tel (home): (66 2) 278 0181

Yordphol Tanaboriboon, Coordinator of Transportation Engineering Program, Asian Institute of Technology, G.P.O. Box 2754, Bangkok 10501. Tel: (66 2) 524 5506; Fax: (66 2) 524 5509; E-mail: yord@rccsun.ait.ac.th

TURKMENISTAN

Hadjimurad Atadjanov, Chairman, Main AVTO Inspection Division, Ministry of Internal Affairs, 4 Stoklozarodskaya Street, Ashgabal, 744005. Tel: (3632) 478 455; Fax: (3632) 356 530

UZBEKISTAN

Akmar Akilov, Regional Representative of International Road Traffic Organization, Shplkov 15, Tashkent. Tel: (8 3712) 357 181; Fax: (8 3712) 351 071

Botir R. Parpiyev, Deputy Minister of Internal Affairs, General Major, Navruz-1 Street, Tashkent. Tel (work): (8 3712) 397 800; Tel (home): (8 3712) 363 783

Kakhramon M. Sydiknazarov, Chairman, Tashkent Region Passenger Transport Company, H. Abdullaeva Street 32 A, Tashkent. Fax: (8 3712) 673 269

Rustambek N. Urmanbekov, Expert, President Administration, 43 Uzbekistan Street, Tashkent

VIET NAM

Pham Ngoc Quynh, Senior Expert, Traffic Department of Viet Nam Road Administration, Ministry of Transport and Communication, 80 Tran Hung Dao Street, Hanoi. Tel (work): (84 4) 826 3573; Fax: (84 4) 824 6427; Tel (home): (84 4) 828 2081

Phan Ngoc Thuy, General Director, Ministry of Transport, 80 Tran Hung Dao Street, Hanoi. Fax: (84 4) 852 1013

8. OTHER CONTACTS

RETA PROJECT TEAM

Ross Silcock Ltd.
Alan Ross, Project Director, Ross Silcock Ltd., Old Brewery Court, 156 Sandyford Road, Newcastle upon Tyne NE2 1XG, United Kingdom; Tel (work): (44 191) 261 8101; Fax: (44 191) 261 8340; Tel (home): (44 191) 265 0060; E-mail: 101325.33@compuserve.com

Caroline Ghee, Mike Goodge, Kathleen Ness, Chris Robson, Tim Selby, and Kim Smith

TRL
Goff Jacobs Overseas Project Director, Transport Research Laboratory, Overseas Unit, Old Wokingham Road, Crowthorne, Berkshire RG45 6AU, United Kingdom. Tel: (44 1344) 773 131; Fax: (44 1344) 770 88

Chris Baguley and Amy Aeron-Thoma

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INTERNATIONAL AGENCIES

ASIAN DEVELOPMENT BANK
Charles Melhuish, Senior Policy Specialist, Asian Development Bank, P.O. Box 789, Manila, Philippines. Tel: (63 2) 632 6803; Fax: (63 2) 636 2423; E-mail: cmelhuish@mail.asiandevbank.org

UNITED NATIONS ECONOMICAND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC
M. Rahmatullah, Director, Transport, Communications, and Tourism Division, UN/ESCAP, The United Nations Building, Rajadamnern Avenue, Bangkok 10200, Thailand. Tel: (66 2) 288 1234; Fax: (66 2) 288 1000

Dieter Niemann, V. N. Timopheyev, I. P. Tiwari, and J. C. Witkowski

THE WORLD BANK
John Flora, Manager, Transport Division, World Bank, Room S-6029, 1818 'H' Street NW, Washington, DC 20433, US. Tel: (1 202) 473 8866; Fax: (1 202) 522 3223

Stein Lundebye, Senior Transport Engineer, Infrastructure Operations Division, Country Department 1, South Asia Region, The World Bank, 1818 H Street NW Washington, DC 20433, US. Tel: (1 202) 458 0148; Fax: (1 202) 477 5520; E-mail: slundebye@worldbank.org

WORLD HEALTH ORGANIZATION
C. Romer, Director, Global Reduction Programme, World Health Organization, Avenue Appia 20, Ch-1211 Geneva 27, Switzerland. Tel: (41 22) 791 2111; Fax: (41 22) 791 0746

Road Safety Guidelines

for the Asian and Pacific Region

Appendix C

COMPARATIVE STUDY: FIJI ROAD SAFETY ACTION PLAN

Asian Development Bank

1 THE PROBLEM

Fiji, in common with other developing countries, saw a deterioration in road safety during the period 1988-1991. Increasing vehicle fleets began to cause problems, rehabilitated roads supported faster traffic through small communities along the national road network, and inadequate enforcement and medical services meant that driver behavior was poor and injured victims did not get the early medical attention they needed. There was a fragmentation of responsibilities and inadequate knowledge and effort to tackle the problems facing the country. Road accident deaths increased steadily year by year and peaked in 1991, the year before the start of the country's Road Safety Action Plan.

2 THE DEVELOPMENT OF A STRATEGY AND ROAD SAFETY ACTION PLAN

The Asian Development Bank (ADB) appointed a road safety advisor to assist the Bank and the Fiji Government to develop a strategy and to oversee implementation of a Road Safety Action Plan. The purpose of the Action Plan was to develop institutional capability to address road safety problems effectively and to oversee implementation of the most urgent improvements over a three- to three-and-a-half-year period. Periodic inputs were provided by other specialists working under the direction of the road safety advisor.

3 IMPROVEMENTS IMPLEMENTED

The improvements implemented covered all major sectors related to road safety and the individual countermeasures were phased to ensure maximum effect. An Action Plan was devised to make best use of the US$3 million budget for the Plan. The strategy adopted was as follows:

1 complete funding of key strategic improvements needed in order to carry out other activities (for example an improved accident data system);
2 "seed" money to encourage desirable developments. Funds to initiate or support, for a limited period only, selected developments and activities that would eventually be taken over by other funding;
3 institution building for safety. Funds to encourage and reinforce the development of existing Fijian organizations and institutions that could make a long-term contribution to safety by assisting them in developing appropriate organizational structures, working manuals, courses, and training programs to tackle the road safety problems in an efficient manner; and
4 staffing development and technical assistance. Funds for specialist training of key personnel so that in due course the wider safety improvements necessary could be implemented in Fiji by adequately trained and skilled local professionals; for the interim period when specialist consultancy assistance would be required to assist in planning and implementation of the key strategic improvements; and the training of local staff through demonstration projects.

The following pages outline the activities undertaken as part of the Fiji Road Safety Action Plan and the framework used in monitoring implementation of the Action Plan is presented at the end of this Appendix.

4 FIJI ROAD SAFETY ACTION PLAN

The focus and strategy of the Action Plan was as follows: initiate the most urgent improvements; tackle problems where there were known and effective solutions available; and to develop and train local professionals in the key institutions so that they could more effectively implement the wider road safety improvement program needed in Fiji.

The project was broken down into two phases with the four most urgent projects (1-4 below) undertaken from the start and the second set of projects brought into play during the second phase of the Action Plan. The sectors addressed and the improvements implemented are detailed below.

1. Accident data system. The existing data system was poor and allowed only limited manual analysis to be undertaken, which gave little or no understanding of the characteristics and nature of the road safety problem in Fiji. A new accident data form was developed and introduced nationally after pilot testing. A new microcomputer-based accident data storage, retrieval, and analysis system (Microcomputer Accident Analysis Package [MAAP] 5 from Transport Research Laboratory [TRL], United Kingdom [UK]) was established at police headquarters and a police accident unit trained to operate all aspects of the system. The Police Accident Unit (PAU) is now operating independently and providing the annual statistics reports to all key agencies so that appropriate countermeasures can be drawn up in each sector.
2. National Road Safety Council (NRSC). Legislation was developed and passed to establish an NRSC with statutory powers to oversee road safety improvement. A building was provided to create an NRSC headquarters and four vehicles were provided to operate as mobile publicity exhibitions. Videos, overhead projectors, and other training equipment were provided to assist in carrying out education and publicity, and road safety materials were produced to raise public awareness. Funding mechanisms were included in the legislation so that a levy of 10 percent was to be applied to all third party insurance policies to be handed over to the Safety Council. Some staff were seconded from other member agencies of the NRSC and other staff, such as the executive director and several technical staff, were hired directly by the NRSC to carry out the secretariat function of the Council. The Council is now fully active and carrying out publicity and education activities all over Fiji through a network of local divisional councils, and even (in some cases) municipal councils.
3. Infrastructure Improvements. A small Traffic and Road Safety Unit was established in the public works department and the staff trained in carrying out accident prevention and accident reduction. Accident prevention activities included the introduction of safety audits, improved access and development controls, and training of the unit in road safety issues. The accident reduction activities included identification and elimination of

Plate 1 (left): Road marking to improve safety.

Plate 2 (right): Police accident unit staff.

the worst accident black spots, the implementation of route action plans and mass action plans, and the development of traffic management schemes for the main towns and urban areas in Fiji. Guidelines and procedure manuals have been prepared for the Unit, which is, with its three Fijian engineers, operating independently and able to carry out an effective accident prevention and accident reduction program, and provide advice on these activities to other engineers in divisions and municipalities.

4. Traffic Law Enforcement. In this area, considerable assistance was given to establish a Highway Patrol along the major road network and to establish a traffic police course at the Police Training College. Police personnel were also instructed in the use of radar, speed detectors, and alcohol testing devices, and a number of practical exercises were undertaken to train them in carrying out operations on drunk-driving, road worthiness checking, and speed detection. Traffic police were also provided with specialist rescue equipment for cutting vehicles and rescuing victims, and trained in the use of this equipment. The net result is that there is now a reasonably effective traffic police enforcement capability along the major national roads in Fiji. The police are capable of traffic law enforcement and are able to provide a rescue capability also.

5 Traffic Legislation. As part of the Action Plan, the existing traffic act was revised and a draft act prepared. It is now awaiting formal approval by Parliament. This, among other issues, addresses gross overloading and how to deter this activity and enforce compliance using mobile weighbridges.

6 Child Traffic Education. A number of important educational projects was initiated by the child education specialist. The projects included a road safety theater production to visit schools, university research into road skills training programs for children, the printing and distribution of guidelines for teachers so that every teacher would have some knowledge about teaching safety to young children, development and printing of a road code and leaflets on lessons for life for parents so that they could be involved in teaching children, and development and printing of special school materials based on a character (the "Road Ranger"). The advisor also trained a counterpart in road safety education officer and working with him and

Plate 3 (below): Police spot checks on drink-driving.

Plate 4 (bottom): Safety of schoolchildren

Plate 5 (right): Overloaded crane truck.

Plate 6:
Drivers in Suva.

the local curriculum development units developed appropriate teaching materials for children for use in schools. These are being tested in eight elementary schools. The net result of all these activities is that there is now active and effective road safety materials development and road safety teaching in Fijian schools, and this will have long-term benefits for the safety of young children in the country.

7 Driver Training and Testing. In this sector the main improvements implemented were as follows:

- introduction of new oral questionnaires with a preset pass mark;
- introduction of standardized licensing test scores and test routes; and
- development of comprehensive manuals for all aspects of driver licensing, including licensing of driving schools and instructors.

It also included monitoring, periodic reporting, and analysis of all driver examination results, development of a revised road code consistent with a revised traffic legislation, and preliminary work with the driving schools industry on improving professional standards and the development of a standard curriculum.

Plate 7:
Roadside spot checks of roadworthiness.

During the Project, all existing driver examiners were given training on the new manual and procedures, and, in addition, the specialist advisor worked closely with the local specialists in developing a defensive driving course suitable for Fiji. A Defensive Driving Instructor Course was also developed and a large number of Fijian instructors was trained. The course has been institutionalized and is now available from the Fiji National Training Council, which has a pool of about 20 fully trained defensive driver instructors from which the Council will be able to draw to conduct courses in the future.

8 Vehicle Inspection and Roadworthiness In comparison with the other sectors, not as much progress has been made in this sector, largely because of the question over the mechanical competence of the existing staff engaged in vehicle inspections. Nevertheless, new inspection procedures have been developed that provide a structured approach to the inspection of any vehicle and the establishment and documentation of pass/fail criteria. All examiners have been trained in these procedures and comprehensive reference and policy manuals have also been developed. Acknowledging the general poor condition of infrastructure, the Fijian Government has embarked on a capital investment program to upgrade these facilities. Advice has also been given on the possibility of introducing testing by private operators regulated by the Department of Road Transport. Guidance has been provided on the policy, technical standards, and administrative procedures that may be necessary. In order to reduce the likelihood of unroadworthy vehicles using the road network, vehicles and equipment were purchased for the Department of Road Transport to use for on-road enforcement of vehicle roadworthiness. The vehicle inspectors, working in harmony with the police, were also trained in carrying out roadside spot checks and inspections of vehicles so enforcement exercises would become part of the routine in Fiji. These are now taking place regularly.

9 Emergency Medical Services. The absence of emergency medical services to help road accident victims was a cause for concern. The Project included some

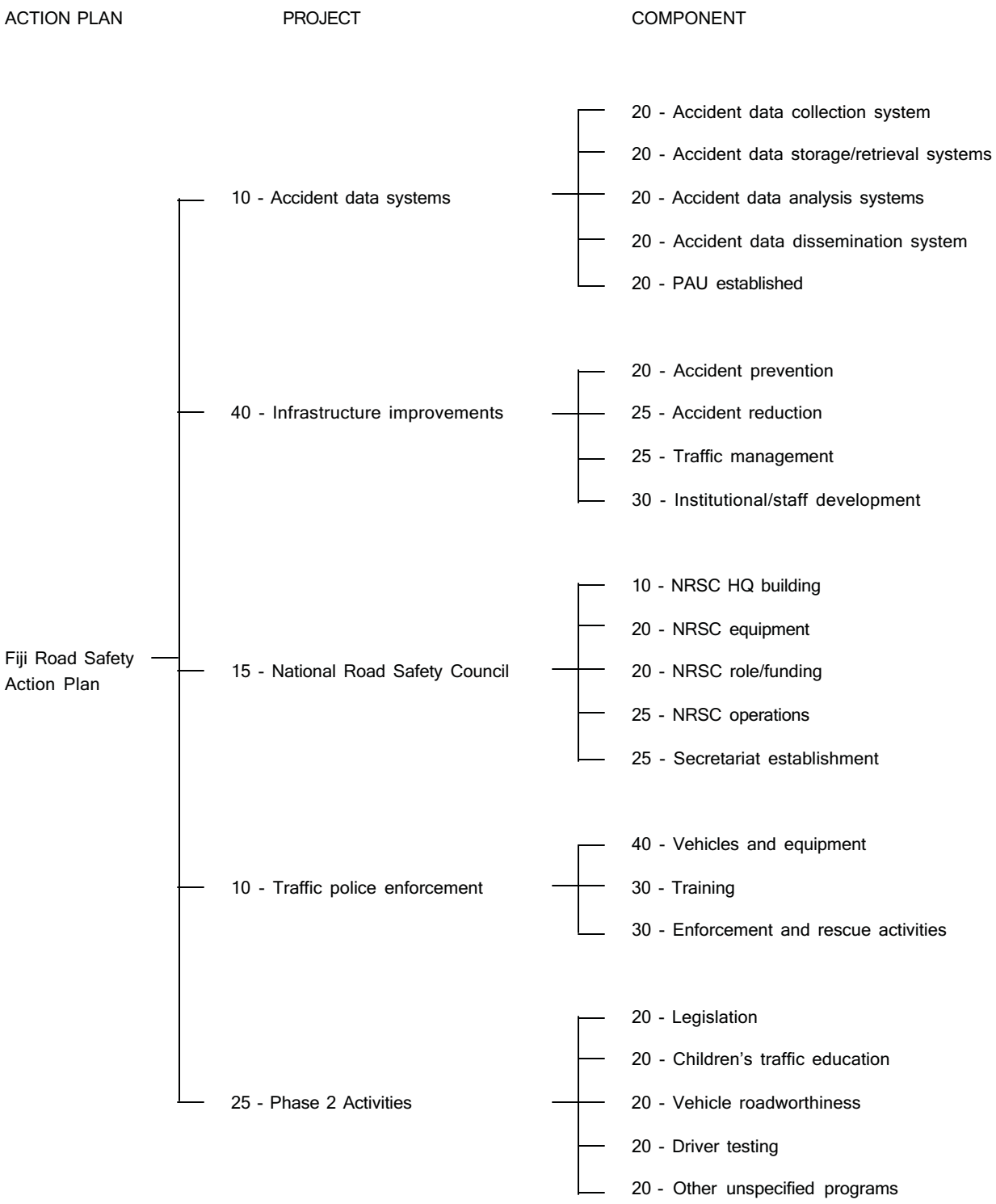
specialist advice in reviewing the existing provision of emergency medical services by voluntary agencies, the fire service, and the hospitals, and the development of pilot programs to try to improve the situation. A pilot scheme has been devised, partially drawing upon voluntary funding of St. John Ambulance and partly with some assistance from the Government to try to develop a pilot emergency medical system for the Suva area. If this is successful it can be extended to other major towns and eventually along the national road network.

5 MONITORING AND EVALUATION

There are often serious problems in monitoring the effectiveness of the aid-funded projects, especially on the nonquantifiable areas, such as to whether institutional impact has occurred or whether the developmental objectives have been attained. This Project was monitored using the disaggregated effectiveness evaluation (DEE) technique, which is particularly appropriate for monitoring the effectiveness of aid-funded projects and for assessing achievement of objectives. The Project was monitored quarterly by the Government and the results were fed back to the aid agencies and to the safety advisor for action as necessary. The whole action plan was originally expected to be implemented by December 1995, but because of some temporary budgeting problems within the Public Works Department, some of the work had to be rescheduled. This was particularly so with respect to the infrastructure improvements, the black spot improvements, and some of the route action plans, which had to be postponed until the following budget year. As a consequence, the progress achieved with respect to the originally stated developmental objectives in each sector by March 1996 were as follows:

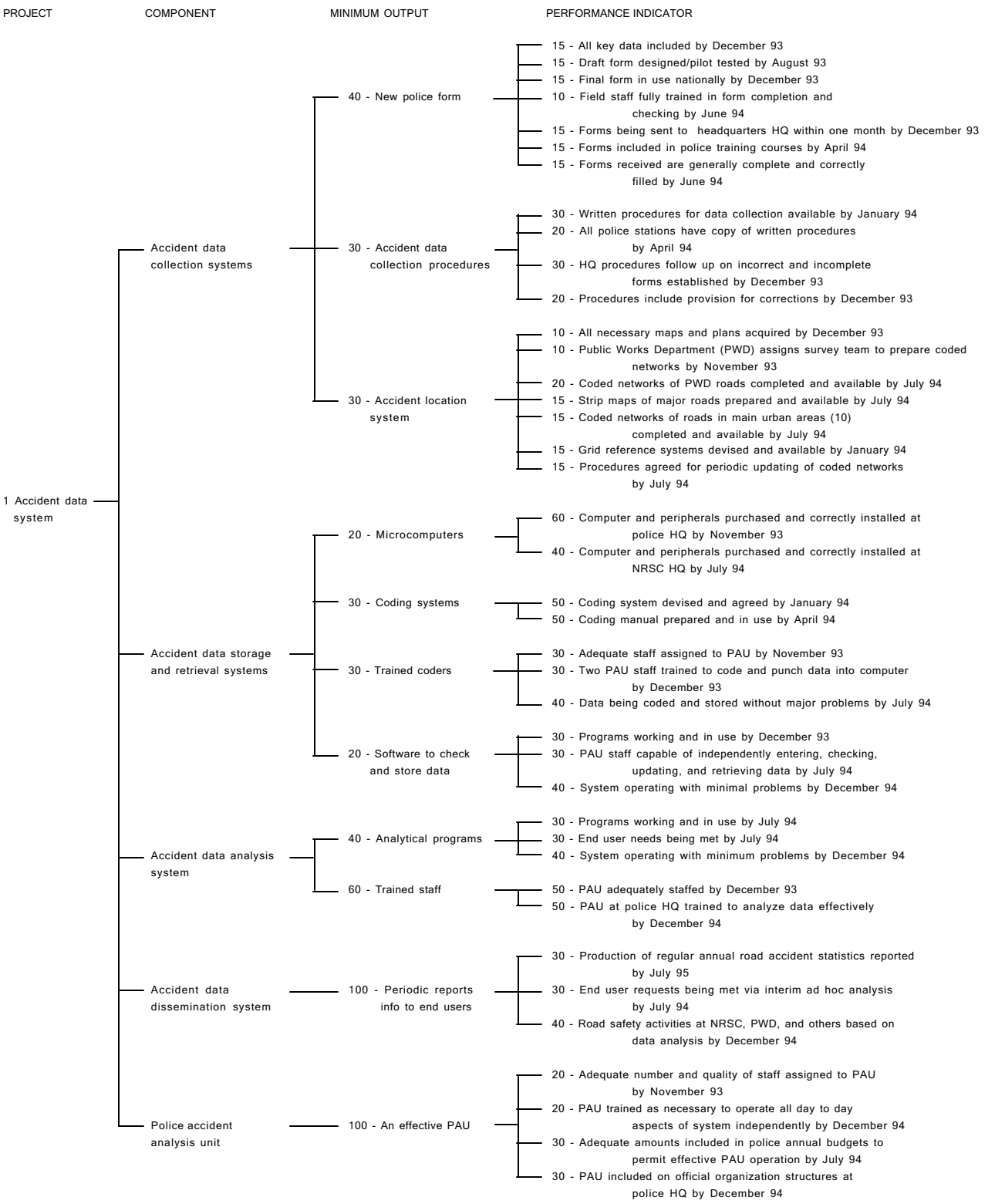
1 accident data system: 100 percent;
2 infrastructure (implementation still ongoing): 80 percent;
3 Road Safety Council: 100 percent;
4 traffic police enforcement: 90 percent;
5 traffic legislation: 83 percent;
6 traffic education: 84 percent;
7 vehicle roadworthiness testing: 100 percent;
8 driver testing and training: 76 percent; and
9 emergency medical services (implementation still ongoing): 60 percent.

It must be noted that the above percentages are a measurement of achievement of the developmental objectives andinstitutional impact of the project. In most aid-funded projects, achievement of even 50 percent of the stated objectives would be considered quite successful. Achievement of 80-90 percent of the stated objectives after three to four years is a significant achievement. This Project, therefore, has been extremely successful in building up the capability of local institutions to tackle road safety problems and has resulted in much enhanced road safety activity being undertaken in Fiji. Although the primary focus of this Action Plan was institution building, the Plan has already improved road safety and created safer roads. Road accident deaths have fallen by about 20 percent in comparison to the 1991 figure (the year before the Action Plan commenced). Further decreases in the number of deaths are expected as the benefits of the Action Plan begin to be realized by the Fiji Government.



ACTION PLAN DEVELOPMENTAL OBJECTIVES
Institutional strengthening and development of key institutions and individuals in Fiji in order to enhance their capability to develop, implement, and oversee improvements in road safety and traffic management nationwide.

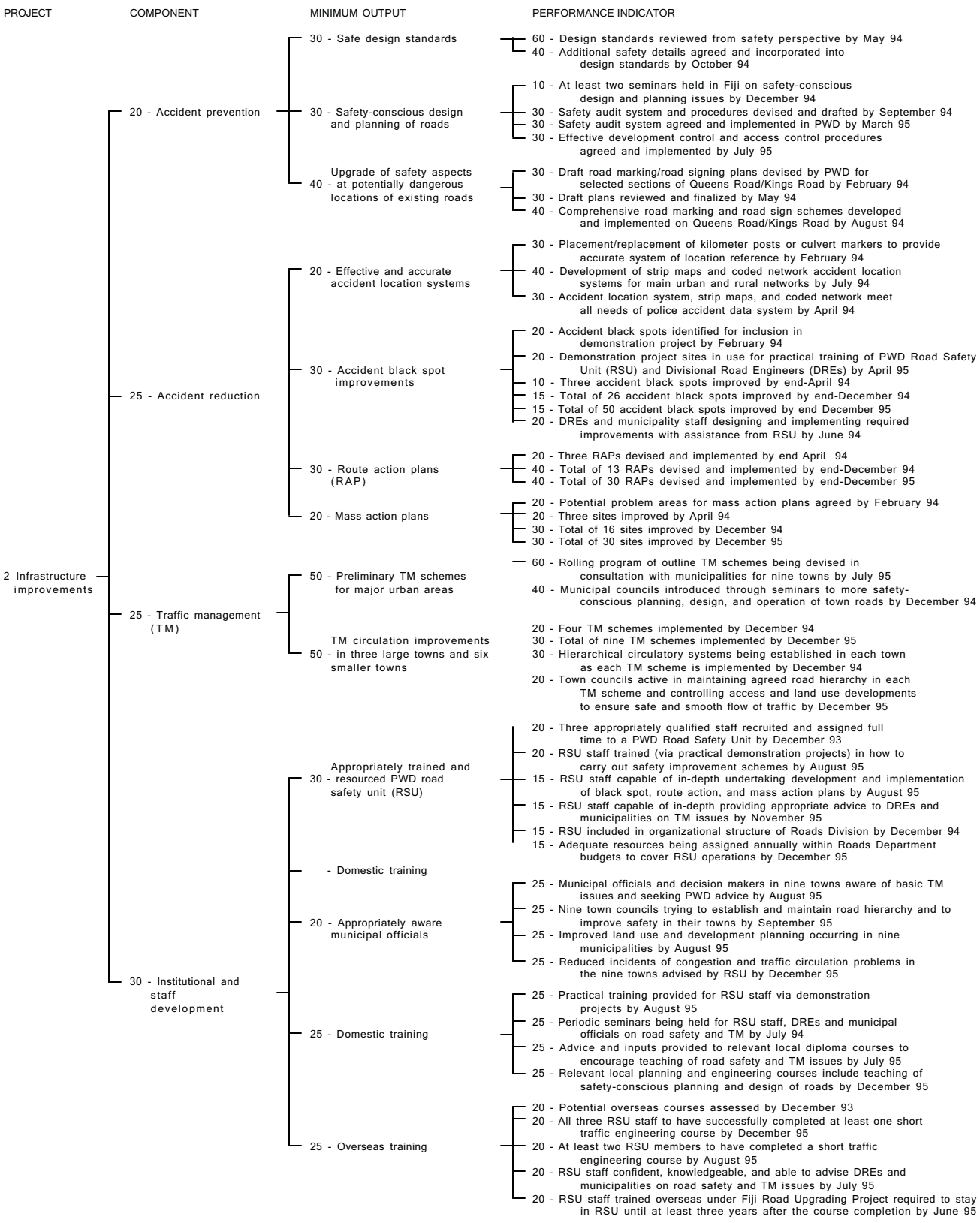
Figure 1: Fiji Road Safety Action Plan



PROJECT DEVELOPMENT OBJECTIVE

An effective accident data system, operated by Fijian police personnel that permits the scale, nature, and characteristics of the accident problem to be properly defined so that appropriate remedial measures can be developed by relevant agencies to reduce the numbers of injuries and deaths on Fiji roads.

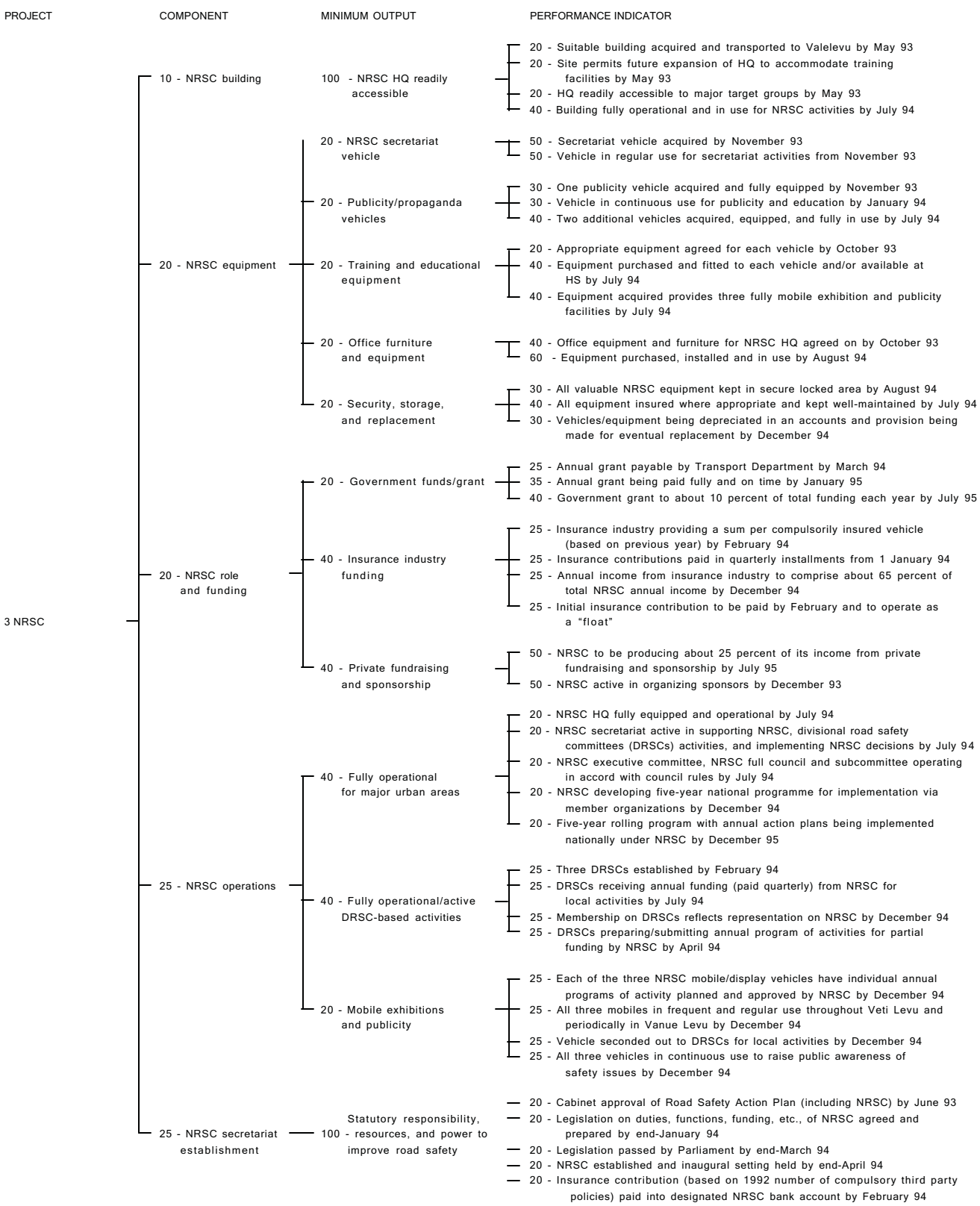
Figure 2: Project 1 – Accident Data System



PROJECT DEVELOPMENT OBJECTIVE

Implementation of a systematic program of accident prevention and reduction to improve hazardous locations on urban and rural roads, to improve traffic circulation in towns, to introduce safety-conscious road planning and design practices in Fiji, and to enhance the knowledge, capacity, and capability of a small team at PWD HQ to carry out and continue such work independently by the project end.

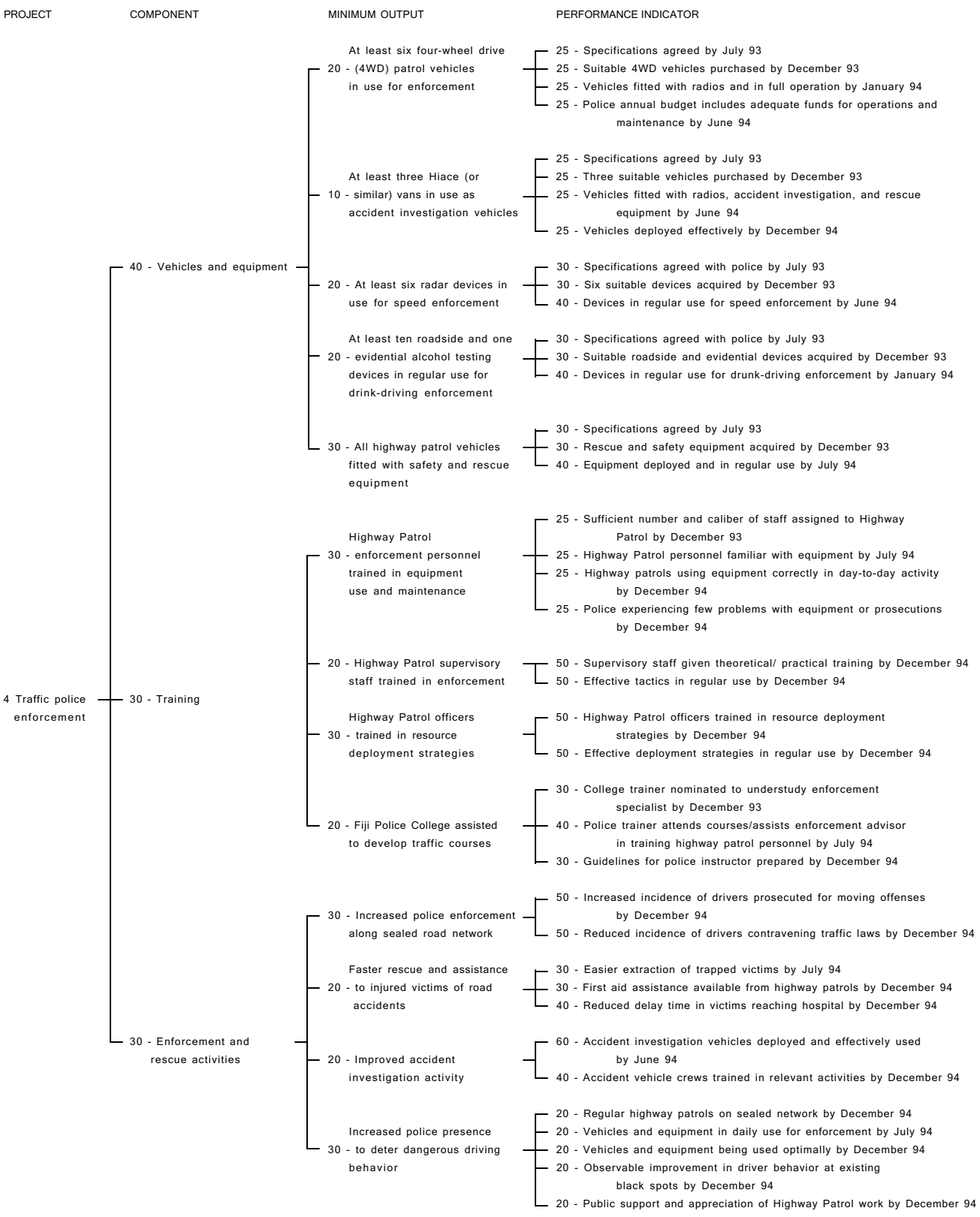
Figure 3: Project 2 – Infrastructure Improvements



PROJECT DEVELOPMENT OBJECTIVE

The development of effective coordinating mechanisms at national and local level to encourage a multidisciplinary approach to road safety which will lead to the development and successful implementation of a Comprehensive National Road Safety Plan and Strategy.

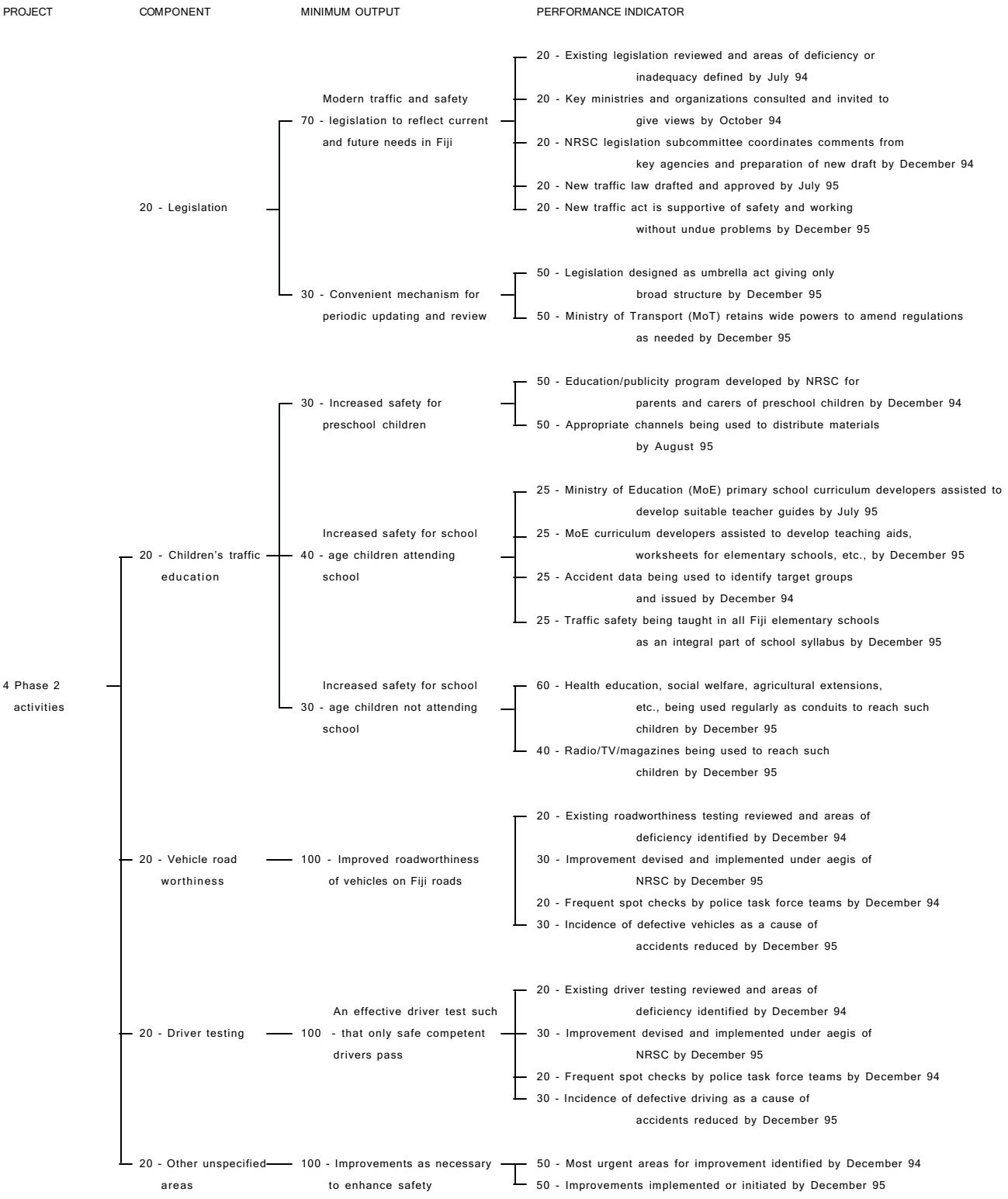
Figure 4: Project 3 – National Road Safety Council



PROJECT DEVELOPMENT OBJECTIVE

Training of Highway Patrol personnel and the establishment of effective Highway Patrol activities along the major roads in order to provide quicker assistance to road accident victims and to deter dangerous driving.

Figure 5: Project 4 – Traffic Police Enforcement



PROJECT DEVELOPMENT OBJECTIVE

Implementation of the most urgent improvements in legislation, children's traffic education, and vehicle roadworthiness inspection, driver testing and other areas as required in order to improve the road safety environment in Fiji.

Figure 6: Project 5 – Activities (Projects 5-8)

Road Safety Guidelines

for the Asian and Pacific Region

Appendix D

COMPARATIVE STATISTICS

Asian Development Bank

COMPARATIVE STATISTICS
Appendix D

This Appendix contains basic statistics on Asian and Pacific countries to enable intercountry comparisons. The data are based on the database of road safety information that is to be established at the United Nations Economic and Social Commission for Asia and the Pacific (UN/ESCAP) in Bangkok, Thailand.

KILOMETERS OF ROAD

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	
EAST/CENTRAL ASIA																EAST/CENTRAL ASIA
PRC(' 000,000s)	*888.25*	*897.462*	*906.963*	*915.079*	*926.746*	*942.395*	*962.769*	*982.243*	*999.553*	*1,014.34*	*1,028.35*	*1,041.14*	*1,056.71*	-	-	*PRC(' 000,000s)*
Hong Kong, China	1,162	1,182	1,217	1,244	1,279	1,323	1,350	1,395	1,434	1,465	1,484	1,529	1,559	-	-	Hong Kong, China
DPR Korea	-	-	-	-	-	-	-	-	-	-	20,000	-	-	-	-	DPR Korea
Republic of Korea	46,951	50,336	53,936	54,600	51,004	52,264	53,654	54,689	55,778	56,481	56,715	58,088	58,847	61,294	73,834	Republic of Korea
Macao	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Macao
Mongolia	-	-	-	-	-	-	-	-	-	-	-	-	49,200	-	-	Mongolia
Taipei,China	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Taipei,China
SOUTHEAST ASIA																SOUTHEAST ASIA
Brunei	1,483	1,561	1,622	1,654	1,733	1,770	1,861	1,994	2,024	2,199	-	-	-	-	-	Brunei
Cambodia	-	-	-	-	-	-	-	-	-	-	-	-	14,800	-	-	Cambodia
Indonesia	142,314	154,181	165,138	184,648	194,944	207,237	214,033	222,924	250,314	266,326	283,516	-	-	-	-	Indonesia
Lao PDR			13,971			12,983						-	13,298	-	-	Lao PDR
Malaysia	28,721	31,406	35,864	37,409	38,503	39,702	39,915	39,339	52,606	52,695	53,986	61,649		-	-	Malaysia
Myanmar		22,740	22,883	22,981	23,068	23,202	23,298	23,387	23,463	23,490	23,981	27,305	30,629	-	-	Myanmar
Philippines	151,919	153,528	154,473	155,671	157,139	161,709	162,325	157,810	157,253	159,059	160,380	160,633	-	-	-	Philippines
Singapore	2,356	2,483	2,533	2,568	2,597	2,645	2,686	2,760	2,810	2,836	2,882	2,924	2,967	2,989	-	Singapore
Thailand	28,151	30,016	31,001	33,148	34,702	36,235	37,724	39,369	41,794	44,409	45,445	45,650	46,712	-	-	Thailand
Viet Nam	81,136	-	-	-	-	85,136	85,681	86,327	86,643	87,267	87,507	105,061	105,500	-	-	Viet Nam
SOUTH ASIA																SOUTH ASIA
Afghanistan	-	18,852	18,974	19,010	-	-	-	-	-	18,000	-	-	-	-	-	Afghanistan
Bangladesh	5,691	6,591	7,432	7,997	9,387	10,374	11,185	11,815	12,321	12,960	13,700	-	14,500	-	-	Bangladesh
Bhutan	-	-	-	-	-	-	-	2,254	-	-	-	-	-	-	-	Bhutan
India (' 000s)	*1,190*	*1,231.1*	*1,530.3*	*1,579.1*	*1,627.5*	*1,686.9*	*1,726.1*	*1,780.6*	*1,843.4*	*1,905*	*1,970*	*2,037*	-	-	-	*India (' 000s)*
Iran	95,800	76,500	64,200	90,000	-	135,882	-	-	-	-	-	-	-	-	-	Iran
Maldives	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Maldives
Nepal	4,940	5,021	5,270	5,546	5,717	5,925	6,039	6,306	6,611	6,611	7,036	7,401	7,400	-	-	Nepal
Pakistan	40,143	42,535	44,669	46,848	49,457	53,020	59,630	107.611	111.152	114.669	118.122	121.485	124.773	128.057	131.433	Pakistan
Sri Lanka	24,643	24,564	24,752	25,466	25,466	25,466	25,494	25,634	25,688	25,749	25,952	-	-	-	-	Sri Lanka
CENTRAL ASIAN REPS																CENTRAL ASIAN REPS
Armenia	-	-	-	-	-	-	-	-	-	-	-	-	-	8,096		Armenia
Azerbaijan	-	-	-	-	-	-	-	-	-	-						Azerbaijan
Kazakstan	-	-	-	-	-	-	-	-	-	-	-	-	87,841	-	87,523	Kazakstan
Kyrgyz Republic	-	-	-	-	-	-	-	-	-	-	19,100	-	-	-	-	Kyrgyz Republic
Russian Federation	-	-	-	-	-	-	-	-	-	-	-	-	-	934,000	-	Russian Federation
Tajikistan	-	-	-	-	-	-	-	-	-	13,400	-	-	-	-	-	Tajikistan
Turkmenistan	-	-	-	-	-	-	-	-	-	-	-	13,400	-	-	-	Turkmenistan
Uzbekistan	-	-	-	-	-	-	-	-	-	39,800	-	-	-	-	-	Uzbekistan
PACIFIC COUNTRIES																PACIFIC COUNTRIES
American Samoa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	American Samoa
Cmn. Nth. Mariana Is.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59	Cmn. Nth. Mariana Is.
Cook Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	Cook Islands
Fiji	-	-	-	-	-	-	-	-	-	-	4,822	4,777	-	-	755	Fiji
French Polynesia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	217	French Polynesia
Guam	-	-	-	-	-	-	-	-	-	-	-	-	-	-	145	Guam
Kiribati	-	-	-	-	-	-	-	-	-	-	-	-	-	-	78	Kiribati
Marshall Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54	Marshall Islands
Micronesia, Fed. States. of	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Fed. States. of Micronesia
Samoa	-	-	-	-	-	-	-	-	-	-	1,800	-	-		-	Samoa
Tonga	-	-	-	-	-	-	-	-	-	305	-	-	-	-	-	Tonga
Vanuatu	-	-	-	-	-	-	1,353	-	-	-	-	1,130	-	-	-	Vanuatu
DEVELOPED NATIONS														-		DEVELOPED NATIONS
Australia	810,900	-	-	801,600	804,800	-	808,500	805,400	-	810,300	-	-	-	-	-	Australia
Japan (' 000s)	*1,114*	*1,118*	*1,123*	*1,123*	*1,125*	*1,128*	*1,127*	*1,099*	*1,104*	*1,110*	*1,115*	*1,120*	*1,125*	*1,131*	*1,136*	*Japan (' 000s)*
New Zealand	-	-	93,000	93,000	93,000	93,000	93,000	-	93,000	-	-	-	-	-	-	New Zealand

Notes: Sources: Statistical year books for each country;
UN/ESCAP *Statistical Yearbook for the Asian and the Pacific Region.*

For presentational purposes, large values have been expressed as thousands. In these cases, entries are shown in italics.

POPULATION BY YEAR ('000s)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	
EAST/CENTRAL ASIA																EAST/CENTRAL ASIA
PRC(' 000,000s)	*996.134*	*1,010.1*	*1,024.58*	*1,039.552*	*1,054.911*	*1,070.575*	*1,086.552*	*1,102.877*	*1,119.509*	*1,136.397*	*1,153.47*	*1,170.697*	*1,187.997*	*1,205.181*	*1,222.017*	*PRC(' 000,000s)*
Hong Kong, China	5,039	5,144	,5,237	5,318	5,300	5,456	5,516	5,570	5,618	5,664	5,709	5,755	5,800	5,845	5,890	Hong Kong, China
DPR Korea	18,260	18,581	18,901	19,221	19,549	19,888	20,239	20,602	20,978	21,368	21,771	22,188	22,618	23,055	23,491	DPR Korea
Republic of Korea	38,124	38,667	39,203	39,737	40,271	40,806	41,345	41,886	42,416	42,917	43,377	43,791	44,163	44,507	44,842	Republic of Korea
Macao	320	-	-	330	360	390	420	430	440	450	479	-	-	-	424	Macao
Mongolia	1,664	1,709	1,758	1,807	1,858	1,909	1,963	2,018	2,073	2,131	2,190	2,249	2,310	2,371	2,434	Mongolia
Taipei,China	17,800	18,100	18,400	18,700	19,010	19,260	19,460	19,680	19,900	20,120	20,340	20,560	20,780	21,000	21,220	Taipei,China
SOUTHEAST ASIA																SOUTHEAST ASIA
Brunei	194	200	206	213	220	226	233	239	245	251	257	263	269	276	282	Brunei
Cambodia	6,498	6,553	6,692	6,890	7,111	7,327	7,530	7,729	7,926	8,127	8,337	8,553	8,774	8,996	9,222	Cambodia
Indonesia (' 000,000s)	*150.957*	*154.143*	*157.384*	*160.672*	*163.992*	*167.332*	*170.687*	*174.059*	*177.448*	*180.856*	*184.283*	*187.723*	*191.17*	*194.616*	*198.055*	*Indonesia (' 000,000s)*
Lao PDR	3,206	3,262	3,330	3,409	3,497	3,595	3,702	3,818	3,942	4,070	4,202	4,335	4,469	4,606	4,742	Lao PDR
Malaysia	13,764	14,112	14,479	14,863	15,264	15,678	16,104	16,542	16,989	17,440	17,892	18,343	18,792	19,239	19,683	Malaysia
Myanmar	33,821	34,529	35,252	35,994	36,757	37,544	38,355	39,191	40,050	40,928	41,824	42,738	43,668	44,613	45,573	Myanmar
Philippines	48,684	49,949	51,263	52,620	54,001	55,395	56,798	58,211	59,627	61,038	62,437	63,819	65,186	66,543	67,898	Philippines
Singapore	2,414	2,443	2,471	2,500	2,528	2,558	2,588	2,618	2,649	2,679	2,710	2,740	2,768	2,798	2,825	Singapore
Thailand	46,718	47,695	48,636	49,533	50,384	51,187	51,938	52,640	53,315	53,988	54,677	55,393	56,128	56,869	57,586	Thailand
Viet Nam	53,711	54,904	56,116	57,351	58,611	59,898	61,214	62,556	63,921	65,299	66,688	68,083	69,485	70,902	72,342	Viet Nam
SOUTH ASIA																SOUTH ASIA
Afghanistan	16,063	15,815	15,441	15,027	14,690	14,519	14,528	14,706	15,085	15,698	16,556	17,688	19,062	20,547	21,968	Afghanistan
Bangladesh	88.221	90.701	93.223	95.77	9.832	100.861	103.384	105.898	108.429	111.014	113.684	116.444	119.288	122.21	125.201	Bangladesh
Bhutan	1,242	1,267	1,294	1,322	1,350	1,380	1,409	1,440	1,471	1,504	1,539	1,574	1,611	1,650	1,689	Bhutan
India (' 000,000s)	*688.856*	*703.75*	*719.151*	*734.907*	*750.793*	*766.651*	*782.423*	*798.161*	*813.954*	*829.932*	*846.191*	*862.745*	*879.549*	*896.567*	*913.747*	*India (' 000,000s)*
Iran	39,254	40,945	42,832	44,849	46,901	48,916	50,882	52,811	54,690	56,508	58,267	59,948	61,565	63,180	64,878	Iran
Maldives	158	163	168	173	178	183	189	195	201	207	214	220	227	234	241	Maldives
Nepal	14,858	15,285	15,730	16,191	16,661	17,136	17,615	18,097	18,584	19,075	19,571	20,072	20,576	21,086	21,601	Nepal
Pakistan (' 000,000s)	*85.299*	*88.007*	*90.944*	*94.073*	*97.332*	*100.676*	*104.103*	*107.611*	*111.152*	*114.669*	*118.122*	*121.485*	*121.773*	*124.057*	*131.433*	*Pakistan (' 000,000s)*
Sri Lanka	14,819	15,078	15,342	15,606	15,864	16,110	16,345	16,568	16,784	16,999	17,218	17,440	17,666	17,893	18,121	Sri Lanka
CENTRAL ASIAN REPS																CENTRAL ASIAN REPS
Armenia	3,067	-	-	3,243	3,292	3,339	3,387	3,435	3,453	3,482	3,545	3612	3,686	4,000	-	Armenia
Azerbaijan	6,165	-	-	6,453	6,560	6,661	6,760	6,866	6,980	7,085	7,153	-	7,392	-	-	Azerbaijan
Kazakstan	14,939	-	-	15,550	15,745	15,935	16,136	16,167	16,362	16,537	16,670	16806	17,038	-	-	Kazakstan
Kyrgyz Republic	3,630	-	-	3,857	3,937	4,014	4,093	4,173	4,250	4,327	4,395	4453	4,493	4,500	-	Kyrgyz Republic
Russian Fed. (' 000,000s)	*138.936*	-	-	-	-	-	-	-	-	-	-	*148.164*	-	-	-	*Russian Fed. (' 000,000s)*
Tajikistan	3,967	-	-	4,298	4,428	4,567	4,719	4,874	5,027	5,175	5303	5,465	5,562	-	-	Tajikistan
Turkmenistan	2,860	-	-	3,080	3,154	3,230	3,316	3,408	3,495	3,578	3670	3,852	-	4,307	-	Turkmenistan
Uzbekistan	15,957	-	-	17,269	17,736	18,231	18,757	19,298	19,737	20,114	20531	-	-	21,700	-	Uzbekistan
PACIFIC COUNTRIES																PACIFIC COUNTRIES
American Samoa	32	-	-	34	35	36	36	37	37	38	39	-	39	-	55	American Samoa
Cmn. Nth. Mariana Is.	-	-	17.3	17.9	19.6	27.7	30.5	33.5	36.9	40.6	44.6	49.1	54	-	59	Cmn. Nth. Mariana Is.
Cook Islands	19	-	17.4	17.4	17	17.2	17.1	17.1	17.7	17.9	18.4	18.5	18.7	-	19	Cook Islands
Fiji	662	675	689	699	708	713	634	647	717	721	726	732	740	747	755	Fiji
French Polynesia	147	-	-	165	170	174	179	183	188	193	206	207	207	-	217	French Polynesia
Guam	108	-	-	116	120	120	124	126	129	131	134	136	139	-	145	Guam
Kiribati	58	-	59.5	61	62.4	64.1	65.6	67.1	68.6	70.2	71.8	73.5	75.2	-	78	Kiribati
Marshall Islands	-	-	32.8	33.8	34.8	37.8	39.4	41.1	42.7	44.5	46.2	48	50	-	54	Marshall Islands
Micronesia, Fed. States of	-	-	82.4	85.3	88.2	94.1	96.8	99.6	102.5	105.4	108.5	111.6	114.8	-	107	Micronesia, Fed. States of
Nauru	7.9	8.1	8.4	8.1	8.2	8.5	8.7	8.9	9.1	9.2	9.4	9.6	9.8	-	10	Nauru
New Caledonia	142	-	-	145	148	151	154	160	164	167	170	173	177	-	182	New Caledonia
Niue	3.3	3.2	3.2	3	2.8	2.8	2.5	2.4	2.3	2.2	2.2	2.2	2.2	-	2	Niue
Palau	-	-	13.5	13.6	13.7	13.7	14	14.3	14.6	14.9	15.2	15.6	15.9	-	16	Republic of Palau
Papua New Guinea	3,086	-	3,110	3,185	3,621	3,337	3,407	3,482	3,557	3,630	3,699	3,772	3,847	-	4,246	Papua New Guinea
Samoa	157	-	157	158	159	159	160	161	162	163	164	165	165	-	163	Samoa
Solomon Islands	231	-	244	252	261	273	283	293	304	312	320	328	337	-	368	Solomon Islands
Tonga	96	-	94.7	95.5	96.4	97.3	94.5	95	95.6	96.1	96.6	97.1	97.4	-	99	Tonga
Tuvalu	6	-	7.8	8	8.1	8.2	8.3	8.5	8.6	8.8	9	9.1	9.3	-	10	Tuvalu
Vanuatu	118	-	120	123.8	127	129.3	132.7	136.3	139.6	143.4	146.8	150.9	154.5	-	165	Vanuatu
DEVELOPED NATIONS																DEVELOPED NATIONS
Australia	14,695	14,901	15,105	15,310	15,527	15,759	16,008	16,272	16,545	16,819	17,086	17,344	17,596	17,843	18,089	Australia
Japan (' 000,000s)	*116.807*	*117.711*	*118.573*	*119.388*	*120.145*	*120.837*	*121.462*	*122.03*	*122.553*	*123.051*	*123.537*	*124.018*	*124.491*	*124.959*	*125.422*	*Japan (' 000,000s)*
New Zealand	3,113	3,130	3,154	3,184	3,217	3,247	3,276	3,305	3,334	3,362	3,392	3,423	3,455	3,488	3,520	New Zealand

Notes: Source: UN/ESCAP population statistics.

For presentational purposes, large values have been expressed as millions rather than thousands. In these cases, entries are shown in italics.

TOTAL NUMBER OF REGISTERED MOTOR VEHICLES ('000s)[1]

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	
EAST/CENTRAL ASIA																EAST/CENTRAL ASIA
PRC	3,803.4	4,436.8	5,061.7	5,677.3	6,616.4	8,360.5	9,316.15	10,610.3	11,902	13,185.3	14,762.7	16,576.6	19,450.3	23,316.4	27,355.8	PRC
Hong Kong, China	299.395	330.309	339.567	327.803	311.87	300.561	300.995	322.29	347.402	376.153	405.407	437.769	471.221	503.509	-	Hong Kong, China
DPR Korea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DPR Korea
Republic of Korea	744.218	847.689	1,057.332	1,314.119	1,717.616	1,824.869	2,121.779	2,535.562	3,102.289	3,847.982	4,780.051	5,830.826	6,993.547	8,210.353	-	Republic of Korea
Macao	15.4	18	19.6	21.2	22.1	22.3	24.3	24.5	26.3	28.7	31.1	-	-	-	-	Macao
Mongolia	-	-	-	-	-	-	-	37.422	35.642	36.001	-	-	39.737	-	-	Mongolia
Taipei,China	4,653.406	5,346.723	6,034.634	6,662.722	7,331.925	7,939.918	8,687.538	7,692.467	8,919.399	10,138.909	11,418.22	12,565.357	13,847.097	14,846.61	-	Taipei,China
SOUTHEAST ASIA																SOUTHEAST ASIA
Brunei	54.507	62.047	67.804	77.68	86.772	95.425	100.888	105.973	110.747	118.113	126.556	134.902	144.159	-	-	Brunei
Cambodia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Cambodia
Indonesia	3,871.558	4,603.965	5,346.995	5,875.75	6,460.425	6,827.317	7,321.77	7,426.174	7,765.949	8,243.982	8,850.729	9,230.741	9,922.737	10,237.069	11,373.217	Indonesia
Lao PDR	25.293	-	-	-	-	40.866	45.104	50.009	55.825	85.015	84.099	95.836	104.039	113.899	134.334	Lao PDR
Malaysia	2,323.574	2,855.177	3,187.07	3,545.784	3,898.895	4,190.195	4,406.087	4,544.446	4,727.127	5,014.176	5,400.934	5,847.034	6,245.991	6,627	-	Malaysia
Myanmar	88	105.987	111.863	119.816	128.448	138.191	143.888	137.703	146.549	160.906	175.24	195.221	218.053	251.676	-	Myanmar
Philippines	1,111.433	1,006.03	1,087.18	1,200.803	1,165.557	1,120.172	1,185.632	1,176.753	1,210.483	1,431.464	-	1,715.366	1,879.563	2,125.115	-	Philippines
Singapore	371.341	401.805	440.276	476.288	491.322	486.76	473.659	471.124	491.808	520.537	542.352	559.304	557.584	584.322	-	Singapore
Thailand	1,710.5	2,201.53	2,601.31	3,015.72	3,352.97	3,403.85	4,044.39	4,956.11	5,799.81	6,505.02	7,541.81	8,427.09	9,557.89	11,062.45	-	Thailand
Viet Nam	154.362	-	-	-	-	-	-	-	159.08	1,166.515	1,455.658	1,779.082	2,308.067	3,019.497	3,395.923	Viet Nam
SOUTH ASIA																SOUTH ASIA
Afghanistan	-	79.7	73	70.9	59	57.5	55.9	55.8	56	56	56	55	75	-	-	Afghanistan
Bangladesh	86.356	95.152	98.936	131.498	136.161	145.804	156.468	167.493	270.86	251.765	274.499	296.317	314.009	349.631	201.541	Bangladesh
Bhutan	-	-	-	-	-	-	-	-	-	-	12.346	13.244	14.268	-	-	Bhutan
India	4,990.06	5,782.99	6,466.07	7,480.7	8,460.93	9,539.17	10,563.8	12,517.7	14,717	16,557.1	18,704.9	21,374	23,507	25,299	-	India
Iran	211.386	158.393	128.973	193.65	221.607	204.9	91	96.91	50.478	45.364	48.884	4,138.197	4,318.3	4,488.008	4,640.694	Islamic Republic of Iran
Maldives	1.062	1.186	1.425	1.048	1.299	1.615	0.779	0.886	1.056	1.275	1.436	-	-	-	-	Maldives
Nepal [2]	-	1.606	1.034	1.105	2.524	2.693	2.121	1.879	2.375	3.245	3.501	-	-	130	150	Nepal[2]
Pakistan	1,109.814	1,019.551	1,352.962	1,502.305	1,673.433	1,924.347	2,037.435	2,187.245	2,363.064	2,585.906	2,766.44	2,602.241	2,773.295	3,257.942	-	Pakistan
Sri Lanka	278.055	307.75	339.924	371.966	406.017	452.39	484.964	497.523	534.449	612.402	710.4	781.296	864.518	-	-	Sri Lanka
CENTRAL ASIAN REPS																CENTRAL ASIAN REPS
Armenia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Armenia
Azerbaijan	-	-	-	-	-	-	-	431.068	442.094	463.165	466.389	468.375	-	-	-	Azerbaijan
Kazakstan	-	-	-	-	-	-	-	-	-	-	-	-	1266.8	-	-	Kazakstan
Kyrgyz Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Kyrgyz Republic
Russian Federation	-	-	-	-	-	20,900	21,400	22,400	23,200	23,600	.23,300	24,200	24,500	27,200	-	Russian Federation
Tajikistan	-	-	-	-	-	-	-	-	-	17.6	18	18.2	13.8	-	-	Tajikistan
Turkmenistan	170.963	185.283	193.106	207.169	214.897	235.794	253.16	264.197	269.117	279.104	286.225	280.002	293.392	296.417	-	Turkmenistan
Uzbekistan	-	-	-	-	-	-	-	-	-	-	1,641.81	1,900.592	1,915.15	1,868.953	-	Uzbekistan
PACIFIC COUNTRIES																PACIFIC COUNTRIES
American Samoa	2.7	3.5	3.1	3.3	3.8	4.5	-	-	-	-	-	-	5.3	-	-	American Samoa
Cmn. Nth. Mariana Is.	-	-	-	-	-	-	-	-	-	-	-	-	17.8	-	-	Cmn. Nth. Mariana Is.
Cook Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Cook Islands
Fiji	38.9	43.1	46	53.7	56.8	59.7	65.6	67.1	68.2	75.3	80.1	83.9	87.8	90.1	-	Fiji
French Polynesia	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-	French Polynesia
Guam	54.2	55.9	82.7	58.7	72.9	77	70	75.4	72.9	84.8	-	-	102	-	-	Guam
Kiribati	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	Kiribati
Marshall Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Marshall Islands
Micronesia, Fed. States of	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Micronesia, Fed. States of
Nauru	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Nauru
New Caledonia	-	54.3	56.8	58.2	60.4	60.1	63.1	65	68	72	73	-	75	-	-	New Caledonia
Niue	0.261	0.291	0.427	-	-	-	-	-	-	-	-	-	-	-	-	Niue
Republic of Palau	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Republic of Palau
Papua New Guinea	45.6	47.1	44.7	43.4	46.4	42.6	43.6	43.2	-	-	-	-	41.3	-	-	Papua New Guinea
Samoa	4	5.3	3.93	4.02	4.5	4.805	4.208	4.689	4.69	5.85	-	6.8	7.3	9.9	-	Samoa
Solomon Islands	0.975	1.148	2.785	-	-	3.425	3.676	-	-	-	-	-	-	-	-	Solomon Islands
Tonga	2.429	2.047	2.628	4.376	2.274	3.394	3.976	4.761	6.223	4.681	5.854	7.364	-	10.359	-	Tonga
Tuvalu	-	-	-	-	-	0.041	0.049	0.055	0.07	0.084	-	-	-	-	-	Tuvalu
Vanuatu	3.2	3.713	3.984	4.018	4.024	4.487	5.691	5.518	5.706	5.81	5.796	-	7.5	-	-	Vanuatu
DEVELOPED NATIONS																DEVELOPED NATIONS
Australia	7,731.6	8,086.3	8,521.8	8,763	9,002.4	9,286.2	9,459.5	9,543	9,715.3	9,977	10,256	10,060	10,423	10,613	-	Australia
Japan	49,244	52,103	55,297	58,548	61,253	63,684	65,942	67,812	70,100	72,399	74,500	76,168	77,395	78,476	79,722	Japan
New Zealand	1,692.40	1,748.83	1,790.16	1,830.10	1,886.75	1,919.95	2,022.09	1,905.78	1,786.04	1,832.04	1,886.73	1,927.67	1,965.74	-	-	New Zealand

Sources: UN/ESCAP Questionnaire, 1980-1993.
Country statistical yearbooks, various years.
UN/ESCAP *Statistical Yearbook for Asia and the Pacific.*

Notes: (1) The sum of motorcycles, cars, trucks, and buses, and other motorized vehicles from the previous tables, or data from other sources giving total motor vehicles.
(2) Nepal: gures available up to 1990 are abnormally low. 1993 and 1994 values from an alternative source.

TOTAL ROAD FATALITIES

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	Death (1)	
EAST/CENTRAL ASIA																	EAST/CENTRAL ASIA
PRC	21,818	22,499	22,164	23,944	25,251	40,906	50,063	53,439	54,814	50,441	49,243	53,204	58,723	63,508	66,362	7	PRC
Hong Kong, China	402	474	453	340	322	309	310	280	301	346	321	315	328	351	-	30	Hong Kong, China
DPR Korea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DPR Korea
Republic of Korea	5,608	5,804	6,110	6,834	7,468	7,552	7,702	7,206	11,563	12,603	12,325	13,429	11,640	10,402	10,087	3	Republic of Korea
Macao	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Macao
Mongolia	-	-	-	-	-	-	182	221	209	245	351	374	-	-	-	-	Mongolia
Taipei,China	4,039	3,840	3,596	3,392	3,540	3,564	4,139	4,373	4,190	3,930	3,910	3,305	2,717	2,349	-	1	Taipei,China
SOUTHEAST ASIA																	SOUTHEAST ASIA
Brunei	40	51	63	47	45	40	42	43	39	35	47	56	47	-	-	-	Brunei
Cambodia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Cambodia
Indonesia	11,456	11,105	10,805	10,862	10,881	10,283	10,692	10,809	10,456	10,726	10,887	10,610	9,819	10,038	11,004	1	Indonesia
Lao PDR	-	-	-	-	-	80	92	79	65	-	99	105	152	166	200	-	Lao PDR
Malaysia	2,568	2,769	3,266	3,523	2,951	2,379	2,358	2,240	2,354	3,090	3,345	3,514	3,263	3,651	-	30	Malaysia
Myanmar	-	-	-	-	-	-	441	466	276	420	553	695	620	924	-	1	Myanmar
Philippines	-	-	1,492	1,348	1,119	1,085	1,093	835	934	-	1,425	-	-	871	1,027	1	Philippines
Singapore	259	275	307	298	327	265	251	205	226	232	236	243	240	258	254	30	Singapore
Thailand	4,493	2,760	3,090	2,472	2,904	2,788	2,086	3,991	8,651	6,563	5,765	8,595	8,184	9,496		1	Thailand
Viet Nam	2,221	2,982	1,938	2,050	2,017	2,048	2,278	2,516	2,477	2,112	2,087	2,395	2,069	3,940	4,533	7	Viet Nam
SOUTH ASIA																	SOUTH ASIA
Afghanistan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Afghanistan
Bangladesh	791	928	1,009	1,116	1,242	1,463	1,169	1,156	1,367	1,867	1,844	1,982	2,317	1,487	1,597	7	Bangladesh
Bhutan	-	-	-	-	-	-	13	16	4	17	7	3	6	5	-	30	Bhutan
India	24,600	27,333	30,067	32,800	35,100	39,200	40,000	44,400	46,600	50,700	54,100	56,500	59,400	-	-	30	India
Iran	-	-	-	2,831	-	-	-	-	-	-	-	-	2,343	2,957	2,840	-	Iran
Maldives	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Maldives
Nepal		245	260	327	354	409	445	439	387	368	528	530	641	632	941	30	Nepal
Pakistan	3,795	4,127	4,143	3,564	4,139	4,714	5,009	5,125	5,251	5,174	4,790	4,916	5,182		-	30	Pakistan
Sri Lanka	1,106	1,247	1,257	1,365	1,310	1,311	1,286	1,226	1,386	1,596	1,795	1,271	1,343	1,599	-	30	Sri Lanka
CENTRAL ASIAN REPS																	CENTRAL ASIAN REPS
Armenia	394	379	370	461	430	429	412	404	399	725	721	633	519	318	-	-	Armenia
Azerbaijan	891	954	853	832	825	819	998	974	1,088	1,090	1,264	1,281	1,265	1,152	-	7	Azerbaijan
Kazakstan	3,404	3,279	3,201	3,324	3,208	2,944	2,633	2,700	3,139	3,839	3,985	4,115	4,021	3,954	-	3	Kazakstan
Kyrgyz Republic	-	-	-	-	87	102	58	66	65	76	65	79	39	-	-	7	Kyrgyz Republic
Russian Federation	-	-	-	-	-	-	-	-	-	-	35,366	37,522	36,471	37,120	-	7	Russian Federation
Tajikistan	-	-	-	-	617	584	551	585	733	709	809	821	520	604	499	7	Tajikistan
Turkmenistan	525	522	517	581	571	504	488	488	596	693	688	766	664	648	484	7	Turkmenistan
Uzbekistan	2,477	2,436	2,449	2,594	2,590	2,440	2,418	2,462	2,654	2,930	3,166	3,184	2,688	2,153	2,032	7	Uzbekistan
PACIFIC COUNTRIES																	PACIFIC COUNTRIES
American Samoa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	American Samoa
Cmn. Nth. Mariana Is.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Cmn. Nth. Mariana Is.
Cook Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Cook Islands
Fiji	88	59	55	80	82	87	69	91	77	84	87	108	72	91	88	1 year	Fiji
French Polynesia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	French Polynesia
Guam	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Guam
Kiribati	-	-	10	8	22	18	8	14		-	-	-	-	-	-	-	Kiribati
Marshall Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Marshall Islands
Micronesia, Fed. States of	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Micronesia, Fed. States of
Nauru	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Nauru
New Caledonia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	New Caledonia
Niue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Niue
Republic of Palau	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Republic of Palau
Papua New Guinea	-	295	253	264	274	277	274	316	347	329	299	305	290	-	-	1	Papua New Guinea
Samoa	11	19	18	22	10	13	9	13	14	18	18	15	9	10	-	3	Samoa
Solomon Islands	4	-	2	4	6	5	5	-	-	-	-	-	-	-	-	-	Solomon Islands
Tonga	7	6	5	13	7	8	8	10	6	11	11	15	16	6	-	-	Tonga
Tuvalu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Tuvalu
Vanuatu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Vanuatu
DEVELOPED NATIONS																	DEVELOPED NATIONS
Australia	3,272	3,321	3,252	2,755	2,822	2,941	2,888	2,772	2,887	2,801	2,331	2,113	1,974	1,953	-	30	Australia
Japan	8,760	8,719	9,073	9,520	9,262	9,261	9,317	9,347	10,344	11,086	11,227	11,105	11,451	10,942	10,649	1	Japan
New Zealand	599	669	673	644	669	747	766	796	727	761	730	651	647	600	-	30	New Zealand

Sources: UN/ESCAP Questionnaire, 1980-1993.
Country statistical yearbooks, various years.
UN/ESCAP *Statistical Yearbook for the Asian and Pacific Region*.

Note: (1) The international definition of death due to a road accident is death within 30 days of the accident. However, not all countries use this definition. This column in the table gives the definition where known . The number of deaths shown are the actual published figures. They can be adjusted to represent standardized 30-day deaths using the following European Union factors, for purposes of comparative analysis:

1 day	+	3 percent
3 days	+	15 percent
6 days	+	9 percent
7 days	+	8 percent
1 year	+	3 percent

Country Data for Most Recent Year

Subregion	Year	GNP (US$ billion)	Population ('000s)	Road Accident Casualties			Motor Vehicles ('000s)			Fatalities per 10,000 motor vehs	Severity Index	Fatalities per 100,000 population	Motor Vehs per 1,000 population
				Fatalities	Injuries	Total	Total	2/3 wh	percent 2/3 wh				
NIEs			74,397	155,661	323,880	339,541	25,755	13,966	54	6.1	5	21.1	346
Hong Kong, China	1993	104.7	5,845	351	20,558	20,909	504	27	5	7.0	2	6.0	86
Republic of Korea	1993	338.1	44,507	11,962	293,634	305,596	8,210	1,936	24	14.6	4	26.9	184
Singapore	1994	65.8	2,825	254	6,751	7,005	586	125	21	4.3	4	9.0	207
Taipei,China	1994	-	21,220	3,094	2,937	6,031	16,455	11,878	72	1.9	51	14.6	775
CENTRAL ASIA			1,245,662	76,582	154,734	231,316	28,659	10,952	38	26.7	33	6.1	23
People's Republic of China	1994	630.2	1,222,000	71,671	137,794	20,9465	27,356	10,938	40	26.2	34	5.9	22
Mongolia	1989	0.9	2,131	245	501	746	36	-	-	68.1	33	11.5	17
CENTRAL ASIAN													
REPUBLICS Kazakstan	1992	28.6	17,038	4,624	16,200	20,824	1,267	14	1	36.5	22	27.1	74
Kyrgyz Republic	1992	3.7	4,493	42	239	281	-	-	-	-	15	0.9	-
SOUTHEAST ASIA			419,373	44,123	117,303	161,426	36,039	23,515	65	12.2	27	10.5	86
Cambodia	1994	-	9,222	128	208	336	359	311	87	3.6	38	1.4	39
Indonesia	1994	167.6	198,055	14,305	18,002	32,307	11,373	7,788	68	12.6	44	7.2	57
Lao PDR	1994	1.5	4,742	200	3,479	3,679	134	109	81	14.9	5	4.2	28
Malaysia	1993	60.1	19,239	3,651	29,201	32,852	6,627	3,695	56	5.5	11	19.0	344
Myanmar	1993	-	44,613	1,201	-	-	252	69	27	47.7	-	2.7	6
Philippines	1988	37.7	59,627	1,214	10,783	11,997	1,210	281	23	10.0	10	2.0	20
Thailand	1994	129.9	57,586	19,729	43,541	63,270	12,940	8,248	64	15.2	31	34.3	225
Viet Nam	1994	13.8	70,902	4896	12,089	16,985	3,396	3,083	91	14.4	29	6.9	48
SOUTH ASIA			1,240,734	71,171	299,537	369,507	28,687	18,251	64	24.8	19	5.7	23
Afghanistan	1994	-	21,968	-	-	-	170	95	56	-	-	-	8
Bangladesh	1994	26.6	125,201	1,725	2,533	4,258	351	202	58	49.1	41	1.4	3
Bhutan	1992	0.3	1,611	6	14	20	14	5	36	4.3	30	0.4	9
India	1992	271.6	879,549	59,400	262,200	321,600	23,507	15,661	67	25.3	18	6.8	27
Maldives	1994	0.2	241	-	-	-	-	-	-	-	-	-	-
Nepal	1994	4.2	21,601	941	1,434	2,375	155	81	52	60.7	40	4.4	7
Pakistan	1993	53.3	128,057	6,299	14,753	21,052	3,258	1568	48	19.3	30	4.9	25
Sri Lanka	1993	10.7	17,893	1,599	18,603	20,202	980	570	58	16.3	8	8.9	55
PACIFIC COUNTRIES			5,551	502	3,500	4002	163	5	3	30.8	13	9.0	29
Cook Islands	1994	-	19	-	-	-	-	-	-	-	-	-	-
Fiji	1993	1.6	747	88	1,165	1,253	90	4	4	9.8	7	11.8	120
Kiribati	1987	0.5	67	14	132	146	-	-	-	-	10	20.9	-
Marshall Islands	1994	-	54	-	-	-	-	-	-	-	-	-	
Micronesia, Fed. States of	1994	-	107	-	-	-	-	-	-	-	-	-	-
Papua New Guinea	1992	3.8	3,847	377	1,948	2,325	41	-	-	92.0	16	9.8	11
Samoa	1993	0.2	164	12	106	118	10	-	-	12.0	10	7.3	61
Solomon Islands	1986	0.3	283	5	84	89	4	-	-	12.5	6	1.8	14
Tonga	1993	0.2	98	6	65	71	10	1	10	6.0	8	6.1	102
Tuvalu	1994	-	10	-	-	-	-	-	-	-	-	-	-
Vanuatu	1992	0.2	155	-	-	-	8	-	-	-	-	-	52
DEVELOPED			146,322	16,377	716,497	732,874	92,344	16,369	18	1.8	2	11.2	631
NATIONS Australia	1993	310.0	17,843	1,953	21,473	23,426	10,613	292	3	1.8	8	10.9	595
Japan	1994	4,321.1	124,959	13,844	678,424	692,268	79,722	16,021	20	1.7	2	11.1	638
New Zealand	1994	46.6	3,520	580	16,600	17,180	2,009	56	3	2.9	3	16.5	571