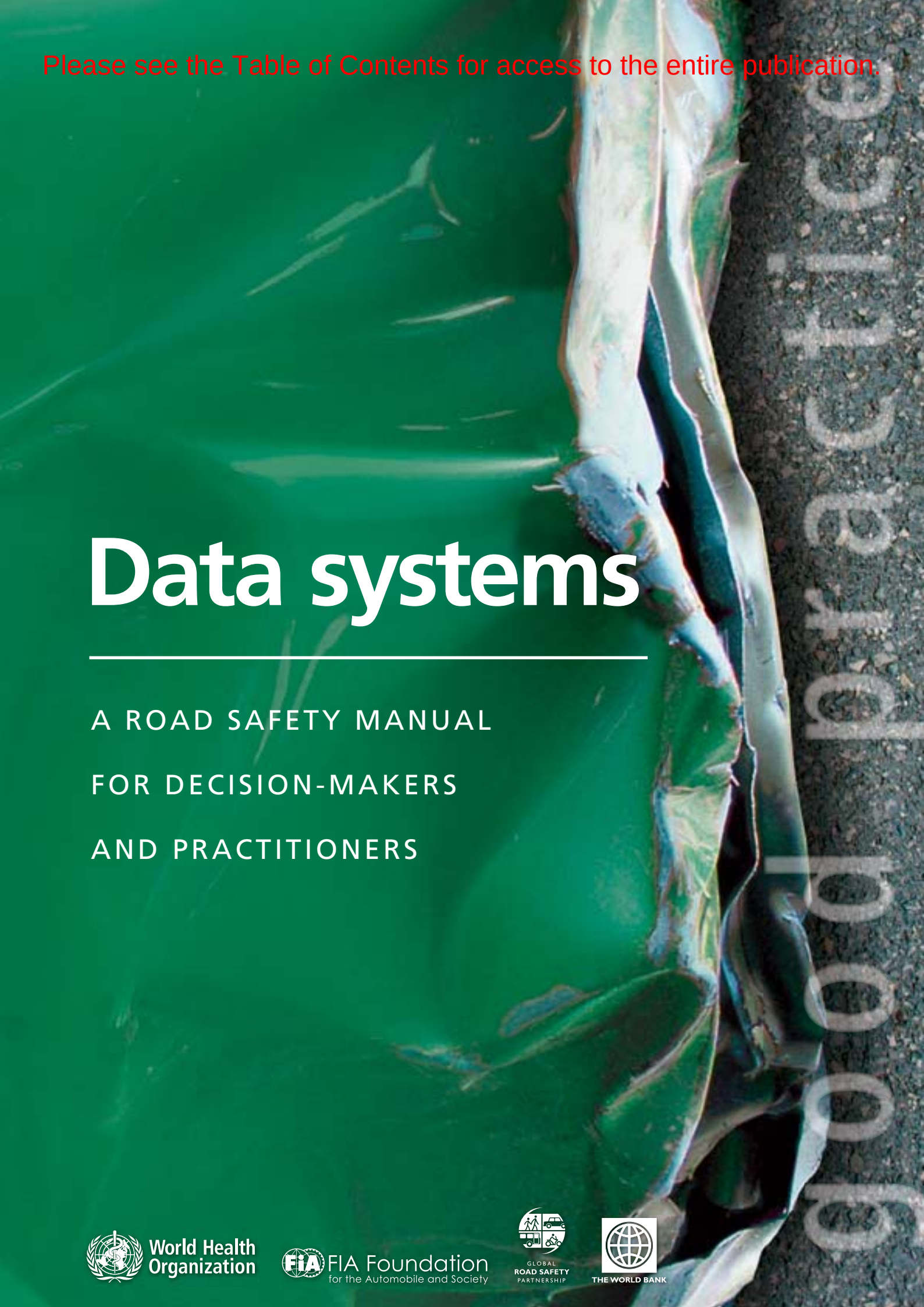

Data systems

A ROAD SAFETY MANUAL FOR DECISION-MAKERS AND PRACTITIONERS

World Health Organization
FIA Foundation for the Automobile and Society
Global Road Safety Partnership
The World Bank

Data systems

A road safety manual for decision-makers and practitioners

World Health Organization
FIA Foundation for the Automobile and Society
GLOBAL ROAD SAFETY PARTNERSHIP
THE WORLD BANK

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Preface

Road traffic injuries are a major public health problem and a leading cause of death and injury around the world. Each year nearly 1.3 million people die and millions more are injured or disabled as a result of road crashes, mostly in low- and middle-income countries. As well as creating enormous social costs for individuals, families and communities, road traffic injuries place a heavy burden on health services and economies. The cost to countries, many of which already struggle with economic development, may be as much as 1–2% of their gross national product. As motorization increases, preventing road traffic crashes and the injuries they inflict will become an increasing social and economic challenge, particularly in developing countries. If present trends continue, road traffic injuries will increase dramatically in most parts of the world over the next two decades, with the greatest impact falling on the most vulnerable citizens.

Appropriate and targeted action is urgently needed. The *World report on road traffic injury prevention*, launched jointly in 2004 by the World Health Organization and the World Bank, identified improvements in road safety management and specific actions that have led to dramatic decreases in road traffic deaths and injuries in industrialized countries active in road safety. The use of seat-belts, helmets and child restraints, the report showed, has saved thousands of lives. The introduction of speed limits, the creation of safer infrastructure, the enforcement of limits on blood alcohol concentration while driving, and improvements in vehicle safety are all interventions that have been tested and repeatedly shown to be effective. The *World report on road traffic injury prevention* also identified the importance of collecting accurate, reliable data on the magnitude of the road traffic injury problem: it highlighted the need for data systems to be put in place to collect the information needed to allow countries to develop evidence-driven road safety policies.

The international community must now take the lead to encourage good practice in road safety. To this effect, the United Nations General Assembly adopted a resolution on 14 April 2004 urging that greater attention and resources be directed towards the global road safety crisis. Resolution 58/289 on 'Improving global road safety' stressed the importance of international collaboration in the field of road safety. Two further resolutions (A/58/L.60 and A/62/244), adopted in 2005 and 2008 respectively, reaffirmed the United Nations' commitment to this issue, encouraging Member States to implement the recommendations of the *World report on road traffic injury prevention*.

In November 2009, ministers and heads of delegations to the First Global Ministerial Conference on Road Safety echoed these calls with the adoption of the Moscow Declaration, resolving to take a number of actions to improve road safety, including improvements to national data collection systems and international comparability of data.

To contribute to the implementation of these resolutions and the Moscow Declaration, the World Health Organization, the Global Road Safety Partnership, the FIA Foundation for the Automobile and Society, and the World Bank have collaborated to produce a series of manuals aimed at policy-makers and practitioners. This manual on developing road crash data systems is one of them. Each manual provides step-by-step guidance to countries wishing to improve a particular aspect of road safety, according to recommendations outlined in the *World report on road traffic injury prevention*. These steps can save many lives and reduce the shocking burden of road traffic crashes around the world. We encourage all to use these manuals.

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Executive summary

Road transport is vital to development. Unfortunately, inadequate attention to safety has meant that road transport systems have developed in ways that have led to significant loss of lives, health and wealth. Reliable and accurate data are needed to raise awareness about the magnitude of road traffic injuries, and to convince policy-makers of the need for action.

Reliable and accurate data are also needed to correctly identify problems, risk factors and priority areas, and to formulate strategy, set targets and monitor performance. Ongoing, data-led diagnosis and management of the leading road traffic injury problems enables appropriate action and resource allocation. Without this, there will be no significant, sustainable reductions in exposure to crash risk or in the severity of crashes.

Data relevant to road safety are collected every day in most countries, but for these data to be useful for informing road safety practice, they must be properly coded, processed and analysed in a computerized database system. The purpose of this manual is to give practical guidance on establishing data systems that produce timely, reliable data on road traffic injuries that can be used to inform road safety management.

The manual begins with a discussion of why good data are important for road safety management, and what kinds of data are required for effective planning and monitoring. It guides users through the process of conducting a situational assessment to identify relevant stakeholders, existing data sources and systems (along with their strengths and limitations), the needs of end-users, and relevant political factors and resource availability. It then describes the steps needed to establish a working group and use the situational assessment to choose the best course of action.

The manual also describes a range of strategies for improving data quality and strengthening the performance of systems already in place, and describes the steps needed to plan, design and implement a new system – noting that there is no single approach that will be right for every country or jurisdiction. A common dataset with minimum data elements and definitions is proposed. Finally, the manual guides the user on how to disseminate road safety data and maximize the likelihood of its use, and on how to use the data to improve road safety, monitor results and assess the impact of interventions.

In preparing the material for this manual, the writers have drawn on case studies from around the world. Whenever possible, examples from low- and middle-income countries have been used to illustrate various issues. While the focus of the manual is on national-level data systems, the strategies presented can be applied at the local level. It is hoped that the modular structure of this manual means it can be easily adapted to suit the needs and problems of individual countries.

Introduction

Background to the series of manuals

The World Health Organization (WHO) dedicated World Health Day 2004 to the issue of road safety. Events marking the day were held in more than 130 countries to raise awareness about road traffic injuries, stimulate new road safety programmes and improve existing initiatives. On the same day, the WHO and the World Bank jointly launched the *World report on road traffic injury prevention*, highlighting the growing pandemic of road traffic injuries. The report discusses in detail the fundamental concepts of road traffic injury prevention, the impact of road traffic injuries, the main causes and risk factors for road traffic crashes, and proven and effective intervention strategies. It concludes with six important recommendations that countries can follow to improve their road safety record.

Recommendations of the World report on road traffic injury prevention

1. Identify a lead agency in government to guide the national road traffic safety effort.
2. Assess the problem, policies, institutional settings and capacity relating to road injury.
3. Prepare a national road safety strategy and plan of action.
4. Allocate financial and human resources to address the problem.
5. Implement specific actions to prevent road traffic crashes, minimize injuries and their consequences, and evaluate the impact of these actions.
6. Support the development of national capacity and international cooperation.

The report stresses that any actions taken by countries to prevent road traffic injuries need to be based on sound scientific evidence, and should be culturally appropriate and tested locally. However, in its fifth recommendation, the report makes it clear that there are several 'good practices' – interventions already tried and tested – that can be implemented at low cost in most countries. These include strategies that address some of the major risk factors for road traffic injuries, such as:

- setting and enforcing laws requiring installation and use of seat-belts and child restraints for all occupants of motor vehicles;
- requiring riders of motorcycles to wear helmets;
- establishing and enforcing low blood alcohol concentration limits;
- setting and enforcing speed limits;
- managing existing road infrastructure to increase safety.

A week after World Health Day, on 14 April 2004, the United Nations General Assembly passed a resolution calling for greater attention and resources to be directed towards road safety efforts. The resolution recognized that the United Nations system should support efforts to tackle the global road safety crisis. At

the same time, it commended WHO and the World Bank for their initiative in launching the *World report on road traffic injury prevention*. It also invited WHO, working in close cooperation with the United Nations Regional Commissions, to act as coordinator on road safety issues within the United Nations system.

Following the mandate conferred on it by the United Nations General Assembly, WHO has helped develop a network of United Nations and other international road safety organizations – now referred to as the 'United Nations Road Safety Collaboration'. The members of this group have agreed common goals for their collective efforts, and are initially focusing attention on the six recommendations of the *World report on road traffic injury prevention*.

A direct outcome of this collaboration has been the establishment of an informal consortium consisting of WHO, the World Bank, the FIA Foundation for the Automobile and Society and the Global Road Safety Partnership (GRSP). This consortium is working to produce a series of 'good practice' manuals covering the key issues identified in the *World report on road traffic injury prevention*. The project arose out of the numerous requests made to the WHO and the World Bank by road safety practitioners around the world, especially those working in low and middle-income countries, asking for guidance in implementing the report's recommendations.

The manuals are aimed at governments, non-governmental organizations and road safety practitioners in the broadest sense. Written in an accessible manner and to a common format, they provide practical steps to implement each recommendation in a way identified as good practice, while also making clear the roles and responsibilities of all those involved. Although primarily intended for low and middle-income countries, the manuals are applicable to a range of countries and adaptable to different levels of road safety performance. Each manual includes case studies from developed and developing countries.

The *World report on road traffic injury prevention* advocates a comprehensive systems approach to road safety – one that addresses the road, the vehicle and the user. Its starting point is that to effectively tackle road traffic injuries, responsibility needs to be shared between governments, industry, non-governmental organizations and international agencies. Furthermore, to be effective, road safety must have commitment and input from all the relevant sectors, including those of transport, health, policy-making and law enforcement. These manuals also reflect the views of the report; they too advocate a systems approach and – following the principle that road safety should be pursued across many disciplines – they are targeted at practitioners from a range of sectors.

Background to the data systems manual

Why was the manual developed?

The *World report on road traffic injury prevention* calls on governments to assess the problems, policies and institutional settings relating to road safety. It works on the premise that effective road safety management is based on a systematic approach that includes the collection, analysis, interpretation and application of good data. In reality, however, road traffic data collection systems are not well developed in low and middle-income countries, where the majority of road traffic injuries occur. The findings of WHO's *Global status report on road safety* (2009) confirmed the need for a manual dedicated to the collection and use of data for the prevention and control of road traffic injuries.

It is essential that each country puts in place a scientific and consistent system to collect, store, analyze, disseminate and apply road crash data. This manual is designed to support countries in doing this.

Who is the manual for?

This manual provides practical advice for professionals working in road safety. It aims to help them develop or improve national or local mechanisms to systematically collect, process, analyse and use road crash data, with the ultimate aim of reducing road traffic injuries through data-led road safety management. It is primarily intended to guide the decision-making of mid-level managers responsible for road safety data management in low and middle-income countries, and may also be useful for policy-makers, politicians, non-governmental organizations and researchers advocating for data systems.

Every effort has been made to ensure that the recommended steps and processes can be implemented in settings where resources are limited. Though the manual describes steps to implement a 'gold-standard' crash database with linked data sources, it is recognized that this is not always possible, and so the manual advises on what can be done with existing data to start to build a more robust system.

What does the manual cover?

In most countries the agencies that interact with road crash victims – primarily police departments and hospitals – collect information about road traffic crashes. Many jurisdictions however lack mechanisms that allow them to make use of that data to formulate effective road safety action. Achieving reductions in road traffic injuries requires that road safety data are not just collected, but also systematically processed, analyzed and disseminated to relevant stakeholders to take corrective

action. This manual provides practical guidance for developing data systems that can expose a jurisdiction's road traffic injury problem, help choose evidence-based interventions, and monitor progress in road traffic injury prevention and road safety promotion.

Module 1 explains **why road safety data systems are needed**. It presents a conceptual framework for data-led road safety management and describes what data are needed by various sectors involved in road safety.

Module 2 guides the user through the process of **assessing a country's situation in relation to road safety data**. It covers identification of stakeholders, data sources, and databases in use, and provides guidance for assessing data quality, resource availability and the policy environment, and using the resulting assessment for decision-making.

Module 3 offers guidance for **improvements to existing road crash data systems**, and outlines steps for the **design and implementation of a new road crash data system**. Topics include mobilizing stakeholders, defining objectives, identifying user requirements, strategies for improving/ensuring data quality, and strategies for improving/ensuring system performance. Minimum data elements are defined. The module focuses primarily on the implementation of a crash database derived from police records, while identifying steps that can be taken to utilize other existing data sources (e.g. hospitals).

Module 4 **explores the use of data for action to improve road safety**. It covers dissemination of data and road safety indicators, and the use of data system outputs to develop interventions and policies and assess prevention measures.

Case studies from a range of countries are included in the manual.

How should the manual be used?

The manual is not intended to be prescriptive, but rather adaptable to particular needs. Each module contains tools to help readers determine what level their country/region is at in relation to road safety data systems, and to take steps that offer the greatest potential for improvement. It is not possible, however, to develop a decision chart that will accommodate the situation and options of all manual users. Road safety data systems have myriad objectives, data sources, designs and uses. Users of this manual will need to apply its principles to their local situation and use their best judgement.

Users are encouraged to read the entire manual. However, individual sections may be more relevant to some countries than others, depending on the situation. We encourage users to adapt the manual to local conditions. While the manual refers mainly to data systems at a national level, it is recognized that national data will

not be reliable if good data collection systems are not in place at the local level. The principles and strategies presented here for designing or improving a national road safety data system should also be applied in local jurisdictions.

What are the limitations of this manual?

Using this manual to design or improve a road safety data system should lead to more reliable data on road traffic deaths, the crashes that cause them and the characteristics of those crashes, and possibly more reliable data on non-fatal road traffic injuries. Different systems are required to capture data for safety performance indicators and costs. Though these data are no less important, guidance on those topics is not included in this manual.

This manual is not intended to be an exhaustive 'state of the art' review. The references it contains are those found useful in its development, or that can provide more in-depth information. Similarly, the case studies – used to illustrate processes, good practice and practical constraints – are not meant to be exhaustive but rather to illustrate points presented in the main text.

How was the manual developed?

Planning for the manual was done in consultation with experts from health, transport and police departments, coordinated by the World Health Organization. Contributions for different sections of the manual came from experts in various disciplines and the whole manual was edited by staff at the World Health Organization and submitted for review. Much of the manual is based on practical experience resulting from existing road traffic safety data, much of which comes from high-income countries. In light of this, the recommendations in the manual have been made to accommodate the realities of low and middle-income countries too.

Dissemination of the manual

The manual will be translated into a number of languages, and countries are encouraged to translate the document into local languages. The manual will be disseminated widely through the distribution network used for the *World report on road traffic injury prevention*. Various partner organizations will plan training workshops to assist countries with implementation of the manual.

The manual will also be available in PDF format to be downloaded free from the websites of all four partner organizations.

This manual is downloadable from
http://www.who.int/roadsafety/projects/manuals/en/index.html

How to get more copies

Further copies of the manual can be ordered by e-mailing **traffic@who.int**, or by writing to:

Department of Violence and Injury Prevention and Disability
World Health Organization
20 Avenue Appia, CH-1211
Geneva 27, Switzerland

1

Why are road safety data systems needed?

1

This module explains why data systems are important for road safety practice. Road safety related data are used by a variety of stakeholders – the police, transport departments, health facilities, insurance companies – as well as policy-makers and practitioners. Reliable data for a country are important in persuading political leaders that road traffic injuries are a priority issue. These data can also be used in the media to make the general public more aware of legislation and changes in behaviour that will improve their safety. Road traffic crash data are key to identifying risks, developing strategies and interventions to address those risks, and evaluating the impact of interventions.

The module is divided into three sections:

- **1.1 Data systems are important for road safety:** This section presents road safety as a key public policy issue requiring data-led action. It emphasizes that while road traffic crash data are collected every day in most countries, these data can only benefit road safety practice if they are processed, analyzed and made available through a good data system. Characteristics of good road crash data systems are discussed.
- **1.2 Data requirements for comprehensive assessment of road safety performance:** This section briefly describes what type of data are needed (beyond crash statistics) to monitor all aspects of road safety performance.
- **1.3 The roles and data needs of different sectors:** This section discusses the roles of law enforcement, transport and health sectors in road safety, and their related data requirements.

1.1 Data systems are important for road safety

Road transport is vital to development. In facilitating the movement of people and goods, it improves access to education, health care, employment, and economic markets. Multilateral development banks invest billions of dollars each year to build and repair road networks in low- and middle-income countries, thereby generating economic growth and employment (*1*). Unfortunately, in the absence of adequate attention to safety, an emphasis on maximizing the efficiency of road transport systems has led to significant loss of lives, health and wealth.

An estimated 1.3 million people die each year as a result of road traffic crashes (see **Box 1.1** for definitions of standard terminology), and a further 20 to 50 million people suffer non-fatal injuries (*2*). These crashes and injuries have devastating economic and social costs, for families and for society. Policies and programmes in the transport, law enforcement, health and other sectors have a direct impact on the safety of road transport, making road safety a critical public policy issue. Thanks to advocacy efforts and improvements in data, governments and the international community increasingly recognize that the magnitude of road traffic injuries constitutes a crisis requiring immediate action.

BOX 1.1: **Standard terminology**

This manual uses definitions of common terms that have been negotiated internationally, mostly drawn from the UNECE *Glossary of Transport Statistics* (4th ed, 2009) and the *World report on road traffic injury prevention* (WHO 2004).

Road: Line of communication (travelled way) open to public traffic, primarily for the use of road motor vehicles, using a stabilized base other than rails or air strips.

Included are paved roads and other roads with a stabilized base, e.g. gravel roads. Roads also cover streets, bridges, tunnels, supporting structures, junctions, crossings and interchanges.

Road network: All roads in a given area.

Road vehicle: A vehicle running or drawn on wheels intended for use on roads.

Road motor vehicle: A road vehicle fitted with an engine providing its sole means of propulsion, which is normally used for carrying persons or goods, or for drawing (on the road), vehicles used for the carriage of persons or goods.

Road traffic: Any movement of a road vehicle on a given road network.

Road transport: Any movements of goods and/or passengers using a road vehicle on a given road network.

Road traffic crash: A collision or incident involving at least one road vehicle in motion, on a public road or private road to which the public has right of access.

Included are: collisions between road vehicles; between road vehicles and pedestrians; between road vehicles and animals or fixed obstacles and with one road vehicle alone. Included are collisions between road and rail vehicles. Multi-vehicle collisions are counted as only one crash provided that any successive collisions happen within a very short time period.

Injury: Physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy. It can be a bodily lesion resulting from acute exposure to excessive energy or impairment of function resulting from lack of vital elements.

Road traffic injury (or casualty): A person who has sustained physical damage (i.e. injury) as a result of a road traffic crash.

Road user: a person using any part of the road system as a non-motorized or motorized transport user.

Road traffic fatality: Any person killed immediately or dying within 30 days as a result of an injury crash, excluding suicides.

For countries that do not apply the threshold of 30 days, conversion coefficients are estimated so that comparisons on the basis of the 30 day-definition can be made.

Injury crash: Any road traffic crash resulting in at least one injured or killed person.

Fatal crash: Any road traffic crash resulting in a person killed immediately or dying within 30 days as a result of the crash.

Sources: (*3, 4, 5*)

Many people have opinions about what should be done to make roads safer, often based on personal experience or anecdotal information that may misrepresent the true priority issues.

By contrast, reliable and detailed data help practitioners accurately identify problems, risk factors and priority areas, and to formulate strategy, set targets and monitor performance (see (*6*) and **Figure 1.1**). This cycle of gathering data, taking action and then evaluating is fundamental for any road safety strategy, including the Safe System approach to road safety (see **Figure 1.2**). Without ongoing, data-led diagnosis and management of the leading road injury problems, there will be no significant, sustainable reductions in exposure to crash risk or the severity of crashes.

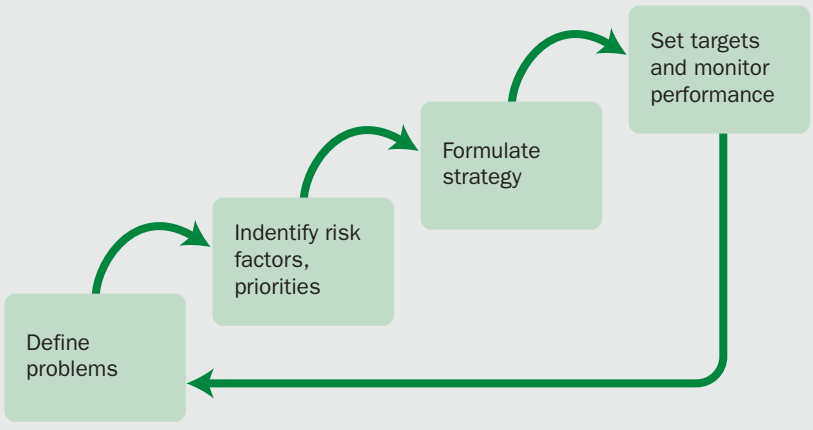
Reliable, accurate data can also help build political will to prioritize road safety by:

- documenting the nature and magnitude of the road traffic injury problem;
- demonstrating the effectiveness of interventions that prevent crashes and injuries;
- providing information on reductions in socio-economic costs that can be achieved through effective prevention.

The use of reliable data to identify problems and target resources more effectively is a key element of the Safe System approach to road safety – an approach increasingly recognized as the most effective way to make road transport systems safer for all users.

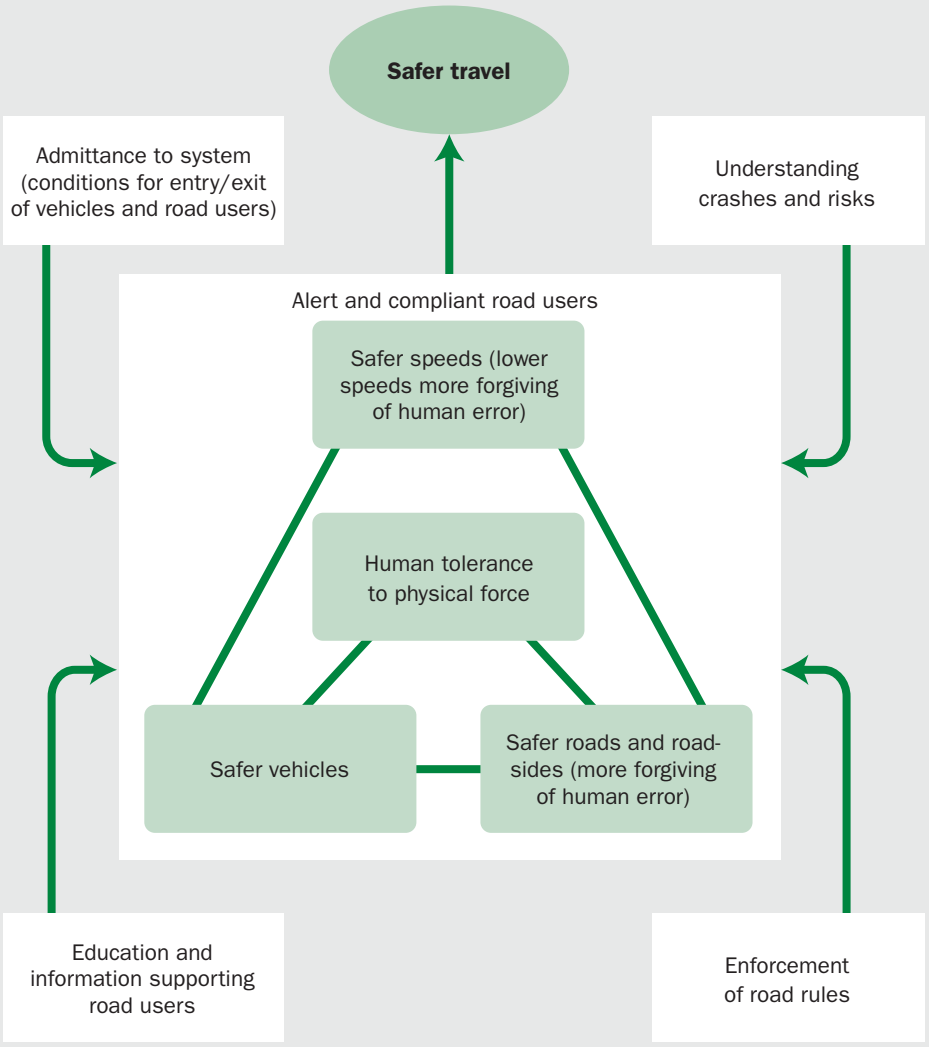
This approach aims to develop a road transport system that is better able to *accommodate* human error and take into consideration the vulnerability of the

Figure 1.1 Use of data for public health approach to road safety



Source: based on (*6*, *7*)

Figure 1.2 The Safe System model



Source: (8)

* The phrase Safe System approach refers to a broad category of strategies for road safety management, as described in *Towards zero: Ambitious road safety targets and the Safe System approach* (9). While the Safe System approach has influenced strategies in several countries, the term itself does not refer to the road safety programme of any single country.

human body, rather than maintaining a primary focus on *preventing* human error. It requires recognition that road safety is a shared responsibility of designers of the road transport system as well as users of that system. The goal of the approach is to prevent fatal and severe injuries by identifying and addressing the major sources of error and the design flaws that contribute to them (*4, 9*). Road users, vehicles and the

road network/environment are addressed in an integrated manner, through a wide range of interventions, with greater attention to speed management and vehicle and road design than in traditional approaches to road safety.

Quality of road crash data systems

Basic information on road traffic crashes and injuries is collected every day in most countries. Police officers write reports on reported crashes. Insurance companies document client crashes. Health workers keep medical records on road traffic injuries they have treated. The main purpose of documenting this information is usually to assist an agency in carrying out its specific function – investigation, law enforcement, provision of health care. While such information may be useful to individual agencies, it cannot be used for identifying risks, selecting interventions, or measuring outcomes at an aggregate level unless is it properly coded, entered in a computerized database system, processed, analysed and disseminated.

In this manual, the term *road crash data system* refers to the people, processes, hardware and software involved in collecting and managing information related to road traffic crashes. Road crash data systems should process information in a way that allows for analysis at an aggregate level and facilitates data-driven action. At a minimum, good road crash data systems should:

- capture nearly all crashes that result in death and a significant proportion of those that result in serious injuries;
- provide adequate detail on the vehicle, the road user and the road/environment to assist with identification of causes, and selection of countermeasures;
- include accurate crash location information;
- provide reliable output in a timely manner to facilitate evidence-based decisions.

HIB-Cambodia

Most countries have some kind of mechanism for counting road traffic deaths and injuries. WHO's *Global status report on road safety* (*2*) used a core set of indicators and a standardized methodology to assess the status of road safety worldwide. Of the 178 countries and areas that participated, all but one reported on the number of road traffic fatalities. Most countries were able to provide some information on non-fatal road traffic injuries as well, though the quality of this information was highly variable. Counting deaths and injuries (the accuracy of these counts aside) is just the beginning, however.

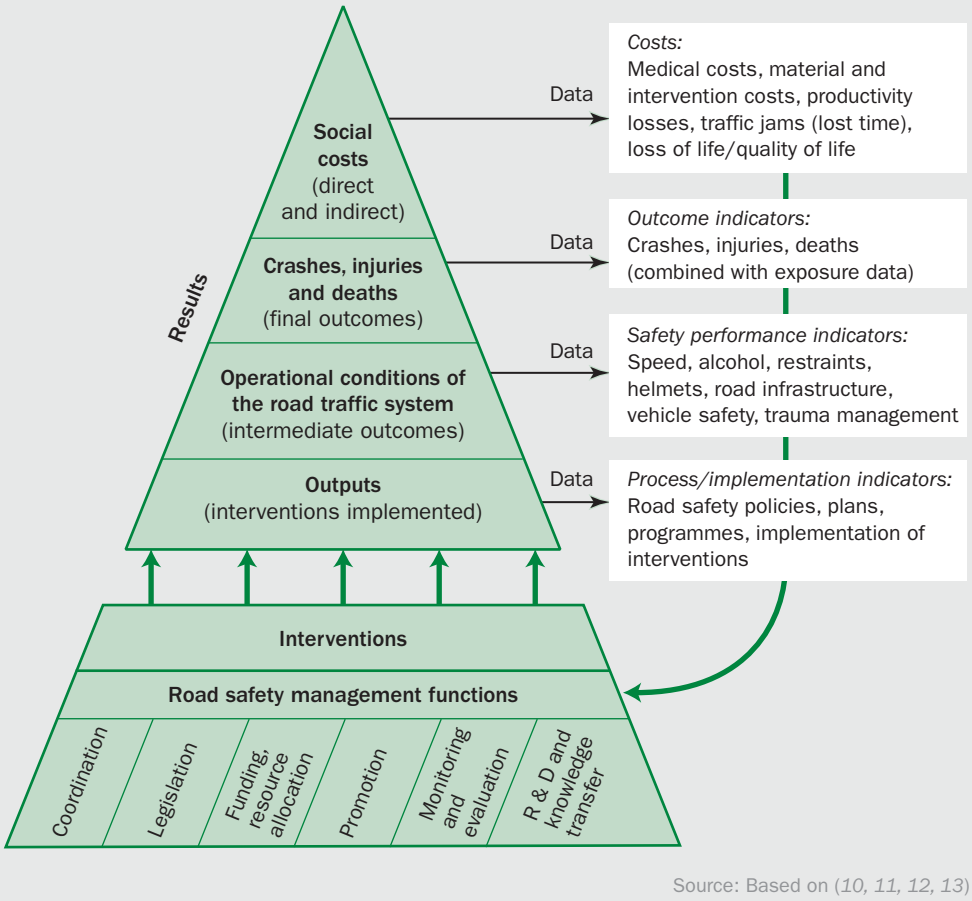
Summary crash statistics can be useful for describing the magnitude of the problem and monitoring programmes and policies, but more detailed information is required for evidence-based intervention and management. In the *Global status report on road safety* (*2*) many countries did not provide data on the distribution of road traffic deaths among road user categories, or trend data. Some countries noted discrepancies between the number of deaths recorded by different sectors, and few indicated use of data linkages across sectors. The results of that report support what international road safety experts have said for years based on experience – that most jurisdictions need to take measures to improve their road crash data system (or implement a new system) so that it meets the criteria listed above, and ultimately so that it is useful for reducing road traffic deaths and injuries.

1.2 Data requirements for comprehensive assessment of road safety performance

There is growing recognition in the international community that effective road safety management requires more data than the crash data described above. Crash statistics do not provide a complete picture of the road safety situation. Crash data must be interpreted in light of other information that cannot usually be derived from police records, such as population size, or the number of vehicles on the road. Crash data do not capture information on risk factors such as helmet use or speeding among the general population, and therefore other road safety related data are important for monitoring performance and achieving results (*8*).

Road safety management involves all institutions, their strategies and interventions, and the results of such strategies and interventions (*10*). Results, or *outcomes*, occur at different but related levels (see **Figure 1.3**). The most visible results are the *outputs* that result from policies and programmes implemented by various institutions: random breath testing checks, campaigns to promote helmet use, legislation, installation of speed cameras. Through such outputs, policies and programmes influence how the road traffic system operates: e.g. the proportion of people wearing helmets, average travel speeds, safety of vehicles admitted to the system (also

Figure 1.3 Outcomes of road safety management



Source: Based on (*10, 11, 12, 13*)

known as *intermediate outcomes* or *safety performance indicators*). These 'operational conditions' directly influence the likelihood of deaths and injuries from road crashes, or *final outcomes,* that road safety practice aims to prevent. Finally, the ultimate result of effective road safety management is the reduction of *social costs* (such as medical costs, property damage) associated with road traffic deaths and injuries.

A true understanding of road safety performance requires information for each of these outcomes. A comprehensive road safety data system would therefore encompass data collection and analysis mechanisms that cover (*8*):

- final outcomes – including at least deaths and serious injuries to road users, and characteristics of the crashes that result in them;
- exposure measures – e.g. demographic data, number of licensed drivers, traffic volume data, infrastructure factors, to help interpret of crash data and measure indicators;

- intermediate outcomes – e.g. mean traffic speeds, seat-belt and helmet wearing rates, drink–driving, and vehicle and infrastructure safety ratings;
- socio-economic costs associated with road traffic injuries;
- outputs – including various enforcement efforts.

Very few countries however, have all these types of information available for road safety planning. Of the 178 countries and areas that participated in the *Global status report on road safety*, only 22% were able to provide information on road traffic fatalities, non-fatal injuries, economic impact, and some kind of data on selected intermediate outcomes (*2*).

1.3 The roles and data needs of different sectors

The work of the transport, law enforcement and health sectors directly influences the risk and outcomes of road traffic crashes, whether or not that work is consciously considered to be 'road safety work'. These sectors require a variety of road safety related data for their day-to-day functioning. As background to conducting a situational assessment on road safety data systems, it is helpful to understand the function of these sectors, what data they require and what data they may have.

Law enforcement

The role of the police is to ensure the personal safety of citizens in all aspects of daily life and in all places, which includes when travelling on the roadway. This protection is provided through the enactment and enforcement of legislation governing safe and appropriate use of the roadway. In many countries there is a legal requirement to report a road crash to the police if it involves personal injury, and for the police to document key information about the crash. It is therefore the police who most often maintain databases on the number and characteristics of road traffic crashes at both a national level and in local or regional jurisdictions. In addition, the police are charged with the responsibility of investigating all road traffic crashes to

K. Rajam / WHO

determine if laws have been broken, and to identify culpability. As a result they generally collect information on the vehicles and drivers involved, the vehicles' movements prior to the collision, on road users involved and also on environmental conditions, such as the weather or road surface. Police officers may be responsible for follow up with crash victims admitted to hospital.

In many jurisdictions, attending road traffic crashes is just one aspect of a police officer's multifaceted job, alongside responsibilities for crime, violence, and public safety. There are therefore usually competing priorities for a police officer's time and attention. When an officer is responding to a road traffic crash, the primary objective for data collection is not to generate data to improve road safety. The officer may be concerned instead with issuing citations, fulfilling legal requirements or with filing the paperwork required by their precinct. Often police officers are required to write crash reports and fill in data collection forms. Good road crash data systems cannot be built without an acknowledgement of the pivotal role of police officers as data collectors. A critical strategy for ensuring reliable road traffic crash data is working with the police to demonstrate how aggregate data can be useful for their own enforcement work, and how careful and complete data collection can lead to reductions in road traffic injuries (see Case study 1.1 and Module 3).

CASE STUDY 1.1: **Strengthening road traffic injury data collection by police, Ethiopia**

The Traffic Police Department of Addis Ababa city has been working since 2002 to strengthen its road traffic injury data management capacity. The activities include:

- developing an easy-to-use data collection form;
- setting up a computer-based data analysis system;
- training the traffic police officers on data management;
- developing a small resource centre;
- promoting collaboration among key stakeholders in road traffic safety.

At the beginning of the project, the traffic police did not have a standard form to use to record data at the scene of a crash. Information was collected on a piece of paper which would be transferred to a logbook that was manually filed. Developing a standard data collection form and training traffic police officers on how to use it were key activities of this project. A draft form was developed, based on the logbook used by police, as well as examples from other countries (Kenya, India and South Africa) and Injury Surveillance Guidelines published by WHO. The draft form was piloted, revised and adopted. Amharic, Ethiopia's national language, was used.

The data collected covers:

- site and location of collision;
- weather conditions at time of crash;
- vehicles and other road users involved;
- insurance status of vehicle;
- vehicle inspection status;
- number of persons injured or killed at the scene;
- demographic data of casualties (name, age, sex, occupation);
- whether first aid was given.

In addition, manual data entry, processing and analysis were computerized. A database was developed in Amharic for data entry and analysis. Based on the experience of the Addis Ababa Traffic Police Department, the traffic data management system has been scaled-up to six major regions in the country and 22 traffic police officers (10 from Addis Ababa and 12 from the other regions) have been trained on computer-based data entry, processing, analysis and report writing.

The police, and indeed the internal security ministry/justice sector, along with its legislative arm, need data that can identify the causes and magnitude of road traffic crashes. This is particularly relevant in relation to risk factors that can be reduced by legislation and its enforcement; for example, driving under the influence of alcohol and drugs, speeding, and use of safety equipment such as helmets, seat-belts and child restraints. Sufficient data can assist the police in identifying areas and locations that require greater enforcement efforts.

In summary, the police need data in order to:

- monitor the occurrence of traffic law infringements;
- keep track of legal proceedings such as court appearances, and outcomes such as fines and sentences;
- enable an intelligence-led approach to enforcement, such as identifying where speed traps and cameras should be located, and when and where alcohol testing should occur for maximum effect.

Transport

The transport sector's role is the provision of an efficient system that allows the safe transport of people and goods. Therefore, the sector is responsible for:

- the condition, design and construction of the road environment that promotes or inhibits safe travel;
- the roadworthiness and registration of road vehicles;
- the management of examinations to test/establish a driver's ability to operate different vehicle types safely on the road.

Transport sector activities focus on ensuring the safe and efficient operation of the road traffic system by encouraging the correct use of the network by road users. The transport sector requires data for the identification of hazardous locations (sometimes called hotspots or black spots), for analysis of crashes at these sites, and ultimately for the selection of appropriate countermeasures. In addition, crash data analysis can be used to identify hazardous routes and road design problems so that engineering standards are improved. One method of acquiring such information, shown in Case study 1.2, is through the application of a Geographic Information System. In many countries, the transport sector initiates improvements to or implementation of data systems and is the main user of the results.

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CASE STUDY 1.2: **Geographic information systems (GIS) for injuries, Mexico**

Much can be learned about injury patterns using 'geographic information systems', which use geographical criteria to pinpoint locations, roads or regions in need of effective measures to achieve visible, short-term results.

The Spatial Diagnostics of Road Accidents project in Federal District, Mexico, helped gauge the magnitude and distribution of road traffic crashes in Mexico City, and to design interventions to prevent them. The project, coordinated and financed by the National Centre for Accident Prevention at the Mexican Ministry of Health, was developed in collaboration with scientists from the Geography Institute of the National Autonomous University of Mexico. It also utilized data from the National Institute for Statistics, Geography and Information, and the Federal District Ministry of Public Safety.

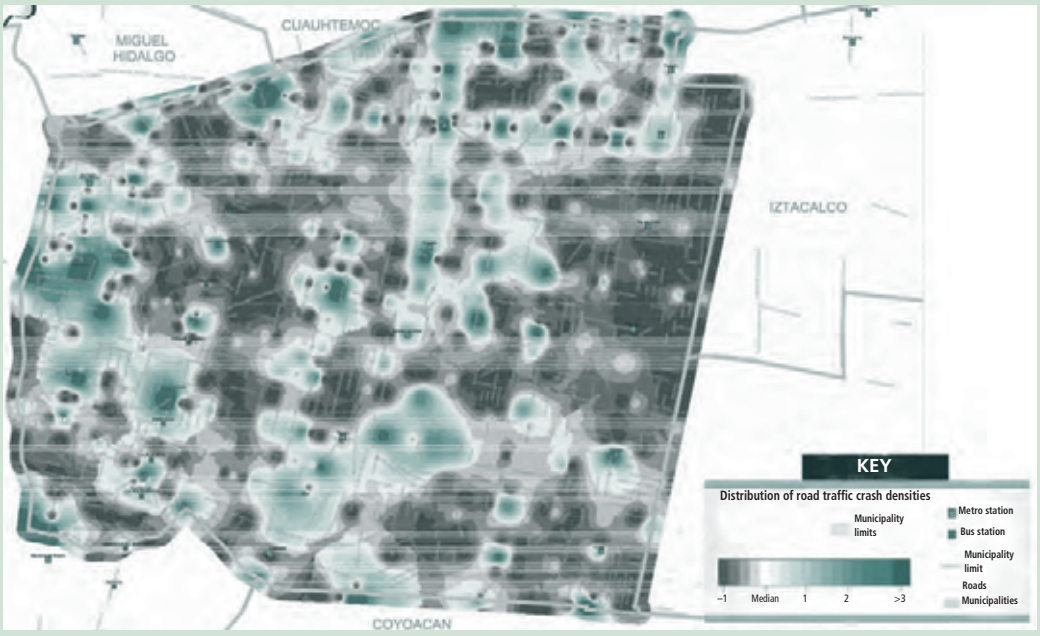
The first phase of the project identified public-sector institutions with road traffic injury data in Mexico City. The data were selected and processed to generate a relational database, structured to support a geographic information system.

The next phase involved the design and construction of mapping models showing the spatial concentration and dispersion of road crashes and their key characteristics, e.g. nature of crash, risk factors and socio-economic factors.

The data were processed using ArcGIS9 or ArcView 03 software. The most dangerous areas, corridors and intersections were identified using techniques such as *hot spots, hierarchical spatial clustering* and *road network analysis* (density and vicinity), making it possible to create a map of road crashes.

The data were integrated to create the *Spatial Diagnostics of Road Accidents in the Federal District,* which uses text, tables and maps, and includes conclusions and recommendations. The report is a useful tool for supporting situation analysis, investigation and epidemiological surveillance for road traffic injury prevention, though the data refer to one year only.

As a result of this project, an interactive geographic information system for the capture and geo-referencing of road traffic crashes has been developed. The system allows the user to enter data and update content in real time. Photographs may be uploaded showing current conditions at any given location. The sensitivity of the system is such that it can supply information at the street/intersection level, and in the case of roads, via map coordinates. Users can generate reports, thematic maps and graphics.



In summary, the transport sector needs data in order to:

- identify locations, time periods and road types or segments with high frequencies of different types of road traffic crashes, according to severity, and the environmental factors which may have contributed to them;
- determine the human factors that may have contributed to road traffic crashes and for which corrective measures should be applied;
- identify vehicles at relatively higher risk of involvement in crashes and vehicle-related technical/mechanical factors of the vehicles that contribute to the crashes;
- select appropriate treatments for high-risk locations and monitor the effects;
- plan and advocate for appropriate policies and legislation.

Health

The health sector's aim in relation to road traffic crashes is to prevent injuries, and where they occur, to minimize the severity of the injury and its consequences. Pre-hospital care, hospital emergency room and in-patient care, and physical and psychosocial rehabilitation are the responsibility of the health sector, although the latter may also be undertaken by the agency responsible for social services.

The health sector usually keeps data on most types of injuries, covering the whole spectrum of injury from exposure to death. Data on fatal road traffic injuries may be extracted from 'vital registration' data (derived from death certificates completed by medical doctors, which state the cause and underlying cause of death) or where these do not exist, from verbal autopsy surveys (*14*). Information on non-fatal road traffic injuries is kept in hospital in-patient records, trauma registries (see Case study 1.3), and may be collected by ambulance services or other emergency services. Some health agencies develop injury surveillance systems for ongoing and systematic collection, analysis, interpretation and dissemination of health information on injuries, and it is possible to extract road traffic injury data from these systems – for more information see (*5*). Minor injuries, which usually don't present to hospitals or health facilities, are the most difficult to quantify and these are usually captured through community-based surveys (*15*).

Information about the health services required for managing injuries, the cost of treating patients, and outcomes are collected either as an ongoing activity or through sample surveys. These data are particularly important to policy-makers as they can guide hospital staffing and doctor and nurse training, as well as the allocation of funds for hospital admissions and rehabilitation as a result of road traffic crashes.

In addition to basic epidemiological data on who was injured, when, where and why, the health sector or partners in academic institutions may undertake risk factor analysis for indicators such as helmet use or seat-belt wearing. This helps them better target health promotion or injury prevention interventions and messaging to the general public. The health sector and its partners also conduct research on prevention and management of injuries, including studies to evaluate the impact

CASE STUDY 1.3: **Injury surveillance system, Argentina**

In 2003, Argentina's Ministry of Health established the 'injury sentinel surveillance system'. The system gathers data on injuries presenting at hospital emergency departments (the 'sentinel sites'), using a standard data collection form completed by the doctor or nurse treating the injury. Data are transmitted electronically to the Ministry of Health.

Hospital participation is voluntary, and so the data cannot provide a complete national picture. However, participating hospitals are comparable with each other, and over time, data gathered by the system can offer a useful profile of injuries. The system can also be tailored to address local situations needing specific attention, and hospital staff can access the data and analysis, which are updated automatically.

An analysis of Argentina's non-fatal road traffic injuries was made using the sentinel system during 2007 and 2008. The system records data relating to sex, age, type of vehicle, helmet use, seat-belt use and blood alcohol levels. A total of 12 844 road traffic injuries were collected in 2007 in 33 'sentinel units', and in 2008 the total was 11 564 in 25 sentinel units. Young people were the most affected, and 67% were male. Motorcyclists and cyclists accounted for 70% of the injuries – only 5% of these were using a helmet. Fewer than 1% of the injured people used a seat-belt, and 11% had evidence of alcohol consumption.

To improve the quality and utilization of road safety data, the Ministry of Health will conduct a national workshop with relevant partners, including the Ministry of Health, the National Road Safety Agency and delegates from all provinces (epidemiology, health services and police). The workshop will focus on integration of vital statistics, hospital and police data for road traffic injury surveillance, and on using data captured by the existing sentinel surveillance system to plan road safety interventions. A new web-based information system integrating all information systems into one coherent system with common identifiers and definitions is being piloted and will be launched, along with a standard operations procedure manual, in this workshop.

The 2007 analysis has been published on the Ministry of Health website and shared with transport institutions and organizations working in road traffic injury prevention (see www.msal.gov.ar/htm/site/sala_situacion/boletin_BEP37_Completo.pdf).

of interventions. These data are useful to all sectors to advocate for more attention to be given to road safety, and to provide input into an evidence-based Safe System approach to road safety, which includes post-crash care.

In summary, the health sector requires data in order to:

- estimate the magnitude of fatal and non-fatal road traffic injuries;
- identify the risk factors involved so that health promotion programmes can target them;
- evaluate the effectiveness of injury management and treatment;
- ascertain current trends and the impact of prevention programmes;
- plan effectively for trauma care and rehabilitation services;
- plan and advocate for appropriate policies and legislation.

Other sectors

The insurance sector offers financial security against the costs of damages and medical treatment incurred either by, or levied against, clients involved in road crashes. Except where no-fault insurance is the practice, insurance companies

must determine who is primarily responsible for the incident and therefore whose insurance is liable for covering the damages. The reality in many countries is that the insurance companies do not conduct independent investigations, but rely on the findings of police, which usually involves the purchase of a copy of the case file, or part of it. The information actively maintained by the insurance companies relates primarily to its clients – their age, sex, the type of vehicle, location of the crash and the damage to persons and property.

Insurance companies across a country may have fairly detailed and complete data on the number of crashes, especially numerous damage-only incidents, which they use to set premiums. The companies usually regard this data as commercially sensitive, however, and thus it is not typically widely available to other road safety stakeholders.

Summary

- Road safety is a critical public policy issue. Good data are needed to raise awareness about the magnitude of road traffic injuries and to convince policy-makers of the need for action.
- Effective road safety management requires data that users can rely on for accuracy, to define road safety problems, identify risks, formulate strategy and develop interventions, set targets and monitor performance.
- Data relevant to road safety are collected every day in most countries, but these data are not useful for informing road safety practice unless they are properly coded, processed and analysed in a computerized database system.
- Road crash data systems should process information in a way that allows for analysis at an aggregate level and facilitates data-driven action. At a minimum, good road crash data systems should:
  - capture nearly all crashes that result in death and a significant proportion of those that result in serious injuries;
  - provide adequate detail on the vehicle, the road user and the road/environment to assist with identification of causes, and selection of countermeasures;
  - include accurate crash location information;
  - provide reliable output in a timely manner to facilitate evidence-based decisions.
- Comprehensive assessment and monitoring of road safety performance requires mechanisms for data collection and analysis that cover not only road traffic deaths and injuries (final outcomes), but also exposure measures (e.g. traffic volume, number of licensed drivers), intermediate outcomes (e.g. seat-belt wearing rates), outputs (e.g. number of citations issued for traffic violations, population covered by seat-belt wearing campaign) and socio-economic costs associated with road traffic injuries.

- Various sectors require road safety related data for their daily functioning. Understanding the roles and data needs of each of the main sectors involved (law enforcement, transport, health) is helpful background information for conducting a situational assessment.

References

1. Ward D. *Make roads safe: a decade of action for road safety*. London, FIA Foundation for the Automobile and Society, 2009.
2. *Global status report on road safety: time for action*. Geneva, World Health Organization, 2009.
3. *Illustrated glossary for transport statistics (4th Edition)*. Geneva, EUROSTAT/International Transport Forum/United Nations Economic Commission for Europe, 2009 (http://internationaltransportforum.org/Pub/pdf/09GloStat.pdf, accessed 11 January 2010).
4. Peden M et al., eds. *World report on road traffic injury prevention*. Geneva, World Health Organization, 2004.
5. Holder Y et al., eds. *Injury surveillance guidelines*. Geneva, World Health Organization, 2001.
6. Rothe JP, ed. *Driving lessons: exploring systems that make traffic safer*. Edmonton, University of Alberta Press, 2002.
7. Espitia-Hardeman V, Paulozzi L. *Injury surveillance training manual*. Atlanta, Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2005.
8. *National Road Safety Action Plan 2007–2008,* Canberra, Australian Transport Council, (www.atcouncil.gov.au/documents/nrss_actionplan_0708.aspx, accessed 11 January 2010).
9. *Towards Zero: Ambitious road safety targets and the safe system approach*. Paris, Organisation for Economic Cooperation and Development/International Transport Forum, 2008.
10. Bliss T, Breen J. *Country guidelines for the conduct of road safety management capacity reviews and the specification of lead agency reforms, investment strategies and safe system projects*. Washington, DC, World Bank Global Road Safety Facility, 2009.
11. *Road safety to 2010*. Wellington, New Zealand Land Transport Safety Authority, 2003.
12. Wegman F et al., eds. *SUNflower+6. A comparative study of the development of road safety in the SUNflower+6 countries: Final report.* Leidschendam, SWOV Institute for Road Safety Research, 2005.
13. Hakkert AS, Gitelman V, eds. *Road safety performance indicators: Manual*. Deliverable D3.8 of the EU FP6 project SafetyNet, 2007.
14. *Verbal autopsy standards. Ascertaining and attributing cause of death*. Geneva, World Health Organization, 2007 (www.who.int/whosis/mort/verbalautopsystandards/en/, accessed 11 January 2010).
15. Sethi D et al, eds. *Guidelines for conducting community based surveys on injury and violence.* Geneva, World Health Organization, 2004 (http://whqlibdoc.who.int/publications/2004/9241546484.pdf, accessed 11 January 2010).