

Reflections on the Transfer of Traffic Safety Knowledge to Motorising Nations



Global Traffic Safety Trust

Reflections on the Transfer of Traffic Safety Knowledge to Motorising Nations

**Global Traffic Safety Trust
Melbourne, Australia
March, 1998**

Reflections on the Transfer of
Traffic Safety Knowledge to
Motorising Nations

First published March, 1998

ISBN 0 86910 757 7

Any material may be reproduced
without permission provided the
source is acknowledged.

Although the report is believed to
be correct at the time of
publication, Global Traffic Safety
Trust, to the extent lawful,
excludes all liability for loss
(whether arising under contract,
tort, statute or otherwise) arising
from the contents of the Report or
from its use. Where such liability
cannot be excluded, it is reduced
to the full extent lawful. Without
limiting the foregoing, people
should apply their own skill and
judgement when using the
information contained in the
Report.

Designed by
ARRB Transport Research Ltd
500 Burwood Highway
Vermont South, Victoria 3133
Australia

**FOR
JUICHIRO TAKADA
AND
GORDON TRINCA
WHO MADE IT HAPPEN**

Trustees of
THE GLOBAL TRAFFIC SAFETY TRUST

B.J. Campbell, USA
Frank A. Haight, USA
Ian R. Johnston, Australia
Peter R. Knight, Canada
Murray Mackay, England
A.J. McLean, Australia
Elaine Petrucelli, USA
Gordon W. Trinca, Australia

Address for Correspondence:

Global Traffic Safety Trust
c/- I.R. Johnston
ARRB Transport Research Ltd
500 Burwood Highway,
Vermont South, Victoria 3133
Australia

Contents

PREFACE	<i>P.R. Knight</i>	vii
Chapter 1	Overview <i>I.R. Johnston</i>	1
PART 1	A Conceptual Context	
Chapter 2	Traffic Safety in a Developmental Context <i>I.R. Johnston</i>	7
Chapter 3	The Complexities of International Comparisons in Traffic Safety <i>B.J. Campbell</i>	15
PART 2	Five Perspectives on Technology Transfer	
Chapter 4	Traffic Safety in Low-Income Countries: Issues and Concerns Regarding Technology Transfer from High-Income Countries <i>D. Mohan and G. Tiwari</i>	27
Chapter 5	A Tale of Two (Model) Cities: A Planning Study in the People's Republic of China <i>I.R. Johnston</i>	57
Chapter 6	Vehicle Safety in the Czech Republic in 1996: A Case Study of the Effects of Industrial Globalisation on Technology Transfer <i>E. Petrucelli and G.M. Mackay</i>	65
Chapter 7	The Development, Philosophy and Transfer of Trauma Care Programs <i>P.R. Knight and G.W. Trinca</i>	75

Chapter 8	The World Bank's Role — Technology Transfer Through Funding <i>B.J. Campbell</i>	79
PART 3	Observations from a Selection of "Donor" Nations	
Chapter 9	Japan <i>A.J. McLean</i>	89
Chapter 10	United States of America <i>B.J. Campbell</i>	97
Chapter 11	Canada <i>P.R. Knight</i>	109
Chapter 12	France <i>F.A. Haight</i>	115
Chapter 13	Sweden <i>P.R. Knight</i>	123
Chapter 14	United Kingdom <i>B.J. Campbell</i>	129
Chapter 15	Norway <i>F.A. Haight</i>	141
Chapter 16	The Netherlands <i>F.A. Haight</i>	149
PART 4	Summary and Conclusions	
Chapter 17	Through a Kaleidoscope Darkly <i>B.J. Campbell, P.R. Knight and I.R. Johnston</i>	155
POSTSCRIPT	<i>P.R. Knight</i>	165
GLOSSARY		169

Preface

Peter Knight (Trust Chairman)

Since the formation of the Global Traffic Safety Trust (GTST) in 1988, a number of projects have been undertaken by individual trustees, as well as collectively, to address particularly the issues raised in the publication "Reducing Traffic Injury — A Global Challenge". During some of the invited visits to various countries it became apparent that documentation was lacking of successful and less successful contributions that have been made to assist nations undergoing rapid expansion of their transport systems. To whom could countries turn for advice and assistance? With this as a concept, the GTST undertook to carry out limited surveys of different countries. This monograph is the result of such activities and is the final combined effort of the eight trustees of the GTST.

It is not a comprehensive compendium and coverage of the many activities, public and private, of many of these nations, but an outline of where and what type of help may be sought.

In the surveys carried out as assignments by the named authors, interviews were undertaken with some of the leaders in the field in these countries. The authors also used written and reported material to expand the coverage and available information. The result is termed, appropriately, "Reflections".

The project leader was Dr. B.J. Campbell who has been the coordinator of all the individual contributions. Drs. Johnston and Knight have assisted with further general editing of the text to give a degree of uniformity to the final format and presentation. The authorship of individual assignments has been maintained. Each author has submitted a draft to the persons interviewed in an attempt to improve accuracy. It should be remembered again that this is not a comprehensive or exhaustive national survey. As such there will be glaring omissions and for these we request your understanding.

Terminology has presented some difficulties in writing about different countries. None of our terms carries other than empirical intent. We have used the term "motorised" for countries with high numbers of vehicles per capita while "motorising" is used for those nations with relatively low, but usually rapidly increasing per capita rates. Similarly, we have used the term

“high-income economies” to reflect relative per capita income, contrasting with nations whose economies are in a growing phase but may at present be classified as “low-income economies”. As will be seen, the distribution of injuries, fatalities and property damage only crashes is different in different countries. The presence of major and unique problems associated with motorising nations has been addressed by Drs. Mohan and Tiwari whose words help to explain some of the difficulties experienced by these nations and why those who wish to help need to rethink how that help may most effectively be carried out.

The authors have been accorded the greatest courtesy and assistance by many people in many countries. To all those who have given of their time, hospitality and honest appraisal we offer our great appreciation and thanks.

Melbourne March, 1998

CHAPTER ONE

Overview

Ian Johnston

A GLOBAL CHALLENGE

In 1985 eight traffic safety professionals, drawn from four countries, began a somewhat unusual traffic safety project. The objective was to build a bridge between the impartial knowledge-base of the traffic safety scientist and the decision making processes of the politician and administrator.

The science of traffic safety is a young discipline, only blossoming in the 1960s, '70s and '80s. Coincident with this was an upswing in government concern in Western motorised countries as traffic-related injuries and fatalities "exploded" as a by-product of the rapid motorisation that followed World War II. There was a strong concern among traffic safety professionals in those days that official action to "curb the road toll" was sub-optimal because it was not driven from the principles and strategies which were emerging from the rapidly increasing body of scientific knowledge.

"Reducing Traffic Injury — A Global Challenge" was published in 1988 by the Royal Australasian College of Surgeons as the output from this project.¹ It has since been translated into Japanese and Chinese.

The book's target audience was politicians, transport administrators and other key decision makers in fields impacting on traffic safety. It sought to create an attitude of dispassionate analysis in the minds of the target audience. It emphasised that there is no traffic safety panacea, that traffic injury is a heterogeneous phenomenon and must be treated as such: myriad individual problems need to be identified, understood and tackled by the application of appropriate measures. It argued that rational decision making was crucial when choosing between competing options and must be accompanied by evaluation to assess the effects of the action taken.

It then focused on explaining five basic strategies available to the decision maker and illustrating how these could be integrated into a comprehensive traffic safety plan for any given jurisdiction.

THE GLOBAL TRAFFIC SAFETY TRUST (GTST)

The book generated rather more interest in rapidly motorising countries than in those countries already motorised. With funds from the Volvo Corporation, which awarded the book the 1988 Volvo International Traffic Safety Award, and with ongoing and generous sponsorship from the Takata Corporation of Japan, the original group of eight traffic safety professionals formed the Global Traffic Safety Trust in order to continue and extend their work.

Courses on traffic safety principles and strategies were presented to professionals and administrators from many countries during sessions in China (Hong Kong), Malaysia and India. Study tours were also made to Dominica, Syria and Uruguay where, after a problem identification stage, seminars and less formal discussions occurred and draft traffic safety strategies were submitted to the organisations which had requested the visit.

The more the Trustees conducted courses and undertook study tours, the more it was realised just how difficult it is to transfer the successful practices of one country into successful practices in another. It also became apparent that, viewed collectively, the motorised nations were making little systematic, integrated effort to assist the rapidly motorising nations. If the principles are well known and the strategies are available, it seems a waste that they are not being modified appropriately and adopted globally.

So the Trust decided to undertake an exploratory study of the technology transfer activities of a small range of motorised countries and of a few relevant international bodies to see if we could identify and promote more effective technology transfer in this field.

THE NATURE AND STRUCTURE OF THIS REPORT

This report is a collection of essays and reports from individual assignments — a set of **reflections** — rather than a treatise on technology transfer in traffic safety. These individual contributions have been organised in four parts:

Part 1 provides a conceptual context.

In Chapter Two, traffic safety is set in its economic, socio-political and cultural context. Understanding the key imperatives of decision making in transport and traffic safety at different stages of a nation's development is critical to planning successful technology transfer.

In Chapter Three, Dr. Campbell discusses some of the difficulties in measuring and comparing traffic safety between countries at different stages of motorisation. This is the second pre-requisite for any discussion of technology transfer.

In **Part 2**, we present five “case studies”, looking at technology transfer from five different perspectives. Our choice of cases is not intended to be exhaustive of possible models, nor is our specific choice of subject within cases to be interpreted as any form of “endorsement”. Our choices related primarily to the availability of information to the respective authors.

In Chapter Four, Professor Mohan and his colleague, Dr. Tiwari, provide a perspective from a “recipient” country, namely India. Professor Mohan has worked with the Trust before, being on the teaching faculty for the traffic safety course we conducted in New Delhi. This is a pivotal contribution, challenging the very basis of technology transfer, indeed arguing that most conventional efforts in the traffic safety field to transplant successful measures to rapidly motorising countries are likely to fail.

In Chapter Five, Dr. Johnston describes a project in the People’s Republic of China, funded by the Asian Development Bank, and executed by an Australian organisation. This planning project developed a traffic safety strategy for the province of Heilongjiang; a strategy which appears to have avoided most of the traps identified by Mohan and Tiwari.

Chapter Six, written by Ms. Petrucelli and Professor Mackay, demonstrates how commercial interest can stimulate technology transfer. They explored the impacts on vehicle safety design of economic reform in the Czech Republic.

Chapter Seven, by Drs. Knight and Trinca, illustrates the influence of international professional networks in the global adoption of specific measures, professional practices and training.

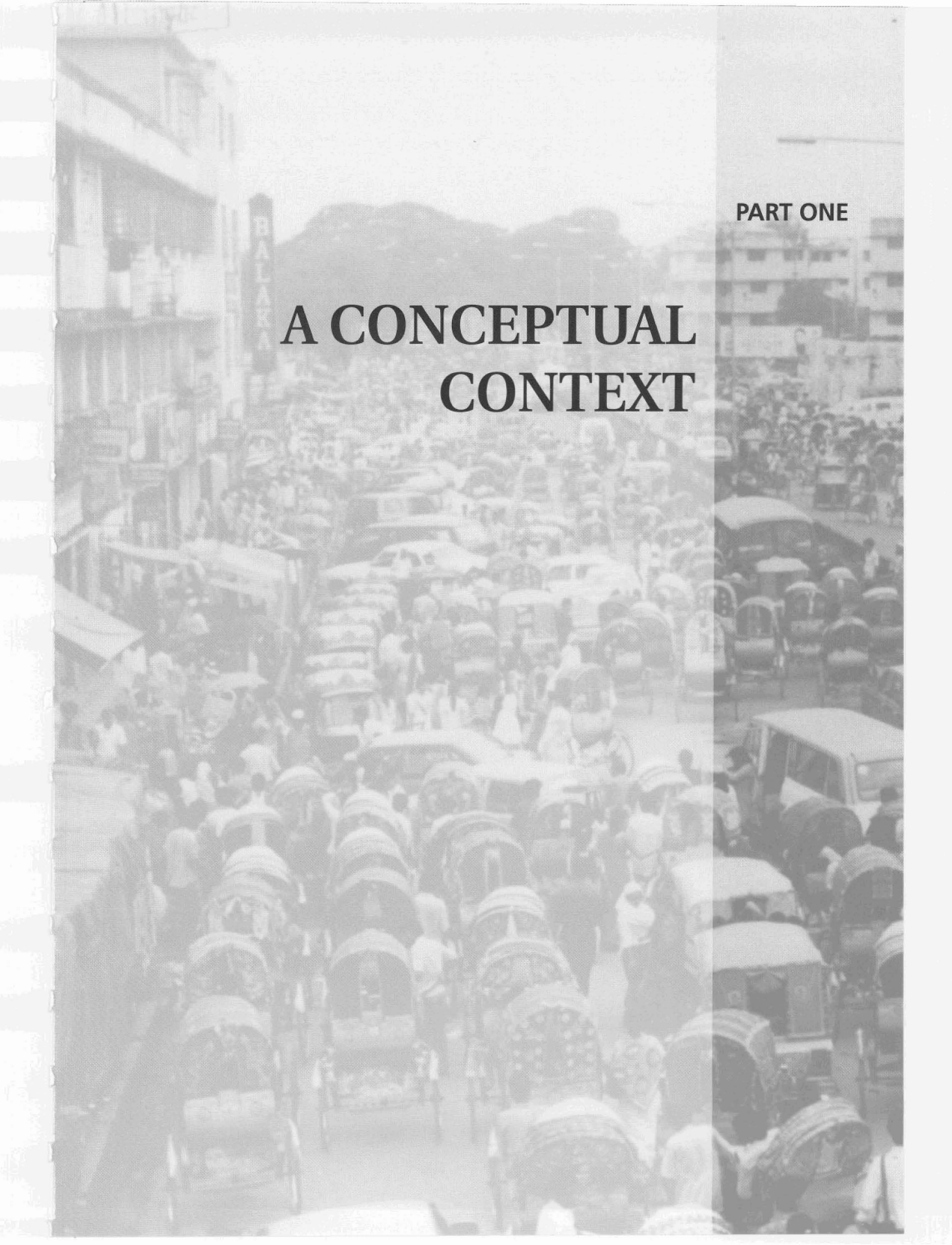
In Chapter Eight, Dr. Campbell outlines the “power of the purse”, showing how the World Bank is stimulating traffic safety in motorising nations by making safety planning and action a condition of infrastructure development loans.

In **Part 3**, we present a series of assignment reports describing the technology transfer activities of some of the organisations in Canada, France, Japan, Sweden, Norway, the Netherlands, the United States and the United Kingdom. These assignment reports were prepared by various members of the Trust and appear as such. They do not purport to be comprehensive investigations of the contributions of different nations but are illustrative examples gleaned, in the main, from professional colleagues of the respective authors.

Part 4 comprises our summary and conclusions.

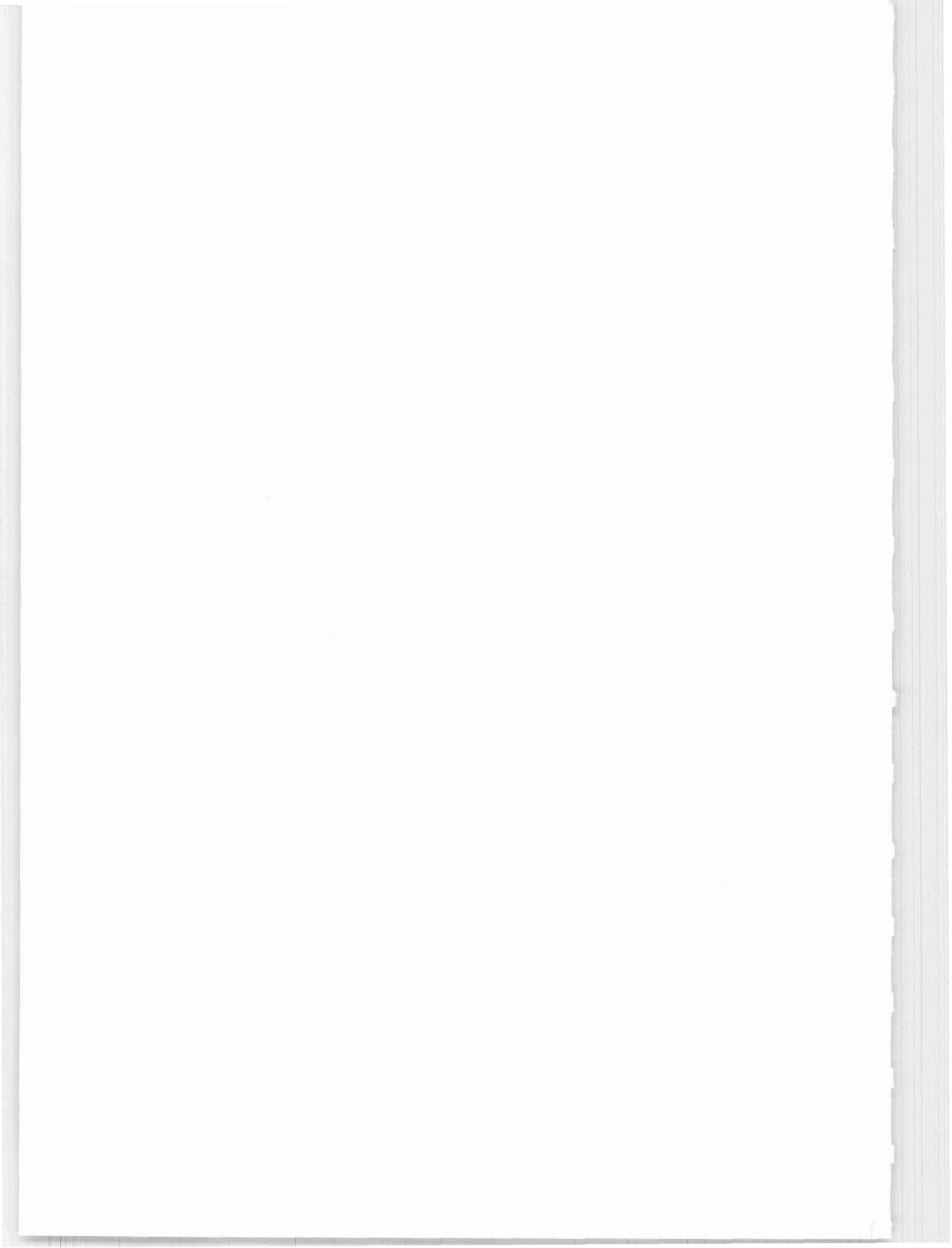
REFERENCE

1. Trinca, G. W.; Johnston, I.R.; Campbell, B.J.; Haight, F.A.; Knight, P.R.; Mackay G.M.; McLean, A.J.; and Petrucelli, E. (1988). *Reducing Traffic Injury - A Global Challenge*, Royal Australasian College of Surgeons: Melbourne.



PART ONE

A CONCEPTUAL CONTEXT



CHAPTER TWO

Traffic Safety in a Developmental Context

Ian Johnston

INTRODUCTION

In the past decade, and more particularly in the 1990s, many governments in the so-called developed world have been fundamentally re-shaping the way they do business for their communities. Stated in grossly over-simplified terms, the basic thrust has been to re-examine all areas of government activity, re-define the objectives in each area and then re-structure the way in which those objectives are achieved. The push has been to focus on policy development and performance measurement and to withdraw from the direct provision of services, wherever feasible.

An excellent description of where this has led, in the roads sector, is the recent report — “Performance Indicators for the Road Sector”, prepared by an international group under the auspices of the Road Transport Research Programme of the Organisation for Economic Co-operation and Development (OECD).¹ The task was to define what the community wishes to achieve from its road transport system and then to determine performance indicators against which governments can measure their progress towards achieving those objectives.

“There is only one issue but it is huge” was the expert group’s conclusion after close study of the complexities and inter-relationships of all the road sector issues they identified. This is a salutary conclusion for a single-minded traffic safety advocate. Unfortunately, traffic safety professionals and advocates alike often forget that traffic accidents, and their consequences of damage, injury and sometimes death, are unintended by-products of a transport system that exists for myriad purposes. Being single-minded is probably the most common block to effective technology transfer!

THE OBJECTIVES OF TRANSPORT SYSTEMS

It is trite to say that a transport system exists to move people and goods from their origin to their desired destination, efficiently and safely. The factors to be considered in designing, building and operating a transport system are far more complex than the apparently simple objective of moving people and goods.

What follows is a generalised description of the multiplicity of often competing objectives, the interplay of which determines the character of transport systems in the so-called “fully developed” countries.

In an ideal world, a transport system would:

- strengthen the economy, particularly its global competitiveness;
- conserve non-renewable energy resources;
- protect environmental and aesthetic quality of life;
- promote social equity; and
- make communities more “livable”.

Let us examine these objectives in a little more detail.

The economic imperative

There are two dimensions to the way in which economic issues shape transport policy. First, transport systems consume enormous resources. In Australia, for example, road and road transport, on their own, account for approximately 20 percent of Gross Domestic Product (GDP).² Relatively little of this (about 1.5 percent) is accounted for by the costs of building and maintaining the infrastructure itself. The remainder is accounted for by the costs of road transport operations such as vehicle operating costs, the salaries of commercial drivers, the costs of accidents, injuries and death and the costs of pollution. All economies are interested in realising the community-wide benefits that flow from increased efficiencies, such that the total costs of transport are reduced or more transport output is produced from a given level of expenditure.

The second economic influence is the role that transport plays in stimulating the growth or competitiveness of the economy as a whole. In this context, the developing countries have huge capital expenditure programs designed to increase their stock of transport infrastructure in order that they can move their goods to market as a fundamental part of their development push. On the other hand, developed countries spend relatively small sums of money on expanding the stock of infrastructure and focus far more on preserving the infrastructure assets that already exist. It is only when a country has fulfilled its fundamental infrastructure needs that it

can begin to think about satisfying some of the other objectives expected from sustainable transport systems!

Large, sparsely populated countries, especially those distant from traditional developed markets — Australia being a classic example — need to be even more focused on gaining efficiencies from the transport system. This is clearly illustrated by a recent benchmarking study of the costs of exporting citrus fruit to Singapore from Australia, the West Coast of the United States and South Africa, three rivals for this market.² At current transport costs in each of these export origins, for every dollar that the Australian grower receives from the Singapore market, his Californian counterpart receives \$1.60 and his South African counterpart \$2.40.

The environmental and safety imperatives

Like transport crashes, the adverse impacts of transport on the environment are unintended by-products that are unrelated to the overall mission of the transport system. Nevertheless, in developed countries concern for the environment is now strongly influencing many areas of public decision making as governments gradually come to accept their obligations to their global neighbours and to future generations.

Past transport gains have at times come at a considerable environmental cost. The challenge now is to find environmentally sound ways of meeting transport needs, generally known as “sustainable transport”.

The findings of community surveys in a number of highly motorised countries provide food for thought.³ When asked to rate concerns about road transport, traffic safety almost always appears as the number one community concern. This concern also manifests itself behaviourally in the tolerance that many communities show towards “tough” safety legislation and intrusive enforcement of that legislation. On the other hand, while concern for the environmental impacts of road transport also rates highly (though never as highly as safety), this concern does not carry through to the key effective countermeasure, namely the reduction of vehicle use through options such as switching from the private car to public transport, car pooling, and so on. Yet these same people behave in environmentally friendly ways on other fronts, such as recycling, composting and purchasing environmentally friendly products. This serves to underline just how entrenched is the need for personal mobility in modern, developed society.

Most fully motorised societies have national or regional traffic safety strategies and national or regional strategies to minimise the adverse environmental impacts of road transport. However, these strategies are not only separate

but are actually independent of each other, typically being prepared by completely independent groups of professionals and organisations.

There is considerable potential for conflict between these independent strategies. For example, most environmental strategies call for more fuel efficient vehicles in order to conserve non-renewable resources. These are typically met through the introduction of smaller, lighter vehicles. Similar fuel use gains can be made by increasing the size of freight vehicles such that more freight is carried per unit resource consumed, the increase in fuel usage from an individual larger vehicle being offset by the reduction in the total number of trips needed to perform the total freight transport task. These opposing trends increase the disparity in vehicle masses among the population of vehicles, thereby increasing the probability of injury in a crash between vehicles of unequal mass. Trade-off decisions are required yet are unlikely to be achieved unless the two sets of strategies are developed in conjunction. Recently, the OECD released a report from an expert group put together under its Road Transport Research Programme which addressed the question of how to integrate safety and environmental strategies within road transport planning.³

The social justice imperative

Most governments have social justice policies. When applied to transport the objectives typically take the form of seeking to provide equitable levels of access to personal mobility for people living in rural or remote communities, for the financially disadvantaged and for people with personal disabilities. The meeting of such objectives requires trade-off decisions with the optimum ways of meeting economic objectives.

It's a wonder decisions get made at all!

Developing, building and operating a transport system in a developed society is about much more than moving people and goods. It is about balancing the economic imperatives with the needs for social justice, for an acceptable level of safety and for a tolerable range of adverse environmental impacts.

How the balance is reached in any particular community depends on the primary needs of that community at any particular time. Countries in an early stage of economic development will place greater importance on expanding the transport infrastructure than on any of the other influencing factors. It is important to understand, in the context of attempts at technology transfer, that such countries do not take kindly to being told that there are more equitable, safer or more environmentally friendly ways of setting up transport systems when their economic survival as a nation depends upon rapidly building a transport infrastructure. It is equivalent to telling a developing nation: "Do not cut your trees down in order to build

houses or to extend agriculture because you will make the global greenhouse effect worse. Yes, we know we did it at the same stage of development but that is because we did not know any better. We reaped the benefits of cheap building materials but you cannot because you must make a contribution on a higher plane." Such a suggestion would not be received with enthusiasm!

Understanding the complex interplay of forces applying in trade-off decision making is critical to successful technology transfer. The first step is clearly to understand what the imperatives are in any given country at the particular time of interest and then to develop the most effective traffic safety strategy that fits that set of imperatives. This rarely happens at present because most traffic safety professionals have no real understanding of the broader context in which the traffic safety strategy has to be implemented. The contribution by Drs. Mohan and Tiwari, describing the situation in India (Chapter Four), is an excellent demonstration of this point.

When a traffic safety professional works within his own country, the fact that he is not fully aware of the total range of factors at play is less important because there is a general understanding of the cultural context. When that same professional seeks simply to transpose a safety measure that has worked in his own country into another country, that ignorance of the bigger picture can well be disastrous.

"FOUR PARADIGMS IN A CENTURY"

The previous section described the complex interplay of objectives involved in macro transport decision making and how these various objectives have different importance for countries at different stages of development. It is time now to move on to the specific topic of traffic safety and to explore its different developmental stages.

In its excellent review of traffic safety theories and models, the OECD coined the phrase "four paradigms in a century" to characterise the evolutionary stages of motorisation.⁴ Each stage is, in turn, characterised by a particular traffic safety strategy or philosophy. It is important to note at the outset that the analysis is of the evolution as it occurred in what are now the fully motorised nations.

The *first stage* involves the introduction of personalised, motorised mobility into the transport system. This stage is characterised by a concern with developing an appropriate infrastructure, including not only a road network but the rudiments of control systems for traffic operation.

Here, already, there is apparent a critical difference between the Western nations we describe as fully motorised and the rapidly motorising nations of the world. Western nations went straight from the horse and horse-drawn vehicle to the motor car — this is what stage one describes. Bicycle use quickly fell away and motorised two-wheeled transport was never widespread in these countries. On the other hand, the emerging nations are motorising at a time when the bicycle, motorcycle and moped are well developed technologically and within financial reach of the bulk of the population. In the case of the Western nations the only barrier to the “car for everyone” was the technology, not the capacity to purchase.

The emerging nations, therefore, are having to build their road infrastructure rapidly to meet their economic growth requirements and are applying Western road design technology that has never had to deal with such a complex mix of vehicle types. Already, we are seeing the application of a sub-optimal technology. Often, it is assumed that this does not really matter as the vehicle mix will gradually lessen but, as Mohan and Tiwari point out, in Chapter Four, that is unlikely to occur in India for at least another quarter of a century!

The *second* of the four paradigms, or stages of motorisation, started when, in Western societies, car transport came to be the dominant form of personal mobility although car ownership was still relatively low. The principal traffic safety strategy at this stage was increasing control through traffic management, increasing traffic regulations and widespread public education to teach road users to adapt to the new forms of traffic interaction.

In the *third stage*, as motorisation increased further, the effectiveness of the earlier traffic safety strategies was counteracted by the dramatic increases in exposure to risk. The “road toll” appeared to be spiralling out of control and, for the first time, governments created dedicated organisations to tackle the traffic safety issue. In the Western nations this period occurred between the mid-1960s and the mid-’70s. As scientific enquiry was seriously brought to bear on the problem, new strategies of risk management began to appear. Individual safety problems began to be identified and understood and specific countermeasures applied to tackle each of the myriad problems.

In the *fourth paradigm*, the rate of increase in motorisation has slowed down but the absolute number of vehicles continues to increase. In this era, governments begin to re-assess and re-define the objectives of their road transport systems in response to growing community demands for a balance to be struck between mobility, environmental impact and social justice. Traffic safety strategies involve trade-off decision making and better integration and management across all transport modes. The critical

importance of institutional integration is realised and mechanisms are created to coordinate safety planning and countermeasure implementation across most of the key organisations.

It is obvious that no rapidly motorising nation has entered the fourth stage and many are just entering the third stage, yet we are seeking to transfer our knowledge with, at worst, a stage four mindset and, at best, a stage three mindset. In some ways, the application of the stage three mindset is even more likely to fail, given that its detailed focus on specific measures is likely to lead to the recommendation of very specific measures which have worked in one country but which may not work given the complex of objectives applying in the recipient country.

REFERENCES

1. OECD Road Transport Research Programme (1997). *Performance Indicators for the Road Sector*, OECD: Paris.
2. Kneebone, D. and Berry, D. (Eds.) (1997). *Australia at the Crossroads*, Austroads: Sydney.
3. OECD Road Transport Research Programme (1997). *Integrated Safety/Environment Strategies*, OECD : Paris.
4. OECD Road Transport Research Programme (1997). *Safety Theory, Models and Research*, OECD: Paris.

CHAPTER THREE

The Complexities of International Comparisons in Traffic Safety

B.J. Campbell

It is a truism that when one uses traditional accident rates to compare traffic safety between highly motorised and motorising countries, the motorised countries appear to be much safer.

When such comparisons are made, it is usually not on the basis of deaths per kilometre of travel because data on the extent of travel, by mode of travel, is not available. Sometimes countries are compared on the basis of the number of deaths per registered motor vehicle. This too is questionable if the annual number of kilometres per vehicle differs greatly from one country to the other, or if the vehicle profile varies greatly as to type or manner of use. In other cases the number of deaths per unit population is shown (partly because that is an indicator commonly used for disease); however, the obtained value is very sensitive to degree of motorisation in a country. Obviously a country with low motorisation will show a more favourable rate using this indicator than will a highly motorised country.

Another factor is the mixture of types of road user. The vast differences in distribution of road users make for a traffic stream in motorising countries that is much more heterogeneous than in highly motorised countries. Moreover, these differences in road user profiles indicate important variations in the very way that society is organised. In China, for example, with its vast use of bicycles, one cannot afford to be very far from a bicycle service or sales point. In a country where pedestrians are a dominant part of transport, it is necessary that food, workplace, and support services be nearby.

In the highly motorised USA, the effective radius of travel can be much greater, and the urban centres have come to be organised ("zoned") to result in substantial separation of functions. How does one compare across such gulfs?

DIFFICULTIES IN ACCIDENT RATE COMPARISON BY COUNTRY AND ACROSS TRAVEL MODE

Comparison between motorising and fully motorised countries reveals that road deaths are much higher in motorising countries when expressed in terms of deaths per 10,000 registered motor vehicles or deaths per 100 million kilometres of motor vehicle travel. Such comparisons almost surely fail adequately to characterise the situation. This is true because it is well nigh impossible to compare death risk per unit travel by walking, bicycling, and motor vehicle within a given country, and the situation is made worse yet when comparing across country lines where the allocation of travel by mode varies by order of magnitude.

One impediment to risk quantification is the scarcity of data on injuries and fatalities caused by collisions between bicyclists and other bicycles or pedestrians, whether on public highways or on separate facilities. Moreover, little if any information is available to explain how bicyclist and pedestrian kilometres of travel are estimated or what types of trips are included in the estimates (for example, children going to school or people walking to work or walking for recreation).

Perhaps most important is the fact that where choice of travel mode exists, then that choice depends on purpose of the trip, route that will be taken, and time of the trip. Then, when the differences between countries are factored in, comparisons become increasingly problematical. The distribution of travel purposes for bicycle trips in India doubtless differs dramatically from the same distribution in the USA.

It is possible to compare any of several expressions of accident rate:

1. accidents per vehicle kilometre of exposure;
2. accidents per passenger kilometre of exposure;
3. accidents per hour of exposure;
4. accidents per number of trips;
5. accidents per number of participants;
6. accidents per population regardless of individual exposure; and
7. fatal or injury accidents per total number of accidents.

Table 1 on page 19 shows such comparisons. This table shows that different rate measures give different answers. Moreover, irrespective of which accident rate is used, the utility of the results is heavily influenced by the

notion of "other things being equal". When a given rate measure is applied to two different situations (as, for example, if car versus bicycle travel were compared using accidents per 100 million travel miles), then the comparison is the most meaningful when "all other factors are equal". But in accident studies, "all other things" are almost always not equal. What sort of things might not be "equal" between two situations under comparison?

Speed of travel:

Speed differs drastically between motor vehicle travel, bicycle travel, and walking, with all that this difference implies for reaction time and crash acceleration level involved.

Trip purpose:

A trip involving a "night out on the town" may be more likely to involve a car, whereas a short trip for relaxing with the family might involve walking. Different trip purposes may well be accompanied by different attitudes, level of stress, fatigue and attention versus distraction. Any, or all of these, may influence the associated accident rates. (All this assumes that the road user has a modal choice.)

Time of travel:

Night travel may be more likely to involve use of a motor car, and bicycle travel may be more associated with daytime travel. This will influence accident rates.

Day, month of travel:

Bicycle and pedestrian travel may be reduced more than car travel in times of inclement weather, with perhaps reduced visibility.

User condition:

If a road user is drunk for example, will mode of travel differ from that when sober?

User age, sex, health, experience, and other personal factors:

As is well known, age is related to accident tendency and mode of travel is related to age. Thus, observed modal differences in accident rate will be influenced by differences in the age profile of those who employ a particular travel mode.

Number of others travelling with the person in question:

Number of car occupants seems associated with accident occurrence rate and accident type. One wonders whether the dynamics of solo versus accompanied travel operates differentially among travel modes.

Route of travel:

In the USA, car travel involves use of Interstate highways, which are

prohibited to bicycle and pedestrian traffic. This illustrates that travel mode can be related to route choice and, therefore, to safety.

Clearly, the more factors that differ from one mode to the other, and the greater the magnitude of any given differences, the more difficult it becomes to ascribe meaning to differences a given accident rate may reveal.

Table 1 uses fatality data and exposure estimates for the USA. By making several assumptions (delineated in the footnotes) about speed, trip length, etc., the same data are shown in the form of several different accident rates. Some rate measurements indicate that motor vehicles have the lowest fatality risk. Other rates indicate that walking or bicycling have the lowest fatality risk.

For deaths per 100 million miles of travel, motor vehicles have the lowest risk of death. The mileage death rate is commonly used in transport analysis since movement is the purpose of a transport system. If passenger miles are used, the motor vehicle likewise delivers more travel miles per death than the other modes.

In contrast to mileage accident rates, the outcome changes if deaths per hour of exposure is used, and the three modes perhaps turn out to be about the same. All three suffer about six deaths per 10 million travel hours. This estimate is, of course, quite sensitive to the estimates of travel speed for each of the three modes.

If deaths per number of trips is used, then, once again, the three modes are more nearly in the same range, with pedestrians about 20 per 100 million trips, motor vehicle occupants about 14, and bicyclists somewhere between six and 20. Thus, on the basis of per hour or per trip, the substantial advantage of the motor vehicle tends to disappear.

Finally, if one shifts the denominator to the population in general, or to the particular members of the population that constitute the user group related to each mode, then both bicycles and pedestrians show up with a lower risk rate than motor vehicles.

The largest source of error in all these rate comparisons is likely to be inaccuracies in mileage estimates associated with the three modes of travel. It is a daunting task, to say the least, to estimate the number of miles an entire population walks in a year. The problem is much the same with bicycling. The situation for estimating motor vehicle mileage is a bit better to the extent that gasoline tax revenues can be made a useful indicator of mileage exposure.

Table 1.
Safety by travel mode in the USA

	Motor vehicle	Bicyclist	Pedestrian
1990 deaths (1)	37,081	856	6,468
Exposed population (2)	240 million	60 million	200 million
Travel miles (3)	2.15 trillion	28 billion	32 billion (4)
Deaths/100 million vehicle miles (5)	1.7	3.1-10.5	20.2
Deaths/100 million vehicle passenger miles (6)	1.1	3.0-9.5	20.2
Deaths/10 million travel hours (7)	6.8	3.1-10	6.1
Deaths/100 million trips (8)	13.6	6-20	20
Deaths/100,000 participants (9)	14.8	1.4-4.5	3.2
Deaths/100,000 population (10)	14.3	0.3-1.1	2.49
Fatalities/100 accidents	<1%	about 3%	about 10%

Notes: (1) Data sources include: National Bicycling and Walking Study (1996);¹ Fatal Accident Reporting System (1991);² General Estimates System Report (1991);³ Komanoff Energy Associates (1992);⁴ Komanoff (1991);⁵ and Elliott (1991).⁶

(2) The writer estimates that nearly all people in the USA are exposed as vehicle occupants. Figures quoted above estimate the number of bicyclists. The assumed exposure for pedestrians is somewhat less than that of vehicle occupants because, in the USA, the old and young may less often be exposed as pedestrians than as vehicle occupants. This would not be true in many motorising countries.

(3) The imprecision in the exposure estimates for pedestrians and bicyclists can produce drastic errors in the rates for bicyclists and pedestrians. Rate data reflects "high" and "low" values based on different mileage estimates.

(4) For pedestrian miles the mid-point of estimates quoted above are used.

(5) The death rate for bicyclists using data in this study is lower than some estimates cited in the literature. Therefore two rates are shown — one is obtained from the data herein and one is more in accord with the literature.

(6) Assumption in order to estimate passenger mile rates: 1.5 occupants per motor vehicle, 1.05 occupants per bicycle, and, of course, one "occupant" per pedestrian.

(7) Estimate of travel hours: Assumed speed of motor vehicles 40 mph, bicycles 10 mph, and pedestrians 3 mph.

(8) Trip estimates assume: 8 miles per trip for motor vehicles, 2 miles for bicycles, and 1 mile for pedestrians.

(9) Participants: 240 million for cars, 60 million bicycles, and 200 million pedestrians.

(10) Estimated 260 million for the USA population.

So what is the “correct” accident measure to use in comparing different travel modes within a country? What is the “correct” indication to use when comparing countries? It is easy to see that there is likely no such answer, certainly not now because of insufficient data, and maybe not ever because of fundamental differences in the “who, when, where, and why” of travel by each of the modes. It seems compelling to this writer that use of traditional expressions of accident rates are likely inadequate as a basis to compare countries with big differences in travel mode allocation. This would seem to be a good topic for future research. The reader should note the chapter by Mohan and Tiwari (Chapter Four) in this regard.

HEALTH AND ECONOMIC IMPLICATIONS OF ROAD DEATHS

Traffic injuries are well recognised as a significant health problem in highly motorised nations. In the USA, for example, motor vehicle crashes have been the leading cause of death for the youngest half of the population for some decades.^{7,8} Likewise, for many years, traffic crashes have been the third leading cause of deaths for the entire USA population, ranking behind only cancer and cardiovascular diseases.⁹ (It is said that, for the 25–44 age group, USA deaths from AIDS may briefly have exceeded that from motor vehicle accidents during the last few years.) For children in the USA, motor vehicle deaths rank far ahead of all communicable diseases.⁷

The public health implications of traffic deaths are widely quoted and recognised in highly motorised countries, but it is important to emphasise that motor vehicle deaths likewise constitute a major health problem in many nations in earlier stages of motorisation. One example is Dominica, a Caribbean island republic with a population of about 100,000, about 10,000 motor vehicles and about 10 fatalities per year. Traffic injuries and death are already a considerable burden on that nation's health care system and budget, and the years of life lost due to motor vehicle crashes exceed that of cancer and heart disease.¹⁰ It is reported that the cost of road accidents in a number of motorising countries is up to 2 percent of the Gross Domestic Product.¹¹

Traffic injuries constitute an economic burden on any country, requiring that resources be allocated to the consequences of injury and death, rather than for other purposes more preferable to the people and their governments. In the USA it was estimated that motor vehicle crashes cost nearly 50 billion dollars (US) per year.¹² It must be said that this “numbers game” leads also to estimates as high as 150 billion dollars (US) per year. The long-term nature of some of the cost is suggested by the fact that motor vehicle crashes cause about half of the 18,000 traumatic brain injuries each year in the USA — trauma that produces long-term disability.¹² It is estimated that the annual total cost of motor vehicle crashes in the USA exceeds that

of cardiovascular disease and is nearly as much as the cost of cancer.¹³ Although many countries now in the process of motorisation do not yet sustain costs of this relative magnitude, traffic injuries still constitute a significant burden on their health care systems.

THE ROAD CRASH PROBLEM IN MOTORISING COUNTRIES

Several of the basic characteristics of road accidents in motorising nations are quite different from those in fully motorised nations. For comparison, consider the USA as a point of departure. In the USA, passenger vehicle occupants constitute the largest single category of traffic deaths. In response to that fact the USA has, during the past 25 years, devoted much attention to making the interior of passenger cars safer through occupant restraints, energy absorbing structures, etc.

In many motorising countries, however, passenger car occupant deaths are quite small compared to other categories. In India, passenger car occupant deaths constitute less than 2 percent of the total. In China, it is less than 5 percent. The largest categories of victims in both those countries are pedestrians or bicyclists who are struck by motor vehicles. Truck and bus riders also rank among the casualties. Thus, in many countries the exteriors of motor vehicles inflict more casualties than the interior. The crash of a motor vehicle against a pedestrian may be seen as too severe to deal with except by prevention, but note that a US study showed that 94 percent of pedestrian injuries in road accidents are not fatal.¹⁴ In considerable degree this is true because so many pedestrian accidents occur in urban areas where vehicle speeds are lower, and pedestrian survivability is possible. Many lives could be saved if that survival rate were improved. Thus, the exterior of the motor vehicle could be the subject of crashworthiness engineering in like manner to the car's interior. The risk to vulnerable road users of course requires that all available interventions be utilised, not just motor vehicle crash design.

Another characteristic of many early-motorising countries is that the role of the roadway in injury reduction tends to be ignored. Too seldom will one see guardrails built with attention to energy absorption, treatment of ditch slopes (by shaping them to avoid vehicle overturn), or other roadside safety appurtenances commonly seen in motorised countries.

Perhaps the most notable feature of traffic in many rapidly motorising countries, in contrast to the USA and other highly motorised nations, is the wide diversity of users who share the road. In the USA, about 70 percent of the traffic stream consists of passenger cars, and most of the remainder is trucks, with a few motorcycles and buses. By contrast, in many rapidly motorising countries, there are considerably fewer passenger cars, and an

enormous number of pedestrians, bicyclists, and motorcycle or motor scooter riders. Add to this trucks and buses (in greater proportion than in the USA) plus animal-drawn and human-drawn conveyances, and one is reminded of the high proportion of "vulnerable road users" in the traffic stream (the theme of a 1991 international conference in New Delhi). This extensive variation within the mix of vehicles produces great variation in vehicle conspicuity, acceleration and turning ability, speed capability, and other characteristics that create traffic flow characteristics different from those in highly motorised nations. Indeed, Mohan and Tiwari in the next chapter argue that this situation creates unique problems in motorising countries, never experienced in now-highly motorised countries.

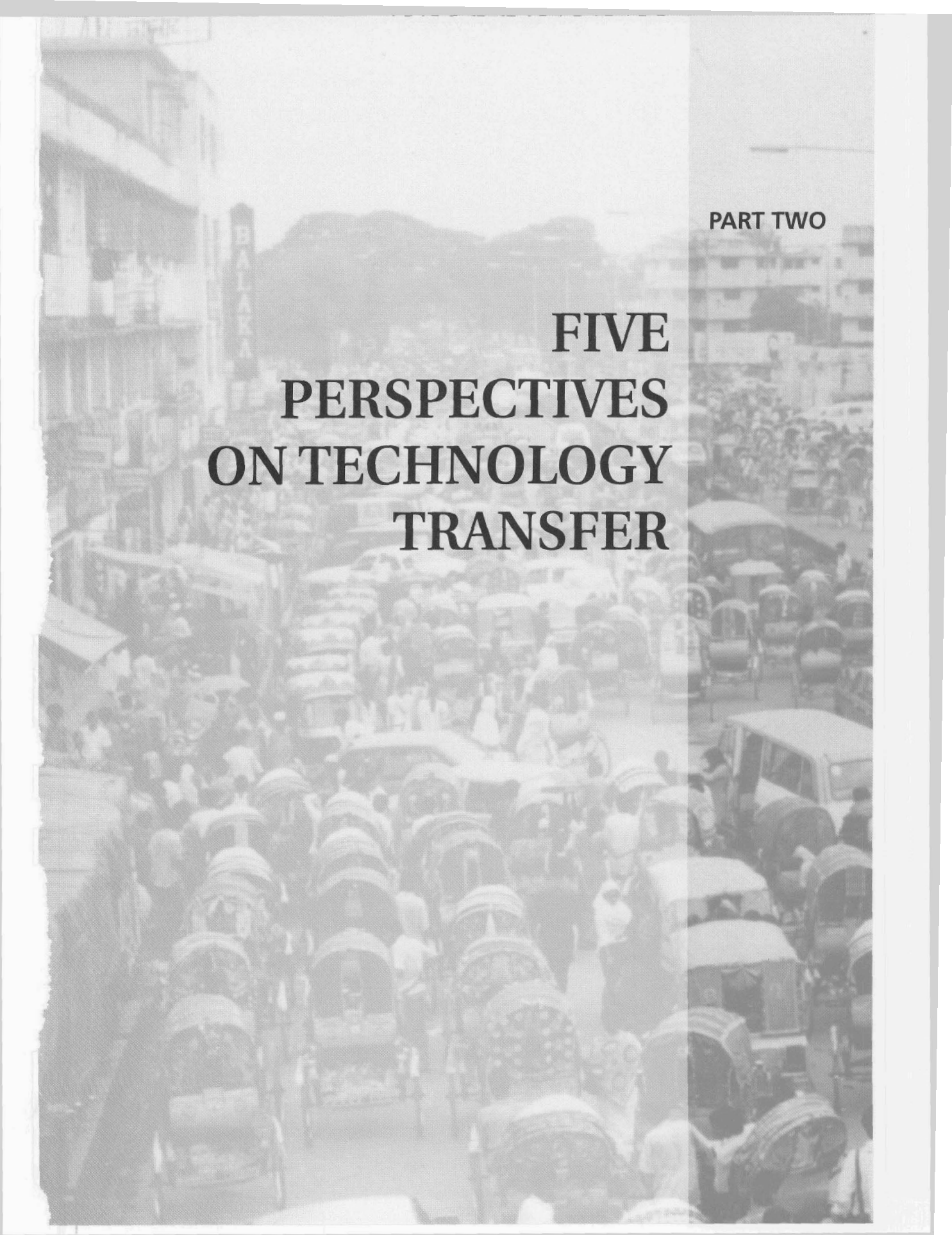
There are measurement uncertainties in comparing countries, and vast differences in allocation of travel mode. It seems likely, therefore, that a program of original research would be a useful component in improving traffic safety in motorising countries. This would be in addition to adapting "proven" interventions taken from highly motorised countries.

REFERENCES

1. *National Bicycling and Walking Study*, (1996). Final Report. US Federal Highway Administration: Washington, DC.
2. *Fatal Accident Reporting System 1990*, (1991). Report No. DOT-HS-807-794. National Highway Traffic Safety Administration: Washington, D.C.
3. *General Estimates System*, (1991). Report No. DOT-HS-807-781. National Highway Traffic Safety Administration: Washington, D.C.
4. Komanoff Energy Associates, (1992). *The Environmental Benefits of Bicycling and Walking*, Case Study No. 15.
5. Komanoff, Charles, Letter to John Fegan, Federal Highway Administration, July 29, 1991.
6. Elliott, Mac., (1991). *Study of Bicycling Fatality Rates for Adults 18 Years and Older*, American Society of Civil Engineers, unpublished report, December.
7. *Accident Facts*, (1990). 1990 edition. National Safety Council: Chicago.
8. Baker, S.P., O'Neill, B., and Karpf, R.S., (1984). *The Injury Fact Book*. Lexington Book: Lexington, Massachusetts.

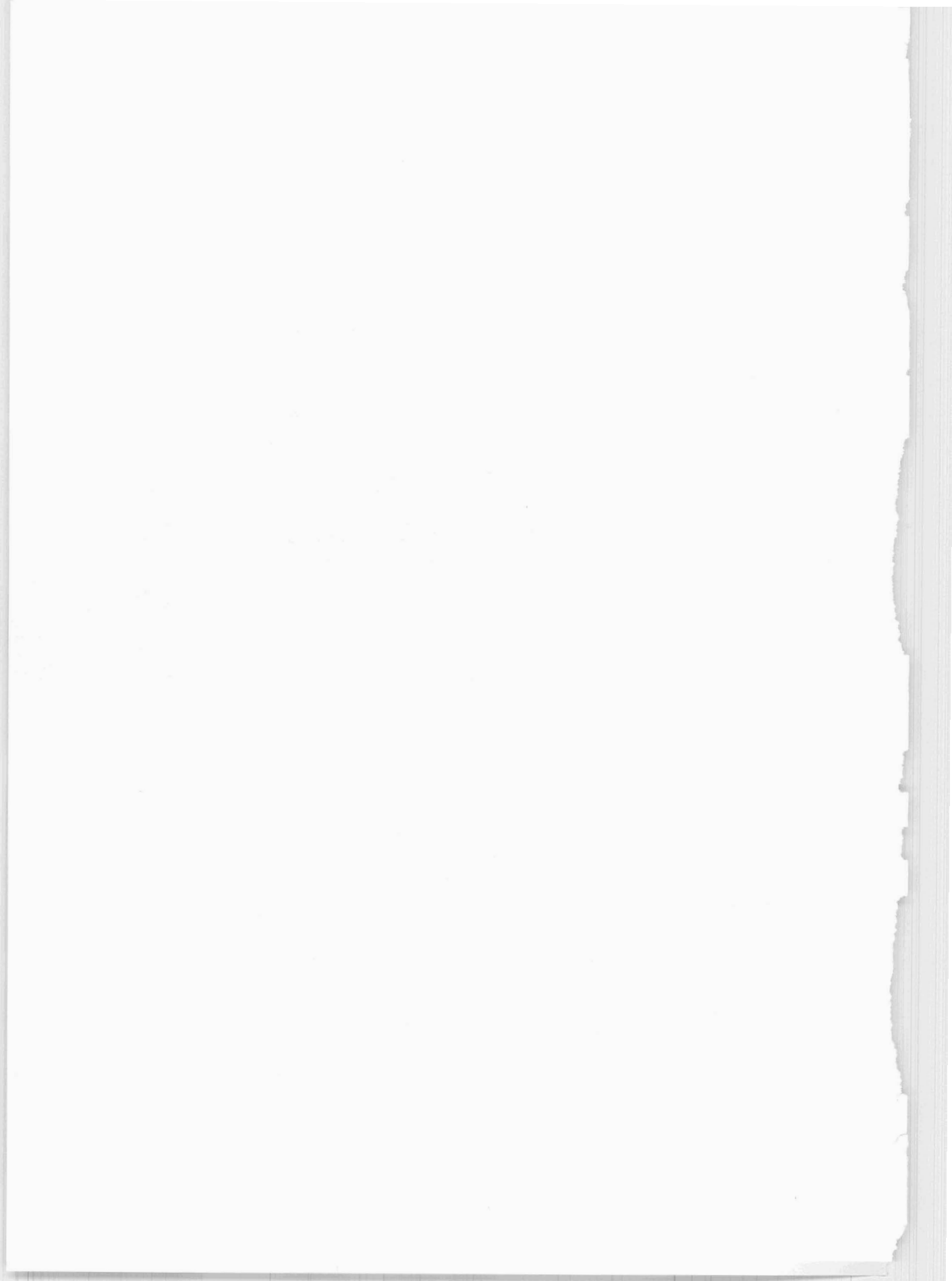
9. *Injury in America: A continuing public health problem*, (1985). National Academy Press: Washington, DC.
10. Knight, P. and Campbell, B.J., (1989). *The impact of the motor vehicle: The challenge of the 90's*. Report to the Prime Minister. UNC Traffic safety Research Center: Chapel Hill.
11. Amundsen, F.H., (1995). *Review of World Bank Experience in Traffic Safety Concerning Motorised and Non-Motorised Traffic (1989-94): Draft Report*. World Bank: Washington, D.C.
12. Rice, D.P. and Mackenzie, E.J., (1989). *Cost of injury in the United States - A report to Congress*. San Francisco, Institute for Health and Aging, University of California and Injury Prevention Center, The Johns Hopkins University,
13. Hartunian, N.S., Smart, C.N. and Thompson, M.S., (1981). *The incidence and economic costs of major health impairments: A comparative analysis of cancer, motor vehicle injuries, coronary heart disease and stroke*. Lexington Books: Lexington, Massachusetts.
14. Hunter, W., Stutts, J., Pein, W., and Cox, C., (1996). *Pedestrian and Bicycle Crash Types of the Early 1990s*, FHWA-RD-95-163. Federal Highway Administration: Washington, D.C.





PART TWO

**FIVE
PERSPECTIVES
ON TECHNOLOGY
TRANSFER**



CHAPTER FOUR

Traffic Safety in Low-Income Countries: Issues and Concerns Regarding Technology Transfer from High-Income Countries

Dinesh Mohan and Geetam Tiwari*

"India is particularly noted for fatal horse accidents, both in riding and driving. There are few of us in this country who cannot name some friend or acquaintance who has either lost his life or been seriously injured from these causes. In England, taking into consideration the large number of equestrians, the thousands who drive, hunt and race, there are comparatively few fatal accidents. This is difficult to account for and cannot be altogether put down, as many aver, to the ground being softer for falling in our native country. Probably the more careful training and management of horses at home has a good deal to do with it."

Times of India, 7 July 1888

* Transportation Research and Injury Prevention Programme, Indian Institute of Technology, Delhi.

INTRODUCTION

The editorial from *Times of India* (a daily newspaper published from Bombay) shows that transportation safety has remained an important issue for over a century. However, in 1888, this British commentator chose to fix the blame on the least important Indian employee rather than examine all the factors associated with the problem. The situation has not changed much over the past century. Policy makers, road engineers, police officials and newspaper editors in less motorised countries (LMCs) still believe that the traffic safety problem would be resolved if the people were better “educated”. This is reflected in comments by Indian and Chinese delegates at a recent international conference: “Correct perception and correct judgements are the two primary measures for avoiding road accidents at the precrash stage and these must be learned and understood well by every individual road user. Traffic education is the only tool for imparting this skill ...”,¹ and “people there (in China) are not used to fast modernised traffic society or are not familiar with it, because of which we should do much more in traffic education”.² International experts from highly motorised countries (HMCs) visiting LMCs for short periods are also convinced that the apparently “chaotic” behaviour of road users is due to their lack of knowledge: “Studies undertaken by the Traffic Research Laboratory, United Kingdom (TRL) of road user behaviour in a number of developing countries clearly showed that road users were much less disciplined than in the UK ... Poor driver behaviour in some countries may be due to their lack of knowledge about traffic safety regulations or to their general attitude toward driving”.³

It is clear that both HMC and LMC officials and professionals concerned with traffic safety in LMCs consider the prevalent road user patterns in HMCs as the norm for all situations.

The unstated assumption is that injury and fatality rates in LMCs can be controlled only if the road users, road designs and enforcement levels in these countries mimic those obtaining in HMCs. Very little effort has been made to understand the influence of the roadside environment, road and vehicle design and economic compulsion on road user behaviour in LMCs. A study on road user behaviour in the Philippines shows that if road users do not appear to follow specified road traffic regulations it cannot be assumed that they are ignorant of the rules.⁴ Similarly, a study from Delhi indicates that road users seem to optimise throughput through intersections by non-observance of formal rules.⁵ This optimisation process looks “chaotic” when there are a large number of motorcycles and small vehicles in the traffic stream. This complex interaction between modal shares in traffic, road design, enforcement levels and road user behaviour is not well understood for LMCs. In a review of road user behaviour in different situations, Saad concludes that the non-observance of road

regulations on the part of various categories of road users is not necessarily due to a lack of awareness of the meaning of road signs and markings, but due to the priority which they give to informal rules.⁶ These studies indicate that anecdotal evidence and intuitive understanding of the causes of traffic accidents in LMCs may lead us to erroneous conclusions regarding the effectiveness of proposed countermeasures for traffic safety.

Traffic safety policies in HMCs have evolved over the last 50 years with a great deal of input from research and academic institutions. All these policies are tailored to the specific situations and problems in those countries. Even the standards instituted for vehicles are based on the traffic patterns and types of crashes that are more prevalent in those societies. For example, pedestrian and bicycle impacts with cars, buses and trucks have received much less attention than vehicle with vehicle crashes. A similar level of understanding has not developed yet for LMCs.

We have to accept the fact that safety has to be promoted in most LMCs within the existing conditions. These include low per-capita incomes, presence of mixed traffic, low capacity for capital intensive infrastructure, and different law enforcement capabilities. This approach will be important for LMCs as most of them are not likely to experience economic growth rates which put them at a par with HMCs within the next couple of decades. This implies that pedestrians, bicyclists and motorised two-wheeler (MTW) riders will remain dominant on LMC roads for many decades. This group of road users will be called the vulnerable road users (VRUs). Traffic systems in LMCs are very complex and will need new understanding and innovative solutions for promoting traffic safety.

THE SITUATION IN LMCs

Almost 80 percent of all cars are owned by 15 percent of the world's population residing in North America, Western Europe and Japan. On the other hand, in LMCs like India and China, less than one in a hundred families owns a car. The car ownership levels in the LMCs are so low that even at reasonable economic growth rates (say 7 to 10 percent per year) for the next few decades, most families in LMCs are not likely to own a car in the next quarter of a century. A comparison of vehicle registration levels per capita of the population and proportions of cars and motorcycles in a few countries is given in Table 1 on page 30.

These ownership patterns show that total vehicles registered per capita, and car and motorcycle ownership levels differ greatly in HMCs and LMCs. These different ownership levels influence traffic behaviour patterns and composition of traffic fatalities. The figures suggest two different phenomena that are relevant to traffic safety policies. It appears that total vehicle registration levels remain below 100 per thousand persons in countries

Table 1.
Vehicle ownership in different countries

Country	GNP per capita (US \$)	Total number of vehicles/1,000 persons	MTWs as % of total vehicles	Cars as % of total vehicles
Japan	34,630	640	20	58
USA	24,780	740	2	88
Germany	23,980	570	9	89
France	23,420	520	10	87
UK	18,340	410	3	86
Australia	18,000	610	3	76
Republic of Korea	8,260	206	24	33
Malaysia	3,140	340	56	34
Thailand	2,140	190	66	16
Philippines	950	32	26	28
Indonesia	810	58	69	15
Sri Lanka	600	50	60	13
China	530	21	40	24
India	320	30	67	14
Vietnam	210	27	91	9

* Statistics are taken from country reports, international agency publications and conference papers, year range 1992-1995.

that have per capita incomes of less than US \$1,000 and that motorcycle registrations decrease below 20 percent of the total vehicle fleet only when per capita incomes are much greater than US \$8,000 per capita. The only exceptions are countries like China where MTW production or availability has been controlled by government policy. The figures show that even at per capita income levels of US \$3,000 car ownership levels remain low and

the proportion of MTWs can be more than 50 percent. Most LMCs, including India and China, will not reach income levels of US \$3,000 in the next decade. As incomes increase, the poorest people in countries like India and China will be able to own bicycles and those who own bicycles today may opt to buy motorcycles when they become richer. As the number of poor and lower middle class people in these countries is larger than that belonging to the upper class, we are likely to witness greater increases in absolute numbers of bicycles and motorcycles than cars in the next decade or so. Traffic safety policies and countermeasures that are based on societies where car fleets constitute over 80 percent of the vehicle fleet will not be adequate for most LMCs where MTWs comprise more than 40 to 50 percent of the total number of vehicles.

The prevalent high rates of pedestrian, bicycle and motorcycle traffic in LMCs (proportions do differ from country to country) result in VRU fatalities constituting 60 to 80 percent of all traffic fatalities.⁷ These patterns of traffic and accidents in LMCs are not only different from those that are prevalent in HMCs today, but are also different from the experiences of HMCs in the past. The HMCs have never experienced road traffic that includes such a high proportion of motorcycles, buses and trucks sharing the same road space with pedestrians and bicyclists. In addition, when the present HMCs had low per capita incomes in the earlier part of this century, motor vehicles (including motorcycles) were relatively more expensive and not capable of as high velocity and accelerations. Therefore, speeds were lower and the number of vehicles using the roads was less than that seen today. In a sense, motor vehicle technology, roadway quality and social systems were more compatible. On the other hand, LMCs now use technologically advanced vehicles using relatively "less advanced" roadways and enforcement systems.

By the time HMCs started building expressways, a very large proportion of the population owned motorised vehicles. In addition, these countries could afford to have roads parallel to expressways that could be used by local traffic and by vehicles not allowed on expressways. In many LMCs, highways pass through rural areas with high-density populations where most of the people do not have access to motor vehicles. Also, many expressways in LMCs do not have parallel road links for slow and non-motorised traffic. This forces slow and non-motorised traffic to use expressways and to cross them illegally where underpasses are not provided.

The issues summarised above convince us that LMCs are experiencing a new phenomenon in road traffic patterns and accidents for which there is little precedent. The fact that these patterns are new and need to be understood through careful scientific research is not recognised by most professionals involved in traffic safety in LMCs. It should be realised that it

took decades to come up with effective traffic safety policies in HMCs. This effort involved the work of hundreds of professionals located in dozens of government institutions and universities. No such large-scale effort has been attempted in LMCs. If we just depend on HMC standards and research results to solve problems in LMCs, we may find the outcome to be very unsatisfactory.

INJURY AND HETEROGENEOUS TRAFFIC FLOW

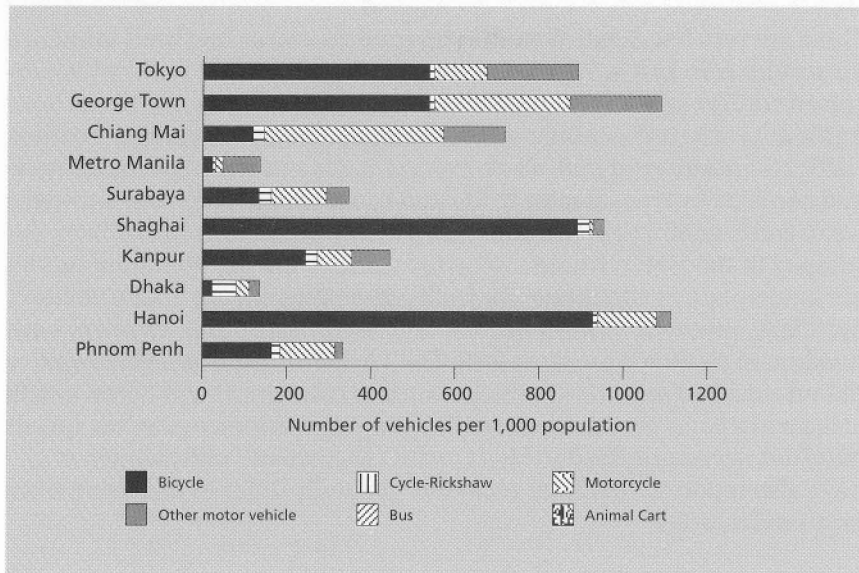
Mixed traffic in LMC cities

Asian cities are characterised by heterogeneous traffic (mix of non-motorised and motorised modes) and mixed land use patterns. Non-motorised vehicles are owned and used by a large section of the population (Figure 1). Car ownership rates in Asian countries are low compared to North America and OECD countries. In 1993 car ownership was 29 cars per 1,000 residents in East Asian countries compared to 561 cars per 1,000 residents in North America, and 366 in OECD countries.⁸ Although the greatest growth rate in the number of motor vehicles is expected in many Asian countries, most of these increases in absolute numbers of the vehicle fleets will result from increases in the numbers in MTWs and three-wheelers.⁹ In Thailand, Malaysia, Indonesia and Taiwan, two- and three-wheelers make up more than 50 percent of all motor vehicles. The number of two- and three-wheeled vehicles is expected to grow most rapidly in China and India. Non-motorised transport (NMT) constitutes a significant share of the total traffic in many Asian cities. Shanghai, Hanoi, Kanpur and Tokyo all have a relatively high rate of bicycle ownership and a high proportion of bicycle traffic (Figure 2). In Indian cities, the share of NMT at peak hour varies from 30 to 70 percent. The proportion of trips undertaken by bicycles ranges between 15 percent and 35 percent, the share tending to be higher in medium and small size cities. The patterns of NMT use change with growth in the city size. In most NMT-dependent low-income cities, bicycles are used for the entire trip (e.g., commuting, shopping). In a high-income city like Tokyo, bicycles are increasingly used as a feeder mode to rail stations as well as for shopping and other purposes.¹⁰ Every motorised public transport trip involves access trips by NMT at each end. Thus, NMT including walking continues to play a very important role in meeting the travel demand in Asian cities.

The road network is used by at least seven categories of motorised and non-motorised vehicles. Vehicles ranging in width from 0.60 to 2.6 m, and capable of maximum speeds ranging from 15 to 100 km/h, share the same road space. All these vehicles which have varied dynamic and static characteristics share the same carriageway. This traffic is characterised by lack of any effective channelisation, mode segregation or control of speeds. In the mind of the formally trained planner it looks like chaos moving

Figure 1.

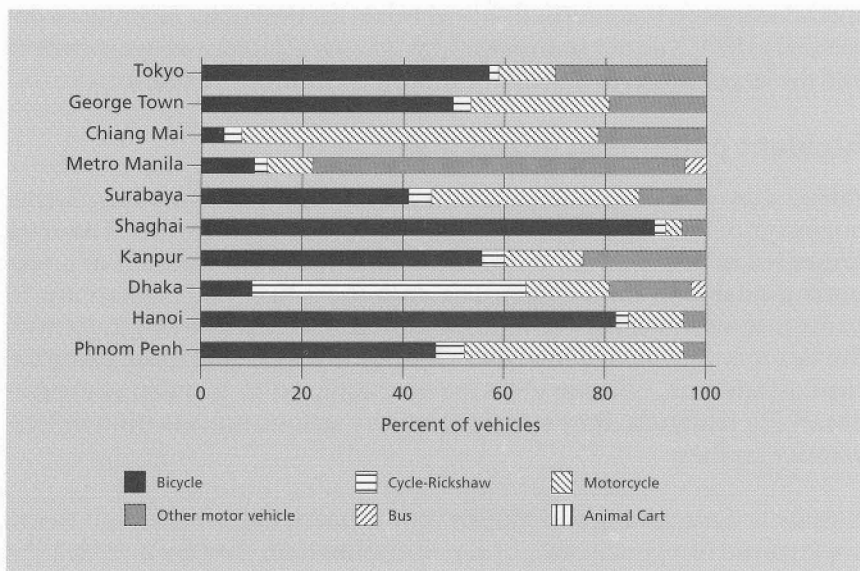
Comparison of vehicles per population among cities



Note: Animal carts & buses are negligible.

Figure 2.

Comparison of vehicle composition among cities



Note: Animal carts & buses are negligible.

toward total gridlock. Yet the people and goods keep getting through, and may, by some measures, actually be doing better than in some controlled conditions.

There are very few detailed studies on traffic patterns and their influence on accidents in LMCs. We use here a study conducted in Delhi which involved conflict analysis for prediction of fatal crash locations.¹¹ Peak hour traffic at 14 selected locations was video taped. Trained observers recorded traffic compositions at mid-block, average space and mean speeds by mode and conflicts by type, reactor mode and cause mode. The study showed a weak crash-conflict association. The present definitions of conflicts developed in the HMCs where motorised vehicles are the dominant modes are inadequate in situations like Delhi. In heterogeneous traffic streams, bicyclists, motorised two-wheelers and motorised three-wheelers have freedom of moving laterally as well. The 3.5-metre-wide lanes designed to fit four-wheeled motorised vehicles, such as cars, trucks and buses, can fit at least two lanes of two-wheelers. These space manoeuvres at low speeds need not necessarily lead to fatal crashes. Kuabenan¹² and Salimen et al.¹³ have also reported that fatal accidents generally differ in causation from non-fatal injuries.

In Delhi, different traffic modes are not segregated and there is minimal enforcement of speed limits. In this situation, flow patterns result in a natural optimisation of road use due to self-organisation by road users. Though aggregate conflict data do not correlate with fatalities, our data show that Delhi has a high number of VRU fatalities on its streets. Therefore, segregation and traffic calming techniques developed for Delhi conditions with special reference to motorised two-wheelers are desirable. Techniques developed in HMCs do not address the high volume of motorised two-wheelers and the large variations in traffic composition from site to site.

Accident patterns in mixed traffic

Table 2 shows the proportion of road users killed in various modes of transport as a percentage of all fatalities in different countries. The data presented in this table are based on available national statistics or on reports available to the authors. The data show that VRUs constitute 75 percent or more of all the fatalities in most LMCs. This flows logically from the fact that this class of road users forms the majority of those using the road. In addition, because VRUs are not protected by metallic or energy-absorbing materials, they sustain relatively serious injuries even in low-velocity crashes.

A study by Kajzer, Yang and Mohan shows that in LMCs buses and trucks are involved in a greater proportion of crashes than they are in HMCs.¹⁴ A summary of road traffic deaths in Delhi, India, is given in Table 3 on page

Table 2.

Road users killed in various modes of transport (as a % of all fatalities)

City, nation (year)	Pedestrians	Bicyclists	Motorised two- wheelers	Motorised four- wheelers	Others
Delhi, India (1994)+	42	14	27	12	5
Thailand (1987)+	47	6	36	12	-
Bandung, Indonesia (1990)+	33	7	42	15	3
Colombo, Sri Lanka (1991)+	38	8	34	14	6
Malaysia (1994)+	15	6	57	19	3
Japan (1992)#	27	10	20	42	1
The Netherlands (1990)#	10	22	12	55	-
Norway (1990)#	16	5	12	64	3
Australia (1990)#	18	4	11	65	2
USA (1995)#	13	2	5	79	1

+ LMCs # HMCs

36. These data show that VRUs constitute 77 percent of the fatal road traffic accident victims in Delhi and that trucks and buses are involved in almost two-thirds of the crashes. Similar details regarding crashes and impacting vehicles are not available in most LMCs. The situation on Indian highways is somewhat similar with the majority of those killed being VRUs. A study done on crashes on rural highways in the state of Tamilnadu in India shows that 39 percent of the fatalities were pedestrians, 16 percent bicyclists, 10 percent motorised two-wheeler riders, 6 percent car occupants, 13 percent truck occupants and 8 percent bus occupants.¹⁵

It is possible that wherever the proportion of VRUs is high as a proportion of all road users, similar crash rates will be experienced as in India. However, some LMCs do not have bicycle use rates which are as high as those

Table 3.
Road user fatalities by type of impacting vehicle, Delhi, India

Victim	Struck by									Total	(%)
	Ped	Bic	MTW*	TSR†	Car	Bus	Truck	Oth	Unk		
Pedestrian	-	-	29	19	35	154	99	22	110	468	(42)
Bicycle	-	1	6	1	6	39	50	13	18	134	(12)
MTW	2	2	15	1	20	88	67	30	27	252	(23)
TSR	-	-	-	4	1	13	8	2	1	29	(3)
Car	-	-	-	-	3	3	8	3	-	17	(1)
Bus	2	-	1	-	-	47	10	47	-	107	(10)
Truck	-	-	-	-	1	4	15	11	-	31	(3)
Others	-	-	-	1	3	12	29	12	5	62	(5)
Unknown	-	-	-	1	-	2	-	1	10	14	(1)
Total	4	3	51	27	69	362	286	141	171	1114	
Percent	(0.3)	(0.3)	(4)	(2)	(6)	(32)	(26)	(13)	(16)	(100)	

* MTW = Motorised two-wheelers, † TSR = Three-wheeler scooter-rickshaw.

seen in countries like India, China and Vietnam,¹⁶ and these countries have lower involvement of bicycle fatalities. In these countries where bicycle use rates are lower, it appears that MTW and pedestrian fatality rates are proportionately higher. These data show that in most LMCs, safety policies must focus on issues concerning the safety of VRUs and their interactions with trucks and buses.

Conflicting requirements of different road users

Users of different transport modes have conflicting requirements. Motorised vehicles need clear roads for uninterrupted traffic flow, whereas bicyclists and pedestrians need shady trees, kiosks for drinks, food and bicycle repair shops etc. at shorter distances. Highway planning standards provide for services needed by motorised vehicle users. However, there are

no standards for providing services needed by NMT. These services mushroom along urban or inter-city highways to fulfil the demand of road users; however, their existence is viewed as "illegal encroachment" on the designed road space.

Motorised vehicles are designed to operate at much higher speeds for better fuel economy and emission levels. Roads are also designed to increase throughput of motorised vehicles only. These measures decrease safety of NMV occupants and pedestrians sharing the same road space.

Urban streets passing through the commercial development and highways passing through small towns serve multiple purposes. They carry "through" traffic. However, the adjacent land use generates "cross" traffic and demands multiple space usage, for example, space for parking vehicles, space for hawkers and informal shopping etc. The existing design standards do not account for the conflicting demand between the local traffic and through traffic, resulting in sub-optimal conditions for both kinds of traffic.

There is a need to accommodate the conflicting requirements of NMV occupants and pedestrians and motorised traffic on our urban and inter-city highways. This includes redesigning the road cross-section, setting more exclusive space for pedestrians and NMVs, and giving pedestrians and bicyclists priority over cars at certain places.

UNDERSTANDING ROAD ACCIDENT INDICES

The indices used most often for understanding the traffic safety situation in a nation include fatalities per capita (FPC), fatalities per vehicle (FPV) and the fatality index (FI). The FI is calculated by dividing the total number of recorded fatalities by the number of injured persons. Almost all the reports presented at the Second Conference on Asian Traffic Safety (Beijing, 1996) by national delegates and representatives of the World Bank, Transportation and Research Laboratory (UK) and Ross-Silcock Ltd used these indices to demonstrate the gravity of the road accident situation in Asian countries. However, these indices cannot be used to compare or evaluate the level of safety in situations where the traffic conditions and vehicle usage are very different among countries.

FPC is a good index for determining the role of road accidents as an overall public health problem. For example, the USA has an FPC index of 16 per 100,000 population,¹⁷ and China 6 per 100,000.¹⁸ This comparison shows that the burden of road traffic accidents as a health problem is much lower in China than that in the USA. It would stand to reason then that the public health officials in China would logically give less importance to injuries due to road accidents than officials in the USA. This epidemiological fact is not understood well enough by international experts and they find it

difficult to understand why officials do not give traffic safety more importance: "Although traffic safety is already a major problem in China, this fact is not yet fully appreciated by senior government officials" (Hatim Hajj, Senior Transport Specialist, the World Bank, 1996).¹⁸

In a study undertaken for the United Nations ESCAP, Ross, Rahmatullah and Ghee document that fatalities per vehicle registered in LMCs (about 20–70 deaths per 10,000 vehicles) are much higher than those in HMCs (about 2 per 10,000 vehicles).¹⁹ The authors conclude that "this single indicator — annual fatalities per 10,000 vehicles — indicates the severity of the road accident problem in many countries in the Asia Pacific region". This is understood to mean that the traffic hazards are much worse in LMCs than in HMCs. Further, from this it is generalised that drivers in LMCs are very "careless", less "knowledgeable", and less "skilled" than those in HMCs. This generalisation is open to question.

Table 4 shows road user specific fatality rates in the USA, Malaysia and Delhi. The FPV rates in Malaysia and Delhi are 2.6 and 4.8 times greater than that in the USA respectively. But, when one examines road user specific rates, a different picture emerges. The car occupant fatality rate in Delhi is 30 percent higher and MTW rate 50 percent lower than the respective rate in the USA. If the exposure of pedestrians is much higher in Delhi then this higher rate may not represent as high a risk. The aggregate fatality rate per 10,000 registered vehicles is obviously not a good index to use for understanding risk and severity of the accident situation in countries with different traffic patterns. If we keep road user specific fatality rates constant for the USA and increase the proportion of MTWs in the fleet, then the FPV rate would be much higher than 2.1. This shows that aggregate FPV rates are highly dependent on vehicle mix in traffic and cannot be used to compare dissimilar situations.

LMCs in general have a larger proportion of non-motorised vehicles (NMVs) and pedestrians on the road than HMCs. Their numbers are never included in calculating these indices. If they were, then it is possible that fatalities per road user would not differ as much as the FPC index shows. Secondly, when two cars crash, the restrained occupants can expect to survive in crashes at velocities up to 50 km/h. On the other hand, if a car, bus or truck collides with a VRU at a velocity as low as 15 km/h, it is possible for the VRU to suffer a fatality. This means that for the same number of collisions in an LMC and an HMC, the number of injuries and fatalities in the LMC would be much higher. If one considers all these factors, it appears that the number of crashes per road user in LMCs may not be as high as the FPV index tends to indicate.

Ross, Rahamatullah and Ghee compare the FIs from HMCs and LMCs and conclude that "relative risk of death if involved in a road accident is 13 to

Table 4.

Road user specific fatality rates in different countries/cities

Country/city	Fatalities per 10,000 vehicles	Car occupant fatalities per 10,000 cars	MTW fatalities per million MTWs	Pedestrian fatalities per million population
USA (1995)	2.1	1.8	600	21
Malaysia (1994)	5.5	3	741	40
Delhi, India (1991)	10	2.3	402	75

27 times higher in such countries (LMCs).¹⁹ They underplay the fact that injury statistics in LMCs represent a fraction of the actual rates due to under-reporting and calculation of FIs is worthless. Statistics in Table 4 show that the conclusions of Ross et al. may be quite erroneous. They also claim that higher FI rates in LMCs indicate that "fatality index depends crucially on medical facilities". One cannot come up with such conclusions if the data used are worthless. The only method by which the effect of medical facilities can be evaluated is to compare the medical outcome of accident victims after normalising for severity of injury at the site of the accident. To the best of our knowledge such analyses have not been attempted.

PERCEPTIONS AND ISSUES CONCERNING TRAFFIC SAFETY IN LMCs

In the process of reviewing the available literature on traffic safety policies in LMCs we have a distinct impression that many issues are identified by national and international experts who are based on anecdotal accounts rather than a scientific analysis of the available data. When such procedures are adopted, the proposed countermeasures are also likely to be unsuccessful even if implemented. In this section we identify some of these issues by focusing on comments and recommendations made by international consultants and organisations like the World Bank,¹⁸ the Asian Development Bank, ESCAP, Transport Research Laboratory (UK),^{20,3} and Ross-Silcock Ltd.^{19,21} In the discussion that follows we have used comments included in such reports to identify issues that need some rethinking.

Awareness of the problem

All international consultants appear to be convinced that there is little awareness of the road accident problem in LMCs, especially among decision makers. This is not entirely correct. Traffic safety issues are highlighted regularly by newspapers in the LMCs and traffic safety literature for children is available in most countries. Over the past two decades a large number of countries in Asia and Africa have set up organisations (usually called "National Traffic Safety Councils") to coordinate traffic safety activity.²² Many countries have also prepared formal plans and policies for traffic safety. For example, the Government of India set up a high-level Study Group on Traffic Safety which submitted a 272-page report in 1972.²³ Therefore, the issue is not that there is a lack of awareness about the traffic safety problem among the decision makers or the citizens, but that there is a lack of knowledge and understanding about how to tackle the problem.

Discipline on roads

Road users in LMCs are accused of being very undisciplined and unaware of rules and regulations. This is not necessarily true. As we have mentioned earlier, there is increasing evidence that road users follow informal rules based on their life experience and what the existing traffic conditions and road designs demand.²⁴ Road user behaviour is heavily influenced by patterns of traffic and policing policies. According to our observations, Europeans and Americans can be as "undisciplined" on LMC roads and LMC citizens very quickly adapt to more disciplined patterns when visiting HMCs. Police enforcement policies have to differentiate between what influences crash rates and what does not. The traffic in LMCs is a function of the heterogeneous mix of road users, inappropriate road design, and low budget-policing methods. These are the issues we need to focus on.

Data and analysis

All LMCs maintain police records of traffic accidents and hospitals also have associated information. A careful analysis of these exiting data in hard copy is adequate to arrive at a first approximation of the issues involved and for setting priorities. Data are available but scientific analyses are not available. For analysis one needs expertise, time and patience. More in-depth data will be useful only after the development of well-trained epidemiological expertise in LMCs.

Availability of software like the Micro Computer Accident Analysis Program (MAAP), (TRL, UK), does not necessarily improve analysis. A study of the use of MAAP in Bangalore, India, and that of the reports produced by LMC professionals using MAAP shows that most of the conclusions and recommendations mentioned were not based on data collected or tables

produced by MAAP.²⁵ The same “conclusions” could have been produced before any data collection and analysis. (see page 130 for details of MAAP.)

Driver competence

Driver competence, training and licensing are identified as a major concern for LMCs. Most LMCs have stringent licensing regulations in place: “... the requirements and cost of obtaining a driver’s licence (in China) are much more demanding than in any Western country”.¹⁸ What we really need to do is to determine what kind of driver behaviour is inappropriate and linked to crash causation before we can do much about driver training. Such information is not available at present. It is very difficult to evaluate what is driver “competence”. We also have to keep in mind the results of international studies that show that car drivers who are experts at controlling their cars have more accidents in daily life than ordinary drivers.²⁶ Since buses and trucks have a greater involvement in accidents in LMCs, we can focus on training of bus and truck drivers. Before such activities can be undertaken seriously, we need to do studies which identify driver problems in LMCs and the factors in driver training that would influence rates there.

Vehicle maintenance and inspection

The purchase of vehicle inspection equipment is often included in traffic safety projects recommended for LMCs. The experience of HMCs in obtaining low safety returns from vehicle inspection policies should be examined in greater depth to understand the relevance of such equipment in LMCs. Vehicle maintenance and upkeep are also dependent on the per capita income of a society. When vehicles are relatively old or not in very good condition, they are driven at lower velocities and this has a compensatory effect on accident rates. It is possible that vehicle inspection regulations may not prove to be any more beneficial than they have proved to be in HMCs.

Safety propaganda and education

All international consultants and local decision makers in LMCs believe that safety education can play a very important role in reducing road accident rates. The evidence from HMCs is quite conclusive that education may be effective only in changing behaviour over a long period of time and when combined with other initiatives including policing and design changes in vehicles and the road environment.^{26,27,28,29} There is no evidence to believe that the theoretical reasons why education alone is not so effective in changing road user behaviour in HMCs should not apply in LMCs also. Researchers working in LMCs focus on studying drivers’ and pedestrians’ knowledge of road signs and rules. The results of such studies

often show a lack of such knowledge. No studies are done to determine whether this actually results in higher accident rates. Children's age-specific and exposure-related mortality rates in all LMCs are not higher than those in HMCs. However, it is assumed that children in LMCs need special attention. Similarly, driver education is considered very important without analysing why drivers behave the way they do. For example, the Delhi Transport Corporation requires their drivers to complete their trips in much less time than equivalent trips in European cities. This pressure on drivers forces them to drive at higher speeds and this results in higher accident rates. But the drivers are blamed for "rash driving" and being in need of safety education.

Blackspots and quality of roads

Blackspot analysis and treatment is given maximum importance in all international consultancy projects in LMCs. This is in spite of the fact that there is no consensus on the actual effectiveness of blackspot treatment in HMCs. A recent review by Elvik concludes that "... the results of before and after studies of road accident blackspot treatment depend strongly on which of the confounding factors studies control for. Large reductions in the number of accidents, generally in the order of 50 to 90 percent, were found in studies not controlling for any confounding factors ... Studies simultaneously controlling for general trends, regression to the mean and accident migration did not find any statistically reliable effect of blackspot treatment on the number of accidents".³⁰

A study of blackspot treatment in Malaysia done as a part of a World Bank project shows that some sites showed a reduction whereas the others showed a "substantial increase" in accidents.³¹ A major project in Korea was to undertake blackspot treatment under the advice of Ross-Silcock Ltd and it is reported that 53 percent of the sites showed a decrease in accident rates and that installation of speed humps was found to be most effective.³² Another study done in Indonesia with the assistance of TRL (UK) reports that blackspot treatment at three locations resulted in a decrease in accidents.³³ However, they also mention that there could have been some under-reporting of accidents in the post-treatment period. None of these studies controlled for all the confounding factors considered important by Elvik.³⁰ In many cases where blackspots have been identified as those locations where pedestrians get hit while crossing a road, a fence is installed to stop such road crossings. The "after" study obviously shows much improvement since pedestrians have been removed from that location. Such changes cannot be considered as improvements because no analysis is made of the different locations where the pedestrians have migrated to. In addition, the inconvenience caused to pedestrians is not taken into account. Though there is no conclusive evidence regarding effectiveness of blackspot treatment from LMCs, all policy documents list this counter-

measure as the most effective. The accident recording software (MAAP) developed by TRL (UK) concentrates on blackspot analysis as its major analytical tool.

The quality of roads issue has to be addressed in terms of providing better facilities to non-motorised road users, developing suitable designs for heterogeneous traffic and slowing traffic in residential areas. Even on national highways, the majority of people killed are pedestrians, bicyclists, two-wheeler riders, and there are crashes with tractors/bullock carts in many LMCs. Therefore, unless these issues are addressed and methods developed for area-wide safety improvements, we will not be gaining much by concentrating on blackspot treatment.

Policing and traffic control

We cannot depend on electronic traffic control methods for improving traffic in the near future. They are far too expensive, need a great deal of monitoring by a highly trained and very well equipped police force, and then improve traffic flow only by 5 to 10 percent in some situations. In some cities area-wide traffic control systems have resulted in worsening of traffic.³⁴ Policing methods and priorities need to be developed for LMCs which identify areas where better training is needed for actually improving safety on the roads.

Traffic safety research in the HMCs has involved a large number of very gifted professionals from a variety of disciplines over the last 25 years. Some very innovative work has resulted in a theoretical understanding of "accidents" and as a part of a very complex interaction of sociological, psychological and technological phenomena. This understanding of injuries and crashes has also helped us design safer vehicles, roads and traffic management systems. A similar effort is now necessary for evolving traffic safety priorities for LMCs. If the above arguments have a basis in reality, then we will have to reassess the current priorities recommended for LMCs. We have to have a much better understanding of the situation in LMCs. Then we will be able to give more attention to structural, technological, and traffic management issues for improvements in traffic safety in LMCs.

RECOMMENDATIONS

Institutional structure

A large number of LMCs have established National Traffic Safety Councils or their equivalents. This has been done very often on the advice of consultants with the idea that they will be able to coordinate activities between government departments, universities and non-government organisations. This has ignored the HMC experience that without "legislative teeth" and

funding such all-embracing advisory bodies are not able to achieve much. This is why such Councils have not been very effective in promoting traffic safety because they did not have enough budgetary allocations and institutional powers to push forward concrete and useful traffic safety policies. Such councils have been in existence in some countries for more than two decades. At present not enough research is being done in any LMC on traffic safety issues and so these councils depend upon perceptions of lay persons and at times just end up pushing hobby horses of important politicians and bureaucrats. There is a lack of formal institutional structures to collect reliable data and to perform scientific studies on the epidemiology of road accidents for the evolution of safer designs of roads and vehicles. Therefore, it is important that:

1. Every country establish a department for traffic safety within the government structure. This department must have a staff of professionals specifically trained on traffic safety issues. The department must have powers to have its recommendations implemented within the country. The department should also have the role of creating various associated agencies concerned with traffic safety. It should also be responsible for funding and promoting research and development in the area of traffic safety.
2. Traffic safety research institutions should be established in every country or jointly by a group of countries having similar traffic conditions and income levels. In addition, academic institutions should also be funded to start programs for training and research in this area. It would be the responsibility of such institutions and research centres to co-operate with the department of traffic safety for developing scientific programs. This is the only way to create a cadre of professionals who have long-term interests in the subject. Such professionals have a vested interest in perpetuating their own breed and thus end up training more people in traffic safety. We cannot depend only on training bureaucrats and policemen. These officials can lose interest and also be transferred to other jobs.
3. Police and road construction departments must also have traffic safety cells staffed by trained personnel.

Priorities

1. The vulnerable road users (VRUs) — pedestrians, bicyclists and motorised two-wheeler users, constitute a vast majority of victims in almost all LMCs. All traffic safety programs must focus specifically on the safety of VRUs. Unless this is done, it will be almost impossible to improve traffic safety in these countries.

2. In many of the LMCs, trucks and buses are involved in a large number of crashes. Special attention needs to be given for safer use and design of these vehicles.
3. Speed control is perhaps the most important measure for reducing road traffic crashes in LMCs. Methods to control speeds in urban and residential areas should be given the highest priority. Currently we do not have a good understanding of how this can be done at low policing levels in the traffic mix seen in LMC urban areas. For rural roads there are not good designs for non-expressway safety with high VRU participation.

Data

1. Data collection methods must be improved and standard forms developed and used for making analysis easier and more scientific.
2. In the absence of detailed data, whatever data are available should be used for analysis in a scientific manner to determine traffic safety priorities for research and action.
3. In addition to analysis of fatalities, attempts should also be made to analyse factors associated with serious injuries as the epidemiology of the latter may be different from the former.

Vehicle factors

Most vehicles are traded internationally these days. Therefore, it would make sense for such vehicles to conform to some minimum international standards. This would apply most importantly to automobiles. LMCs could apply their own standards in addition, to make the vehicles more suitable for their specific traffic conditions.

In many LMCs there has been a growth of vehicles which have been designed locally and do not conform to international safety standards. There is a wide variety of these vehicles but they can be broadly classified into three groups:

1. three-wheeled vehicles;
2. four-wheeled vehicles; and
3. trailers pulled by tractors or other similar vehicles.

These vehicles will be termed country-specific motor vehicles (CSMV) in this paper.

Crashworthiness of CSMVs

The construction methods, materials used and economic considerations will not allow for the imposition of car safety standards on these vehicles. It will also not be easy to design very efficient crash-attenuating frontal structures for CSMVs. However, design changes can be attempted in the following areas:

1. improvements in rollover characteristics of the vehicles;
2. body designs which restrict passenger ejection from vehicles;
3. removal of all pointed and sharp objects (eg. bolts, rivets, etc.) from the inside surfaces of the cabin;
4. provision of impact-absorbing padding in areas where passengers are likely to hit the vehicle surfaces during a crash; and
5. improvements in conspicuity of the vehicles and lighting arrangements.

The types of changes mentioned above will not require heavy investments in research and can be implemented with local initiative.³⁵ Cooperation and involvement of biomechanics experts from around the world as short-term consultants can make a significant contribution in making CSMVs safer.

Design of less aggressive fronts for buses and trucks

During the past decade, the pedestrian safety problem for impacts with private cars in HMCs has been studied using mathematical models, epidemiological studies, and impact tests with mechanical dummies and biological materials.³⁶ Various recommendations for the front structure design of vehicles (mainly private cars) have been made. However, the fronts of buses and trucks have not been designed to be "forgiving" in impacts with VRUs.

Preliminary studies show that it is possible to design fronts of buses such that impact forces in a bus-pedestrian impact can be reduced significantly.¹⁴ This is done by making the front of the bus "softer". Much more work needs to be done to optimise padding properties for impacts at different velocities and for different age groups of pedestrians. Once these material properties are determined, then designs will have to be developed for retrofitting old buses. Standards will also have to be developed for crashworthiness of buses in impacts with pedestrians and bicyclists.

Ergonomic design of NMVs

It is possible that if bicycles, rickshaws and other NMVs were made more comfortable for the user and their braking abilities and conspicuity improved, then they may be involved in fewer crashes. For example, many bicycle riders are involved in a crash because they fall on the road and then an oncoming vehicle hits them.^{14,37} Some of these crashes may be prevented if bicycles were low enough so that the riders' feet could touch the ground.

Most NMVs have terrible braking systems. Vehicle drivers are generally not aware of the problems NMV users face in stopping their vehicles in a hurry. Better braking systems and education of motor vehicle drivers could help reduce the probability of a crash in emergency situations.

NMVs and MTWs are much less conspicuous, especially at night. An economical way of making NMVs and MTWs more conspicuous is to encourage the use of colours like yellow and orange by education of users and eventually by legislation. Wheels and rear portions of rickshaws and carts can very easily be painted in these colours. Many countries require placement of reflectors on the front and back of NMVs. However, use of reflectors on the sides of these vehicles would also help as they would then become more noticeable at intersections.

Road surface and lighting

Data on walking and details of all injuries sustained by pedestrians are not widely available. Most people around the world travel largely by foot,³⁸ especially in densely populated urban areas. Pedestrian safety research has focused on vehicle-pedestrian impacts. Very little work has been done on non-collision injuries sustained by pedestrians and a majority of them do not figure in accident statistics. In a study of some villages in North India, we found that a substantial number of pedestrian injuries did not involve any vehicle.³⁹

Non-collision injuries among pedestrians are generally due to falls, impacts with obstructions on the road or path, and sprains due to twisting of the ankle. In cold climates, falls on icy surfaces also play an important role.⁴⁰ Pedestrians injured in falls on slippery surfaces spent an average of 20 days in the hospital in Motala in Sweden.

Pedestrians, more than motor vehicles, need to have clean surfaces on which to travel. Even small objects can cause injuries to toes. Uneven surfaces or small potholes result in sprains or falls which can disable individuals for more than three weeks. Sidewalks or streets where people walk suffer worse maintenance than roads for vehicles, both in HMCs and LMCs. A survey in the UK found that 46 percent of the sidewalks had broken

or uneven pavements.⁴¹ In LMCs, sidewalks are either non-existent or kept in bad conditions. The relative role of “single vehicle” accidents of pedestrians must be given much more prominence so that more realistic financial allocations are made for maintaining walking surfaces.

A great deal of work has been done on street lighting standards. Most of this has focused on the needs of the motor vehicle driver. Very little work has been done to understand the needs of pedestrians and bicyclists. Pedestrians and bicyclists find it difficult to detect changes in road surface levels and obstructions when lighting conditions are not good. In particular they find it difficult to differentiate between changes in levels and shadows.

It would be difficult to have lighting conditions such that all streets are well illuminated always, especially in countries and communities where finances are limited. Standards have to be set for designing pavements and bicycle paths such that obstructions, changes in levels, turns, etc. are conspicuous. Research also needs to be done to set standards for minimum and maximum dimensions of steps and slopes. Positions of street lights and reflectors have to be determined such that they help pedestrians and NMVs negotiate their way safely at night.

Traffic separation

Pedestrians and NMVs are forced to share road space with motor vehicles because there is either no separate space earmarked for them or the designated space is inconvenient to use. Many crashes take place because pedestrians and bicyclists are hit by vehicles who may not have noticed them, especially at night.³⁷ It is very important to provide physically separated spaces for pedestrians and NMVs on arterial roads.

Road designers and urban planners in most parts of the world feel that providing separate space for pedestrians and NMVs involves a great deal of expense. This is because roads are considered to be space meant mainly for motor vehicles. However, VRUs constitute a significant proportion of road users and it is imperative that their needs are given as much importance as those of motor vehicles.

In general, flow rates for pedestrians and bicycles are very high compared to passenger transport by motor vehicles on the same road spaces.⁴² These data show that in urban areas more people can be transported in the same space by providing walkways and bicycle paths. The expense of building and maintaining these paths would also be much less than travel lands required for motor vehicles.

A study done in Delhi indicates that when bicycles are not segregated on arterial roads, one lane operates as a defacto bicycle lane.¹¹ This means

that when bicycle traffic on a three-lane road is not segregated, only two lanes remain available for motor vehicle traffic. Therefore, by segregating traffic we not only make the roadway safer for VRUs, we may also end up improving traffic flow rates in urban areas.

On non-arterial roads in urban areas it may not always be desirable to separate NMVs and fast-moving traffic. Very little research has been done in this area and there are no clear guidelines regarding situations when separation is advisable and when it is not. Standards and policy frameworks have to be developed to help road planners and engineers design road and traffic systems for mixed traffic in urban areas. This must come from professionals who understand the local issues.

The studies cited above are preliminary investigations into studying the effects of NMVs on traffic flow. At present there are very few traffic flow models which account for NMVs. Much more work needs to be done to incorporate NMVs in traffic flow modelling. Improved computer models which incorporate NMVs in traffic flow would help in optimising road design and setting guidelines for separation of traffic.

Intersection designs for roads which have segregated NMV traffic is an area where we need much more data from real world experience. NMV riders find it very difficult to make turns at intersections without coming into conflict with motor vehicles. Traffic light cycles, and guidelines for traffic control at intersections where NMVs have a presence, are areas where much more innovative work is necessary. New roundabout designs hold a great deal of promise for improving safety both on urban and rural roads.

Speed control

Speed control measures have particular relevance for LMCs. Use of restraint systems by vehicle occupants is not likely to make a large dent in the overall accident death rates because car occupants constitute less than 10 percent of the fatalities. Speed limiting devices on vehicles, limits on engine power, and traffic calming measures hold the greatest promise in LMCs. There is an urgent need for research on traffic calming measures for roads with a high percentage of motorcycles and safer design of intercity roads with non-motorised traffic. The latter issue is particularly important because motorised traffic is increasing in LMCs and we will not be able to afford limited access motorways for intercity travel. Environmental, energy conservation and financial concerns are also exerting a push toward downsizing of vehicles in LMCs. There are severe physical limits to safer design of very small cars. Lower speed limits would be necessary wherever these smaller vehicles are introduced.

Speed control appears to be one of the most effective and promising ways to reduce injuries and deaths in road traffic crashes in the next decade.^{43,44,45,46,47} In LMCs this holds great promise because improvements in vehicle design may have reached a point of diminishing returns. In LMCs the effects of lower speeds on the safety of vulnerable road users would be more significant than safer vehicle designs. Any money spent on research to develop vehicle and road designs which control speeds automatically would be money well spent.

Vehicle speeds can be controlled by adopting traffic calming measures in urban areas. In the past few years many guidelines for traffic calming have been published in the HMCs.⁴⁸ Most of the ideas included in these guidelines apply to LMCs also. However, these ideas are most suitable to traffic situations where cars constitute a vast proportion of road traffic. These ideas have to be modified for traffic situations where NMVs and MTWs may be a significant proportion of road traffic.

For example, chicanes, road closures, entry treatment and traffic throttles may slow down cars but may not have the same effect on MTWs. On the other hand, some of these obstructions may make it difficult for rickshaws and hand-pulled carts to operate. Therefore, a fresh look has to be given for designing traffic calming measures for LMCs. This is particularly relevant for intercity roads passing through the centre of small towns.

Human factors and protective systems

Motorcycle helmets

The effectiveness of motorcycle helmets is widely accepted around the world. However, there are still many LMCs where compulsory helmet laws are not uniformly applied. It is very important that helmet use among MTW riders becomes compulsory in all the LMCs.

Helmet designs which incorporate ventilation would help in making them more acceptable to riders in warm climates. Some designs of helmets with ventilation have been developed and are being sold in India. Some of these helmets may have problems in meeting all the international helmet safety standards. These standards usually include a penetration test which makes it mandatory for the helmet shell to be very tough and also precludes the provision of holes for ventilation. Research studies show that motorcyclists' heads are rarely hit by pointed objects,⁴⁹ and therefore it is necessary to review the motorcycle helmet standards to make it possible to provide ventilation.

Because the outer shell of the helmet has to be very rigid, the costs of manufacturing the helmet also increase. The shock-absorbing padding (generally polystyrene) is relatively inexpensive. By changing the current standards, it may be possible to provide less rigid shells which are less expensive. There

is some evidence that such designs are possible.⁵⁰ Much more work needs to be done in this area so that a strong case can be made for changing the helmet penetration test requirements. It is our impression that a relatively safe helmet can be designed and marketed in India for about US \$15.00.

Bicycle helmets

Studies show that bicycle riders can suffer serious head injuries at ordinary speeds in non-crash-related falls.⁴⁹ In such situations, and in impacts with other vehicles, a bicycle helmet would be very useful. The state of Victoria in Australia is the only place where use of helmets by bicycle riders is mandatory and also British Columbia and Ontario in Canada with exemptions.

It will not be possible for some time for such laws to be introduced in most LMCs. Designs have to be developed which make it possible to manufacture and sell bicycle helmets which are much cheaper. In any event, it would be possible to push bicycle helmet laws in LMCs only after all MTW riders start using them.

Conspicuity of VRUs

One of the major reasons why VRUs are involved in traffic crashes is that they don't appear conspicuous enough at night. Many two-wheeler riders in HMCs wear reflective vests or jackets to make themselves more conspicuous. These jackets and vests may not become very popular in LMCs because of the costs involved and also because they are uncomfortable to use in warm climates. A design has been developed for a shopping bag which can be converted into a conspicuous vest just by cutting the bottom.⁵¹ If all shops handed out such bags in yellow and orange colours, then conspicuous vests would be freely available in every home. The advantage of this design is that even if people do not use it as a vest, no one loses any money.

CONCLUSIONS

Traffic safety research in the HMCs has involved a large number of very gifted professionals from a variety of disciplines over the last four decades. Some very innovative work has resulted in a theoretical understanding of "accidents" as a part of a complex interaction of sociological, psychological, physical and technological phenomena. The results could be exchanged and solutions transferred from one HMC to another because the conditions in these countries were roughly similar. This understanding of injuries and accidents has helped us design safer vehicles, roads and traffic management systems. A similar effort at research, development and innovation is needed in LMCs. A much larger group of committed professionals needs to be involved in this work for new ideas to emerge. Roving "experts" cannot do the job adequately.

Knowing the principles of epidemiology is more important for understanding issues than merely the availability of more data. Like all other developments in science and technology, traffic safety measures in the HMCs developed at certain historical junctures. They have an imprint of the prevailing socio-economic situation embedded in them. When the HMC policies and designs are transferred to societies which have much lower per capita incomes, then large parts of these policies and designs are not successful. However, the attempt at introducing these measures in LMCs also sets up a demand for instituting systems and technologies which imitate those in HMCs. Since this is not always possible at low levels of income, these projects either become status symbols without much functional value, or remain in place as demonstration projects. While a few present small LMCs can experience high growth rates for some periods, most of the other countries will continue to function as LMCs for quite some time to come.

International cooperation in the area of traffic safety should focus on exchange of scientific principles, experiences of successes and failures, and on scientific training of a large number of professionals in the LMCs.

REFERENCES

1. Mehta, R.D., Bahadur, A.P. and Singh, N.J., (1996). India's efforts to make roads safer. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp.61-71.
2. Liren, D., (1996). Viewing China road traffic safety and the countermeasures in accordance with international comparison. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp. 39-60.
3. Jacobs, G.D. and Kirk, S., (1996). Safety Problems in Developing Countries. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp. 435-440.
4. Saad, F., (1990). Contribution de l'analyse des comportements des usagers de la route au diagnostic de securite routiere: études de cas dans trois pays en développement. *International Conference on Traffic Safety and Accidents in Developing Countries, Cairo*. Academy of Scientific Research and Technology: Cairo, Egypt.
5. Tiwari, G. and Kanda, A. simulation of heterogeneous traffic flow, *J. Indian Roads Congress* (in print).

6. Saad, F., (1990). Road User Behaviour. *Introduction to road traffic safety: a multidisciplinary approach*, Eds. D. Mohan and N. Muhlrads, Indian Institute of Technology: Delhi, pp.79-92.
7. Mohan, D., (1992). Vulnerable road users: an era of neglect. *Journal of Traffic Medicine*, 28:3, 121-128.
8. AAMA, (1995). *World Motor Vehicle Data*, 1995 Edition. American Automobile Manufacturers' Association: Detroit, USA.
9. World Resources Institute, (1996). *World Resources: A Guide to the Global Environment*. The World Resources Institute: Washington DC., USA., pp82.
10. World Bank, (1995). *Non-Motorised Transport in Ten Asian Cities*, Report TWU 20, The World Bank: Washington DC, pp27.
11. Tiwari, G., Mohan, D. and Fazio, J., (1995). Conflict Analysis for Prediction of Fatal Crash Locations in Mixed Traffic Streams. *Proceedings Annual Conference of the Association for Advancement of Automotive Medicine*, AAAM: Des Plaines, IL, USA, 399-420.
12. Kuabenan, R.D. (1996). When fatal accidents happen in normal conditions. *Handbook of the International Conference of Traffic and Transport Psychology*. Valencia, Spain, 105-115.
13. Salminen, S. et al., (1992). Fatal and non fatal accidents: identical vs differential causations. *Safety Science*, 15: 108-118.
14. Kajzer, J., Yang, Y.K. and Mohan, D., (1992). Safer bus fronts for pedestrian impact protection in bus-pedestrian accidents. *Proceedings 1992 International IRCOBI Conference on the Biomechanics of Impacts*, 13-23. IRCOBI: Bron, France.
15. The Institute of Road Transport, (1996). *Identification of Accident Prone Stretches in National Highways in Tamilnadu*. IRT: Chennai, India.
16. Tiwari, G. and Saraf, R., (1997). *Bicycle Transport and Prevention of Theft - A Case Study of Five Cities*. Applied Systems Research Program, Indian Institute of Technology: Delhi, India.
17. NHTSA, (1996). *Traffic Safety Facts 1995*. National Highway Traffic Safety Administration: Washington D.C., USA.
18. Hajj, H., (1996). A framework for traffic safety improvement in China. *Proceedings Second Conference on Asian Road Safety*, 82-103, Beijing, China.

19. Ross, A., Rahmatullah, M. and Ghee, C., (1996). Traffic safety in Asia Pacific region: trends, comparisons and prospects. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp.19-38.
20. Downing, A., (1993). Pedestrian safety in the developing world. *Proceedings Conference on Asian Road Safety 1993*. Kuala Lumpur, Malaysia, pp. 7:10-25.
21. Ross, A. and Melhuish, C., (1996). Traffic safety initiatives and action plans: lessons for the Asia Pacific Region. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp. 263-274.
22. Recommendations and Summary: International Course on Control and Prevention of Road Traffic Accidents and Injuries, (1996). Transportation Research and Injury Prevention Program: Indian Institute of Technology, Delhi, India.
23. Government of India, (1972). *Report of the Study Group on Road Safety*. Ministry of Shipping and Transport: New Delhi, India.
24. OECD, (1990). *Behavioural Adaptations to Changes in the Transport System*, Organisation for Economic Co-operation and Development: Paris, France.
25. Tiwari, G., (1996). Analysis of data collection systems in Asian countries. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp. 105-118.
26. Evans, L., (1991). *Traffic Safety and the Driver*. Van Nostrand Reinhold: New York.
27. Berger, L.R. and Mohan, D., (1996). *Injury Control: A Global View*. Oxford University Press: New Delhi, India.
28. OECD, (1993). *Marketing of Traffic Safety*. Organisation for Economic Co-operation and Development: Paris, France.
29. Robertson, L., (1983). *Injuries: Causes, Control Strategies and Public Policy*. Lexington Books: Lexington MA, USA.
30. Elvik, R., (1997). Evaluations of road accident blackspot treatment: a case of the iron law of evaluation studies, *Accident Analysis and Prevention*, 29:2, 191-199.

31. Kamalaldin, A.L. and Barton, A.W., (1996). The identification and treatment of accident blackspots on federal highways in Malaysia. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp.192-199.
32. Hong, Doo-Pyo, (1996). Safety evaluation after improvements at blackspots in Korea. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp.200-213.
33. Rudjito, D., Umar, S. and Sargeant, B., (1996). Blackspot investigation in Indonesia. *Proceedings of the Second Conference on Asian Road Safety, Beijing, China, 28-31 October 1996*. The Society of Traffic Engineering: Beijing, China, pp. 413-427.
34. Mohan, D., Tiwari, G., Saraf, R., Deshmukh, S.G., Kale, S.R., Wadhwa, S. and Soumitri, G.V., (1997). *Delhi on the Move 2005: Future Traffic Management Scenario*. Transportation Research and Injury Prevention Program: Indian Institute of Technology, Delhi, India.
35. Mohan, D., Kajzer, J., Bawa-Bhalla, K.S. and Chawla, A., (1997). Impact modelling studies for a three wheeled scooter taxi. *Accident Analysis and Prevention*, 29:2, 161-170.
36. Kajzer, J., (1991). Impact biomechanics of knee injuries. Thesis, Department of Injury Prevention: Goteborg, Sweden.
37. Mohan, D. and Bawa, P., (1985). An analysis of road traffic fatalities in Delhi, India. *Accident Analysis and Prevention*, 17:1, 33-45.
38. Wright, C.L., (1990). A characteristics analysis of non-motorised transport. *UMTRI Research Review*, 20:5:1. The University of Michigan: Ann Arbor, Mi, USA.
39. Varghese M. and Mohan D., (1991). Transportation injuries in rural Haryana. In *Proceedings of the International Conference on Traffic Safety*, New Delhi: Macmillan India Ltd., 326-329.
40. Nilsson, G., (1989). Safety for different road user groups - data collection, problems, consequences and costs. *Proceedings of The Second European Workshop on Recent Developments in Road Safety Research*, INRETS: Arcueil Cedex, France, 65-73.
41. Transport 2000. *Feet First, the Case for a Pedestrian Priority*, 2. Transport 2000: London, UK.

42. *Transportation Strategies for Human Settlements in Developing Countries* (1984). UNCHS/HABITAT: Nairobi.
43. ETSC, (1995). *Reducing Traffic Injuries Resulting from Excess and Inappropriate Speed*. European Transport Safety Council: Brussels.
44. Fieldwick, R. and Brown, R.J., (1987). The effect of speed limits on road casualties. *Traffic Engineering and Control*, 28:12, 635-640.
45. IIHS Facts, (1987). *55 Speed Limit*. Insurance Institute for Highway Safety: Arlington VA, USA.
46. Noguchi K., (1990). In search of "optimum" speed: from the user's viewpoint. *IATSS Research*, 14: 66-75.
47. Rock, S.M., (1995). Impact of the 65 mph speed limit on accidents, deaths and injuries in Illinois. *Accident Analysis and Prevention*, 27: 2, 207-214.
48. Vahl, H.G. and Giskes, J., (1990). *Traffic Calming Through Integrated Urban Planning*. Amerconde: Paris, France.
49. Mohan, D., Kothiyal, K.P., Mishra, B.K. and Banerji, A.K., (1984). Helmet and head injury study of crash involved motorcyclists in Delhi. *Proceedings 1984 International Conference on Biomechanics of Impacts*, 65-77. IRCOB: Bron, France.
50. Mohan, D. and Patel, R., (1992). *Safety Assessment of Motorcycle Helmets Being Sold in Delhi*, A Report prepared for the Delhi Police. CBME, Indian Institute of Technology: New Delhi.
51. Mohan, D. and Patel, R., (1990). Development and promotion of a safety shopping bag/vest in developing countries. *Applied Ergonomics*, 21:4, 346-347.

CHAPTER FIVE

A Tale of Two (Model) Cities: A Planning Study in the People's Republic of China

Ian Johnston

BACKGROUND AND ACKNOWLEDGMENT

The People's Republic of China is undergoing massive economic development. This requires vast investment in infrastructure of all kinds, including, as a primary need, transport infrastructure. The Asian Development Bank (ADB) is one of the international agencies financing such infrastructure creation.

A dramatic restructuring of cities typically accompanies economic development. New industries are located in cost-effective "industry parks", frequently established on the outskirts of existing cities. Existing industry is also often relocated from inner city locations to meet the demands for space required by new manufacturing technologies as well as to facilitate transport. Simultaneous changes in urban form, in the nature of work activity and practice, and in lifestyle, provide enormous challenges for government to meet. It is not surprising, therefore, that traffic safety concerns are not paramount.

The ADB is aware that it is much more effective to build traffic safety into a road transport system as part of its development than it is to take corrective action at a later stage. Increasingly, the ADB makes the development of a traffic safety strategy and action plan a condition of an infrastructure

development loan to a rapidly motorising country. This chapter describes just such an instance in the north-eastern Chinese province of Heilongjiang. The traffic safety project was carried out under contract to the ADB by a consortium led by ARRB Transport Research Ltd. The project leader was Dr. J.R. Jarvis; the principal sub-contractors were Rust PPK, VicRoads and David Axup and Associates. This chapter draws heavily on the contract report,¹ and on discussions the author has had with Dr. Jarvis. No attempt is made to describe the traffic safety problems of Heilongjiang or the strategies and measures the study team recommended to deal with them. Rather, an attempt has been made to tease out, from the study team's experiences, principles for transfer of traffic safety knowledge. The interpretations drawn from this analysis are solely those of this author.

SOME 'PRINCIPLES' FOR CROSS-CULTURAL KNOWLEDGE TRANSFER

The safety strategy must be consonant with the transport development strategy.

Effective investment in transport infrastructure is fundamental to the success of economic development in the People's Republic of China. A traffic safety strategy can only be effective if it is implemented. Unless the strategy is consonant with the road network development strategy then its probability of implementation is negligible.

Winning hearts and minds.

The first plank in an effective traffic safety strategy is to obtain commitment to its implementation.

It was clear early in the study that there was a degree of "opposition" towards it. Recall that the traffic safety component was an ADB-imposed condition of the infrastructure investment loan, not something that had been sought directly from the local end. This "opposition" had to be overcome if the study were to have any chance of success.

Use of the term "opposition" does not imply that the Chinese officials were opposed to improving traffic safety or that they in any way devalued human injury or loss. It is simply that they have myriad problems to deal with, associated with the rate of economic, urban and transport change and that safety is not yet their highest priority.

The study team commenced the project with a seminar for the staff from all agencies involved in aspects of traffic safety to seek their involvement and input. In this seminar the **participants** identified the major urban safety issues, the major rural safety issues and the wider regional needs **as they saw them**.

Throughout the course of the study, the team members worked assiduously to consult with the key local officials to establish a high level of commitment.

Recommend the achievable, not what cost-benefit analysis concludes.

In a context where the economic imperative is paramount, it is critical in the early stages of the development of traffic safety policies and programs to focus on a small number of acknowledged safety issues and to tackle them with the lowest cost, most easy to implement, measures that have any reasonable chance of being effective.

Given that China is at a stage of major expansion in its road infrastructure, there is obvious opportunity to incorporate safety at the design stage. The problem, it seems, is not with design standards. The study team observed that the basic geometric road design, for example, the level of alignment, sight distance and so on, was the equal of current practice in most motorised nations. However, in an attempt to get maximum road length per dollar invested, crash prevention measures such as line marking, signing, road lighting; and crash amelioration measures such as roadside barriers, tended to be used sparsely. Rather than argue for all these measures, the study team focused on line marking as the one most likely to be implemented and the one most likely to provide widespread impact at lowest possible cost.

As a second example, the study team noted that the province did not have a conventional ambulance system. The traffic police have adopted an informal method of patient transfer using drivers of involved or passing vehicles to transport the injured to hospital. Sometimes, the police themselves provide the transport. The literature suggests that up to 15 percent of traffic deaths could be avoided with state-of-the-art emergency at-scene treatment and rapid transfer to emergency medical facilities. However, such a system is very expensive to implement and therefore competes with the scarce funds for road expansion. Thus the study team was content to recommend operational refinements to improve the effectiveness of the existing "scoop and run" system, rather than to seek its replacement at this stage.

Offer help about where the money is to come from.

Where traffic safety is not yet a major priority it is extremely difficult to obtain funds for safety programs. A traffic safety strategy that recommends a host of measures but does not indicate how they could be financed is doomed to failure. The study team spent a lot of time wrestling with this issue.

One possibility was a surcharge on gasoline prices with the surcharge hypothecated to traffic safety programs. The difficulty with this suggestion is that, at a stage of rapid expansion of personal motorised mobility, communities strongly oppose price rises. The second option was to hypothecate the revenue derived from fines imposed on traffic offenders to traffic safety programs. Already in Heilongjiang about 50 percent of traffic fine revenue is returned to the police force, where it is used to supplement salaries. Given that the principle of hypothecation is already accepted, and, as the police are the primary traffic safety agency in China, this potential funding source has great merit. The third possible source was to suggest the use of a proportion of motor vehicle insurance premiums. Already the People's Insurance Company of China has provided some funds for the implementation of blackspot programs. It may be possible to build on this precedent by demonstrating that the insurance company will receive a direct financial return from a reduction in damage, injury and death.

Adapt the strategy to the local cultural context.

A strategy that is not implemented can have no effect! Ensuring the strategy accords with the key priorities in the larger transport plan, focusing on low-cost measures and recommending funding sources are all important steps towards ensuring implementation. In this assignment the study team also hit upon a way of promoting implementation in a very culturally appealing way.

Throughout much of its recent history, China has used what the Western world calls demonstration projects but what the Chinese call "models" to foster the adoption of practices within communities. There are numerous examples of model schools, model factories, model farms and so on. The study team proposed a model traffic safety city concept to provide a practical focus for initiatives to be undertaken at an early stage. Two cities were identified as together being typical of the many conditions found throughout Heilongjiang. Da Qing is a modern, fast-growing city in the plains area. Jia Musi is an older city in a valley in the mountainous region of the province. It was known that both cities were interested in being involved and both had a moderate level of available resource. The study team then concentrated its efforts on developing detailed and achievable action plans for the two model cities. These action plans were, in turn, designed to fold upwards into the overall master plan required under the ADB contract.

Thus rather than using the usual method of evolving a high-level strategic plan and cascading downwards into individual area action plans, the study team chose to work in the reverse direction. It sought to get results on the ground at a demonstration level but ensuring that these results were based on action plans which incorporated principles consistent with an

overarching strategy. They deemed this to be the more effective way of getting commitment and, above all else, implementation.

Don't ignore the "Safety System" — processes are as important as tools.

When consultants work on particular safety problems in motorising countries their approach is usually confined to recommending one or more countermeasures or "traffic safety tools". This approach may prove ineffective if the prevailing "safety system processes" cannot use these tools or if the commitment to tackle the intervening problems is not there.

With a focus on the blockers to implementation, the study team conceived a three-tiered approach:

- Develop a vision of and commitment to a new safety strategy and system.
- Understand the safety system processes and seek to adapt them to align with the vision.
- Propose only those tools (countermeasures) which can be effectively implemented within the constraints of the system processes and for which a commitment exists.

Understanding the safety system processes in one's own culture is difficult enough, but understanding them in a totally different context requires enormous effort. As was explained in Chapter Two, property damage, injury and death are by-products of a complex transport system. That transport system not only has multiple, and often competing, objectives but the importance of the various objectives differs, depending on the broader economic and social objectives of the particular nation at the particular point in time. Effective traffic safety programs require integrated safety processes among diverse agencies ranging from road construction and maintenance, traffic management, vehicle registration, driver licensing, law enforcement, public and schools education as well as health care. Truly effective institutional integration is very rare and can only be found in nations well into the "fourth paradigm" (see Chapter Two). The state of Victoria in Australia provides a clear example of how such integrated institutional arrangements can add enormous impact to the effectiveness of integrated traffic safety strategies.²

In the province of Heilongjiang the Public Security Bureau has overall responsibility for traffic safety. Within the bureau, the safety function is entrusted to the traffic police. Within the traffic police there is a dual structure with headquarters' departments being mirrored in a comprehensive branch or regional structure system throughout the province. Thus,

headquarters' groups provide guidance and advice to the regional groups but there is no direct link in an administrative sense and therefore little in the way of a province-wide approach to traffic safety initiatives.

Ideally, a special, permanent administrative body would be set up to develop an integrated strategy and to oversee its implementation. Such a body would have appropriate powers vested in it by government and appropriately senior representation from all the agencies significantly impacting upon traffic safety. Given the saliency of traffic safety, relative to other provincial priorities, such a powerful traffic safety structure in Heilongjiang is unlikely to be achievable in the short to medium term.

What the study team recommended, therefore, was to build upon the existing base, re-structuring and strengthening wherever possible. That base was the Heilongjiang Safety Committee which has a structure at both provincial and regional level. The study team reported that its many subcommittees are too large and too general in purpose and that past attempts to institute more focused subcommittees to deal with specific areas of safety had apparently been unsuccessful. The difference now, however, is that if there were observable success in the two model cities, accompanied by an overarching safety strategy and detailed safety action plans, a new impetus for process reform would exist.

The study team did not attempt to identify a specific structure, arguing that it is far better for institutional integration to evolve and to be built upon early successes. The team identified a list of criteria for consideration. These included:

- creating a high profile for the traffic safety committees;
- identifying a "champion" in senior government circles to promote the work of the committees ;
- ensuring the committees have people of influence as well as being representative;
- ensuring that the committees are responsible for planning and prioritising and not for program delivery. Delivery must come from the individual agencies;
- adequate funding to achieve their planning and consulting tasks; and
- critical attention being given to monitoring and evaluation systems to ensure that there is continuous improvement in the strategy and in the implementation of the action plans.

CONCLUSION

There is nothing revolutionary in any of these principles for cross-cultural knowledge transfer. They are solid common sense. The only trouble with common sense is that it isn't very common! At least its practice is not widespread.

It would be wonderful to close by reporting that the crash and injury rates in the two model cities have fallen dramatically, but we cannot. We do not know yet the extent of implementation as the planning project described in this chapter has so recently concluded. Nevertheless, the case study warranted outlining to demonstrate in the aftermath of the Mohan and Tiwari contribution (Chapter Four), how relatively easy it can be to adapt to the needs of the recipient country, thus providing a solid base for meaningful traffic safety progress.

REFERENCES

1. ARRB Transport Research, (1997). *TA No. 2177-PRC: Preparation of Road Safety Program - Final Report*. Contract Report to Asian Development Bank. ARRB Transport Research: Vermont South, Vic.
2. Ungers, R., (1997). Road safety co-ordination: Victoria's experience and approach, *Road and Transport Research* 6(3), 48-56.

CHAPTER SIX

Vehicle Safety in the Czech Republic: A Case Study of the Technology Transfer Effects of Industrial Globalisation

Elaine Petrucelli and Murray Mackay

INTRODUCTION

With the demise of communism much has changed in the countries of Central Europe. We thought it useful to consider a specific aspect of traffic safety, that of vehicle design, and explore how the many changes in government and industry have impinged on that topic. Through correspondence and discussion in Prague at the 1996 FISITA Congress and afterwards, we got some appreciation of the extraordinary speed with which government and industry have been reshaped in the Czech Republic in a period of six years. Privatisation and internationalisation have transformed the vehicle fleet on the roads of the Czech Republic, and introduced uniformity of design to broadly Western European standards. National control over vehicle design rules no longer exists in any practical sense. Growth in vehicle ownership is leading to increasing road casualties and a national policy to cope with this does not appear to exist.

THE CZECH REPUBLIC

In geopolitical terms the Czech Republic is on the western side of Central Europe; landlocked, it is bordered by Germany, Austria, Slovakia and Poland. Since 1995 over half of its frontier abuts the European Union (EU).

The following table illustrates the salient economic state of the country, with a 1995 per capita income of about US \$4,000.

Area (sq.km):	78,864
Population per sq. km.:	10,364,000
Population density:	131
Prague population:	1,220,000
GDP/capita, annual (US\$):	4,000
Average monthly salary (US\$):	300
Unemployment:	2.8%
Inflation:	9.0%

One reason for this report was to look at how the political changes of 1989 and later, have influenced the traffic accident situation in a formerly communist nation. The replacement of the communist system with a relatively open, free-market democracy has had a profound influence on all aspects of the country. Everyone we spoke to referred to the subsequent restructuring of institutions and industry as the defining event in their professional lives, both for good and for bad. Changes in traffic, the vehicle population and traffic accidents are just one element in this "opening up".

With the political changes of 1989 and the creation of the Czech Republic from the Czechoslovak Federation in 1993, the Czech Government of Vaclav Klaus instituted a comparatively speedy transition towards an open economy with privatisation of major industries; including the automotive area. A voucher scheme has allowed widespread ownership of shares in previously state-run organisations, but at the same time, many aspects of the automotive industry have passed into the control of foreign companies as a result of the privatisation process. Trade bans and tariffs have been radically reduced, so that now for example, the tariff on importing new vehicles into the Czech Republic is only 3 to 4 percent, and is soon likely to be eliminated.

Following the early political changes, the Czech Republic went through a profound economic slump in 1990–91. Since then however, growth in GDP has ranged from 6 percent to 13 percent annually. The most striking statement of these changes, we heard from an official in the government, was that the non-state sector initially (in 1989) contributed 11 percent of GDP; now it contributes 70 percent of GDP.

From discussion with everyone we met, it became clear that the general policy of the Czech Government is to move towards economic integration with the EU. In the transport sector this has meant that the Czech Republic is adopting EU Directives generally and is hoping to become one of the major components of TERN, the Trans-European Road Network. That network, built to expressway standards, will include an important segment through the Czech Republic connecting Germany and Slovakia, Hungary and all of the Balkan countries beyond the EU; part of what will be a road network comparable to the US Interstate system stretching from Portugal in the West to Warsaw and Budapest in the East.

Even without TERN however, large investments in the transport infrastructure are being made by the Czech Government. The transport ministry has an annual budget of 3 percent of GDP, most of which we are told is being spent on the highway system. In 1990 one in five Czechs owned a car: now the ratio is one in three.

Historically, the Czechs have always had strong links with Germany, and at the professional level we were impressed with the close links between engineering societies, universities and business generally in the two countries. In the transport sector the influence of Germany is particularly strong, with many joint ventures in both public and private sectors. Companies such as Siemens, Bosch, Heller and many others have a manufacturing presence in the Republic.

THE VEHICLE INDUSTRY

With closed frontiers during the communist period, automotive design and production throughout the communist block remained fixed in the period comparable to Western European design of the 1950s and 1960s. This was particularly so for the Czech Republic when passenger car manufacturing was dominated by Skoda cars. Many vehicles from that period are still in use so that a walk through the streets of Prague is a wonderful opportunity to see, side by side, cars and trucks which, in design terms, span a 40-year period. Besides the early rear-engined Skoda Octavia, with the fuel tank mounted in the front section and the filler pipe set forward in the right front fender, there are many Polski Fiats, Wartburgs from the old DDR, Trabants with their black exhaust plumes from badly adjusted two-stroke engines, a few Zils and Volga cars from Russia, and Czech-made Tatra saloons. But fully half the vehicle fleet are cars less than four years old.

In 1992, Skoda cars were taken over by Volkswagen. The market was opened to the West and the new car segment is now a homogenised mix of Ford, GM Opel, VW (of Germany), Seat and the rest of the high-volume manufacturers of Western Europe. Skoda now have, we are told, about 50 percent of the domestic Czech market.

We spent a day at the Skoda factory at Mlada Boleslav, 50 km from Prague. The imprint of Volkswagen design shows clearly on the new Skoda range, and a policy of commonising the basic platforms and sub-systems is being instigated across the Volkswagen group from Brazil, through Seat, to Skoda.

Skoda produce over 200,000 cars a year of which two-thirds are exported, mainly to other Eastern European countries, but also and increasingly to countries of the EU. Thus, from the safety perspective they conform to the current requirements of EU Safety Directives, regardless of their final point of sale. Czech truck manufacturing historically has been a substantial industry dominated by Tatra, Liaz and Avia. With liberalisation those companies crumbled; production of Liaz trucks fell from almost 20,000 in 1989 to 800 in 1995. These companies are now consolidated under a holding company, Skoda a.s. (a separate company from Skoda cars). Nothing illustrates the international reshuffling of the automotive industry better than a conversation with a Skoda a.s. truck engineer who described how he is currently working on a deal with Hyundai from Korea who will make pick-up trucks in a Tatra factory in the Czech Republic, 50 percent of which will be exported, many to Asian and African countries.

THE ACCIDENT SCENE

The Czech Republic defines a traffic death as occurring within 24 hours. If deaths were standardised to the WHO definition of within 30 days, the number of deaths would be raised by about 25 percent. If a one-year definition were used the total would increase by a further 3 percent.

For 1993 the following totals apply:

Number of fatalities:	1,355
Seriously injured:	5,629
Slightly injured:	28,821
Number of reported accidents:	152,157
Cost of road accidents:	\$65 million
Cost of road accidents as % of GNP:	1.3%

Of the traffic deaths, the categories of road users were:

Car occupants:	52%
Pedestrians:	26%
Motorcyclists:	8%
Cyclists:	10%
Other:	4%

The definitions of serious and slight casualties do not appear to be well defined, at least from our conversation with officials in the Ministry of Transport. The ratio of fatal:serious:slight is 1:4:21, for the Czech Republic. The equivalent ratios for the European Union are 1:10:90. This suggests not only great differences in definitions of injury categories, but likely quite significant under-reporting of casualties. It is hard to believe that the actual accident conditions would vary so substantially.

What is notable about the Czech situation is the large proportion of pedestrian, and the small number of motorcyclist, casualties. The latter was reflected in our observations of traffic where motorcycles were relatively few in number. On enquiry we were told that this was because of the hostile winter climate, but also because substantial tariffs exist against Japanese motorcycles. The maintenance of such tariffs does not appear to be an overt traffic safety policy. Of the motorcycles, roughly one-third are actually moped riders (less than 50 cc machines).

Descriptions of "accident causes" are given by the police annually. For 1993 the main "causes of accidents caused by drivers" were as follows:

Speeding:	39%
Incorrect driving:	31%
Not giving right of way:	25%
Incorrect overtaking:	4.5%
Technical defect:	0.5%

Such descriptions are reminiscent of Western Europe and US analyses of accidents in the 1960s, and indeed the general focus of all officials with whom we had discussions was based on road user behaviour and how to change it. We concluded that much needed to be done in terms of accident analysis if effective countermeasures were to be identified and introduced. An unsubstantiated faith in education and propaganda was prevalent amongst officials, and the idea of objective evaluation of such programs was not well established or even understood.

Paradoxically the investigation of serious accidents by the police and forensic scientists is exceptionally good. Historically there has been strong emphasis on forensic investigation of accidents in West Germany, the DDR, and the Czech Republic, together with Hungary and other Central European countries. One complaint we heard was that liberalisation has decimated the quality of accident investigation, because the funding of such investigations by the Ministries of Transport and the Interior (responsible for the civil police) has been radically curtailed. Forensic scientists still play

an important role, however, distinct from the police; they are called in to investigate the more serious accidents for the investigating magistrate.

Perhaps because of this there is heavy emphasis on investigating vehicle maintenance defects as a potential contribution to accidents. Such does not appear to be the case in reality, but nevertheless periodic inspection of vehicles (every year for cars older than three years and trucks every year) was held up as one of the important safety countermeasures contributing to accident reduction in the Republic.

VEHICLE SAFETY DESIGN

Nothing illustrates the internationalisation of the automotive industry and the diminishing role of a small nation in the process of controlling vehicle specifications better than the changes in vehicle safety design in the Czech Republic.

Since the 1970s, the Czechs have been represented on the various Economic Commission of Europe (ECE) committees in Geneva. Czechoslovakia thus was a party to ECE technical standards and with the agreement of the old Skoda firm, selectively adopted some of them. In effect however, this was a voluntary process where the timetable was set by the manufacturer.

With the opening to the West and the takeover of Skoda by Volkswagen the necessity of meeting EEC (now EU) Directives became imperative. Thus, new vehicles manufactured in the Republic, whether they are passenger cars or commercial vehicles, conform to the international requirements of the EU (although not of course to the FMVSS system of the USA). This has been achieved by the adoption of Volkswagen in-house standards at Skoda, and a necessary transfer of significant technological skills and engineering to the Skoda plant.

For suppliers within the Czech Republic this process has been achieved not only through joint ventures with Western companies such as Mannesmann, Autoliv, TRW, etc., but also through joint ventures with Western car manufacturers such as Renault, Fiat, PSA and Volvo who are seeking low-cost suppliers of sub-systems for cars to be assembled within the EU countries.

In the communist period the Republic had a well-established Motor Vehicle Research Institute (UVMV) funded by the Government. In 1988 it had a staff of 630; today it has a staff of 140. Those who were forced to leave were mainly the young.

The research of the Institute was all but terminated, and its survival was only made possible by entering into a joint venture with TUV Bayern of Munich, one of a number of official certification testing organisations, which test vehicles and components to the regulatory requirements of European Type Approval. Now it is largely a test house with TUV providing official certification competence and special facilities. Thus, for example, a Czech manufacturer might approach UVMV for Type Approval certification. That will be provided but, depending on the complexity of the tests needed, the product will perhaps be shipped to Munich and tested there. Whole vehicle crash tests for example, and some environmental and emission testing is now centralised at TUV in Munich, which has joint venture test houses in Poland, Northern Ireland, Hungary and Russia, as well as the Czech Republic.

TUV in turn competes for certification testing all over the world. Thus, the privatisation and internationalisation of what were national facilities is complete. This makes good commercial sense, and by the very nature of the certification process which is reasonably transparent, it probably ensures genuinely uniform procedures for all customers — something that was not always present in the past, when certification to safety standards was conducted for national champions by national test houses.

Vehicle safety standards therefore in effect are now set by the European Commission in Brussels not only for the 15 countries of the European Union, but for the Czech Republic and most of the other Central European countries. For those with ambitions of joining the EU in the near future, this process is important and we were told that what we saw in the Czech Republic was largely true for Poland, Hungary, Romania, Slovakia and Bulgaria. Particularly for trucks, which are manufactured in all of those countries, it is essential that they can compete within the European Union, so EU certification is a prerequisite.

INSTITUTIONAL STRUCTURES

Responsibilities for traffic safety in the Czech Republic are divided between the Ministry of Transport and the Ministry of the Interior. There is a Czech Governmental Council for Traffic Safety (BESIP) which is charged with co-ordinating traffic safety work at the national level and advising the Czech Government on traffic safety matters.

In practice the Ministry of Transport has direct responsibilities for roads, their construction and function. The Ministry of the Interior is responsible for the police and a section of local authorities, teachers and some special interest groups such as insurance, the Czech Auto Club, trade unions and television.

The Council for Traffic Safety has a small full-time staff and concentrates on education and propaganda. Its work program is focused on publications for schools, television spots on dangerous road user behaviour, the Young Cyclist Traffic Safety Competition, driver training and encouraging bilateral contacts with neighbouring countries.

The main council of BESIP meets twice a year. The program of the secretariat for 1995 concentrated on publicity campaigns covering young drivers, dangerous speed, alcohol and drugs and seat belt use. It also ran a major media campaign entitled "A Butterfly on your Hood". This campaign used well-known personalities to "reach the hearts and minds" of all road users. The butterfly on your hood is supposedly to arouse agreeable feelings towards other road users. A million small butterfly stickers were distributed to schools and 400,000 large butterfly bumper stickers. No evaluation of this campaign was made.

Overall one must conclude that although the coordination of the two Ministries and high-level access to governments on paper appears to be a good model, in practice it fails because of lack of professional skills in the science of traffic safety. Data collection, its accuracy and objectivity require improvement, and the application of known countermeasures is weak because of lack of government funding and interest. In a word, the traffic safety community in the Czech Republic is well intentioned, but pre-scientific, and would greatly benefit from contacts with experienced professionals in other countries.

In our conversations with officials and engineers we enquired frequently about any input to any aspect of transport safety from the medical profession. We received no information to suggest that there was any. This was surprising considering that in the two neighbouring countries of Austria and Germany there are thriving national Societies of Traffic Medicine. This appears to be one specific area where professional cross-border links might well generate some latent interest considering the rising number of traffic casualties and the increasing burden on hospital resources.

CONCLUSION

We are conscious that any short visit to a country is necessarily selective and likely superficial. This study focused narrowly on vehicle safety and how it has changed as a result of the demise of communism. The speed with which Western industry and vehicles have changed the automotive scene in the Czech Republic in six years is extraordinary. The internationalisation of manufacturing, marketing, testing, type approval and research decimated the old structures and institutions. The Republic is determinedly moving towards EU membership and in many ways its car industry is already closely integrated into EU ways. Vehicle safety is thus

largely determined by whatever progress can be achieved through the European Commission, and the individual efforts of professionals within the industry.

ACKNOWLEDGMENTS

We have not specifically referred to any individuals, but we are most grateful for the courtesy, time and effort which many people gave in answering our often naive questions. We collected our information through discussions and correspondence. Everyone in the Czech Republic was exceedingly helpful and considerate.

CHAPTER SEVEN

The Development, Philosophy and Transfer of Trauma Care Programs

Peter Knight and Gordon Trinca

The goal of all nations should be to prevent motor vehicle crashes some of which may result in injuries and death. However, it is inevitable that people will receive injuries on the roads, as well as from non-vehicle-related causes.

The effectiveness and quality of the initial assessment and management of an injured person have a significant bearing on the outcome for that patient. A properly organised multidisciplinary approach to such a trauma victim, utilising established protocols for triage and management, will provide optimum care. As a result, morbidity and mortality of trauma victims may be reduced or prevented and injured workers may be returned to the workplace more rapidly.

The optimum care that may be provided to any injured person in any country will depend on the resources, level of education of the public, available medical and hospital facilities, as well as pre-hospital transport and communication systems.

The recognition and realisation of the cost benefits occurring as a result of the appropriate care of traumatised persons is the first essential for any society irrespective of its level of sophistication.

In 1976, as a result of a tragedy involving a surgeon whose wife and child died in a plane crash in Nebraska, USA, it became apparent to the medical community in that area that there was a need for improved trauma care. It was also recognised that there was a need for improved care of injured people in small community hospitals. The concept of Advanced Trauma

Life Support (ATLS™) matured and an educational program which involved lectures and practical clinical skills was developed. A prototype ATLS™ course for physicians resulted. This course was field tested in 1978, in the USA. The American College of Surgeons (ACS) Committee on Trauma adopted the ATLS™ course in 1979. The major provider of the ATLS™ instruction and certification course is now the ACS in Chicago, Ill.

This course has undergone revisions and now is accepted as a standardised national trauma program in the United States. In the USA in the first 10 years after the introduction of ATLS™, more than 120,000 medical practitioners were trained and probably more than 15,000 trainees pass through the ATLS™ instruction courses annually in the USA and Canada.

The course was provided for medical practitioners in Trinidad and Tobago in 1986. The ACS has agreed to permit establishment of ATLS™ in other countries. Physicians in those countries have been trained to ATLS™ standards. This first occurred in 1987 in Mexico, Central and South America, and in 1988 in the United Kingdom and Australia.

In Australia the course was provided with the involvement of ACS faculty. The course was entitled Emergency Management of Severe Trauma (EMST) by the Royal Australasian College of Surgeons (RACS) Trauma Committee. The EMST course was an adaptation of the ATLS™ course with modifications to meet Australasian professional, cultural and language variations. This course is provided for surgeons, anaesthetists, emergency physicians, intensivists and rural general practitioners. All Australasian surgeons who obtain their FRACS (Fellowship of the Royal Australasian College of Surgeons) have been required to complete an EMST course. The Australian and New Zealand College of Anaesthetists (ANZCA) also requires Fellows to successfully complete an EMST course. It is the aim of the RACS that all medical practitioners practising in Australia should be trained in advanced trauma life support skills and be confident in applying these skills in the most basic of medical environments.

Australasian and ACS faculty have been involved in teaching the course in Hong Kong, Indonesia and Papua New Guinea. ATLS™ courses have also now been carried out in Israel, Ireland, the Republic of South Africa, and Saudi Arabia. Currently 16 countries are actively providing ATLS™ courses to their medical professions.

At least one medical school in Canada encourages final year medical students to complete the course at approximately their time of graduation.

The content of the ATLS™ course is designed to provide care of traumatised persons from the site of injury through to rehabilitation by utilising standardised protocols.

The ATLS™ course has 2 levels of presentation:

1. a provider level; and
2. an instructor level.

This latter course is to enable the development of a cadre of physicians capable of educating and instructing a country's own physicians in the necessary skills of ATLS™. The courses are then given by local physicians but there is a regular interchange and involvement of ACS faculty to provide the essential maintenance of the quality of the program. Instructors and participants benefit from regular updating of their skills which should usually occur approximately every four years.

The primary objectives and principles of trauma management incorporated into the ATLS™ course include:

1. rapid and accurate assessment of a patient's condition;
2. provision of rescue and stabilisation on a priority basis; and
3. early determination that a patient's needs will likely exceed local capability and safe inter-hospital transfer will be necessary.

The application of such principles is also readily transferable to motorising nations where the improvement in care will decrease the costs, morbidity and mortality of injured victims. This model has been developed and designed to be used in varying degrees by different societies, depending on the medical personnel, hospital and other facilities that are available.

A Global Traffic Safety Trust (GTST) delegation of two surgeons with attachment to the RACS visited Damascus in 1994, at the request of the Minister of Health of Syria. The purpose of this visit was to assist in the development of a trauma service for Syria. The utilisation of some of the principles outlined above was considered appropriate. Subsequently, two Syrian surgeons involved in the planning and implementation of the trauma program in Syria went to Australia and participated in an EMST course in 1996. They returned to Syria and will help train other surgeons and emergency physicians to understand the need for such basic trauma management principles.

At the request of surgeons or allied medical staff, courses can be arranged through the ACS with the objective of training physicians in the technique of management of acutely traumatised and burned persons. ACS-invited guest faculty may be augmented and assisted by trained instructor faculty of inviting nations as has occurred with Australasian participation in Hong Kong, Indonesia and Papua New Guinea. After such participation, local faculty have been trained to instruct and develop further trainees and instructors.

A course of instruction for nurses and other paramedics has been developed.

In 1996, an International ATLS™ meeting was held in the United States and representatives from 17 nations attended.

The ATLS™ course has truly travelled across the world and trainees using the original ATLS™ and updated course versions have significantly altered the outcome of many trauma victims and saved many lives.

This technology transfer has played a major role in initial care and in the prevention and/or aggravation of existing injuries.

CHAPTER EIGHT

The World Bank's Role — Technology Transfer Through Funding

B.J. Campbell

PROJECTS RELATED TO TRAFFIC SAFETY

Over the years, the World Bank has sponsored hundreds of road construction projects in developing countries. Increasingly, the Bank has required traffic safety components in such projects. In fact, World Bank policy requires that traffic safety and/or non-motorised traffic be addressed in all road projects.

According to Barrett and Lundebye (1991),¹ it was in 1979 that the Bank began formally to address traffic safety as part of road construction projects they sponsored. A seminar held with the Pan American Health Organisation was an inaugural expression of this interest. When, in 1981, Bank staff undertook a review to identify previous road projects having a safety component, they identified 42 prior projects that had included such elements. In 1982 the World Bank issued informal guidelines pertaining to road construction projects. The main thrust of the guidelines was as follows:

1. In all road projects explicit consideration should be given to traffic safety.
2. This would include measures to separate pedestrian and motor vehicle traffic.
3. Pilot safety programs were encouraged.
4. Traffic safety funding could constitute 5 to 10 percent of total project costs, not to exceed five million dollars (US), later raised to 10–12 million dollars.

A 1991 report reviewed 107 road projects and identified 36 with a safety component.² In 1992, Ross and Mwiraria produced a report with a project-by-project assessment, indicating, as might be expected, that some projects were less successful than had been hoped.²

In the most recent review, authored by a World Bank consultant,³ it was reported that from 1989 to 1994, about 50 percent of World Bank road projects had an identifiable safety component. Among 192 projects analysed, the safety component involved topics as follows:

Physical engineering:	52
Vehicle inspection:	17
Road user education:	15
Highway legislation:	5
Enforcement:	17
Post accident assistance:	4
Accident data:	23
Safety studies:	23
Institutional strengthening:	33
Other:	3

Overall, the safety component constituted about 3 percent of total funding.

Early on, World Bank officials recognised that non-motorised traffic was an important component of traffic in developing countries.³ During the period from 1980 to 1989, for example, funded projects dealt with sidewalks, bus passenger shelters, pedestrian bridges, bicycle lanes, pedestrian paths, bikeways, and provisions for bicycle-drawn conveyances. A project in Peru included loans/credits for purchasing bicycles.

By 1991, Ross, Lundebye and Barrett⁴ discussed an emphasis on what they called “sustainability” — projects whose results would hopefully extend beyond the duration of the funding period.⁵ According to them, projects that contribute to “sustainability” might include:

- training;
- introduction of procedures;
- provision of manuals and guidelines; and
- introduction of training courses and teaching materials.

“... the objective should be to establish, strengthen, and develop capabilities of key individuals and local institutions.” However, a later report said “only a few projects had improved institutional capacity to undertake sustainable traffic safety activities beyond the project itself”.⁴

TRAINING AND CONFERENCES RELATED TO TRAFFIC SAFETY

World Bank staff and reports from their consultants continue to emphasise the importance of training, conferences and seminars in addition to direct projects as ways to increase awareness and knowledge of the road accident problem and its solutions in developing countries. Seminars have been conducted in Mexico, Eastern Europe and Africa. An early example is the conference World Bank and other agencies sponsored in Nairobi, Africa in 1984. The sponsors of that First African Traffic Safety Conference included:

- United National Economic Commission for Africa;
- the Norwegian Agency for International Development;
- the Finland Ministry of Foreign Affairs;
- Viatek Limited, Sweden;
- the Norwegian Institute of Transport Economics; and
- the Norwegian Traffic Safety Group.

Traffic safety work carried out by the project sponsors has included projects in Tanzania, Swaziland, Zambia, South Africa and Kenya. From this it is obvious that a number of organisations from the Scandinavian countries have a substantial history of safety efforts in developing countries (see also Chapters Thirteen and Fifteen).

EASTERN EUROPE INITIATIVE

A project with a somewhat different thrust was carried out in Eastern Europe by officials whose experience has been largely in government policy and financing. The study team, sponsored by the World Bank, was composed of C. Gerondeau, J.B. Bouzigues, D. Ellinghaus, A. Hobbs, P. Lowe and J. Wall.⁵ Their effort addressed traffic accident problems in Bulgaria, Hungary, Poland, Romania, the Czech Republic, and Slovakia.

While these officials were not themselves technical experts in safety, their report pre-supposes a high level of awareness of safety needs on the part of other officials in the Eastern European countries in question.

Within that framework, Gerondeau and his team addressed how to finance ongoing and new efforts through tax revenues, insurance and the like. Notably, they addressed institution building at its very foundation — “how can provision be made to establish the financial base necessary to support programs and officials in order that they may carry forward a country-wide traffic safety effort?” Technical experts in safety can help to initiate a project, but the question is whether there is sufficient institutional strength to sustain the effort after the experts have departed. If an institutional base is established, then traffic safety technology transfer can begin to flourish through training, videos, technical reports and in-country projects.

PROBLEMS RELATED TO TRAFFIC SAFETY PROGRESS

Their extensive experience in funding traffic safety efforts in developing countries has provided for World Bank staff and their consultants a familiarity with the range of problems facing developing countries and constituting barriers to success of safety initiatives. Problem areas identified by World Bank officials and their consultants include the following:

- Lack of accident and traffic data, making it difficult to delineate the problem in these countries;
- Lack of accountability for the projects since there is normally no evaluation mechanism.
- Often a lack of inter-ministerial coordination;
- Due to the lack of institutional strength, and the lack of trained and funded staff, there is too often a lack of project “sustainability” once the externally funded project expires; and
- Because of the many urgent, competing needs in developing countries, the lack of funds, and the problems mentioned above, sometimes key officials may not assign a high priority to traffic safety.

Sometimes the lack of funds is doubly punishing. Some countries lack money to maintain vehicle inspection and vehicle weighing equipment. This means that revenue generating equipment falls into disuse and the revenue is lost. One country lost hard currency amounting to about one half million US dollars per year from inability to finance the repair of the scales used to detect overloaded trucks passing through from other countries.

POLICY RELATED TO TRAFFIC SAFETY

The World Bank has evolved a policy on traffic safety through the years. Further, in reports and documents prepared by staff and consultants, additional policy elements have been advanced for consideration. These elements are often worked into project funding:

1. As noted above, Bank policy has evolved to the point that all road projects must have a component that addresses safety and/or non-motorised traffic.
2. Before funding projects, the Bank must assess in each area the “levels of awareness” of the safety problem. Unless local officials are aware of their safety problem and are committed to addressing it, there is little hope of success. A consultant recommends guidelines for assessing three levels of local awareness and suggests suitable kinds of projects that might be funded.

3. As noted earlier, in projects undertaken through external funding, it is necessary to know the degree to which changes can be sustained by the country beyond the duration of the project. Typical projects or activities believed to contribute to "sustainability" include training, introduction of procedures, provision of manuals and guidelines, and introduction of training courses and teaching materials. The objective is to attempt to establish and develop capabilities of key individuals and local institutions.
4. As a way of trying to assess such qualities as "level of awareness" and "sustainability", a consultant recommends a safety audit or checklist. This consultant, in fact, prepared a very lengthy and detailed checklist to be filled out for a given country. The checklist is intended to enable characterisation of the level of safety that exists in the country.⁶
5. Also of concern is the question of monitoring and evaluation of projects. Little evaluation is in evidence. Pre-project studies are sometimes done, but post-project evaluations rarely are carried out. Of course, this failure to evaluate traffic safety initiatives is also quite common in developed countries.
6. One barrier to evaluation is the lack of adequate data to form the basis for an evaluation. One consultant report endorses use of the Transport Research Laboratory (UK) accident data system for this purpose. While some World Bank staff agree with this suggestion, other staff members question whether an initial data system as detailed as that maintained by the TRL investigators is needed. One World Bank staff official observed, merely for illustration, that it might be initially sufficient to "know six things about fatal accidents".

Both consultants and World Bank staff have suggested that it would be useful for the Bank to publish a Traffic Safety Policy document, which would give directions to operational Bank staff and to appropriate authorities in borrowing countries. Recommendations in one report include:

1. The World Bank should establish a data bank of all traffic safety and non-motorised traffic projects.
2. World Bank staff should monitor benefits from earlier traffic safety and non-motorised traffic projects.
3. In considering whether to fund projects, the World Bank staff should make front-end assessments of the "level of awareness" of safety and fund them accordingly.

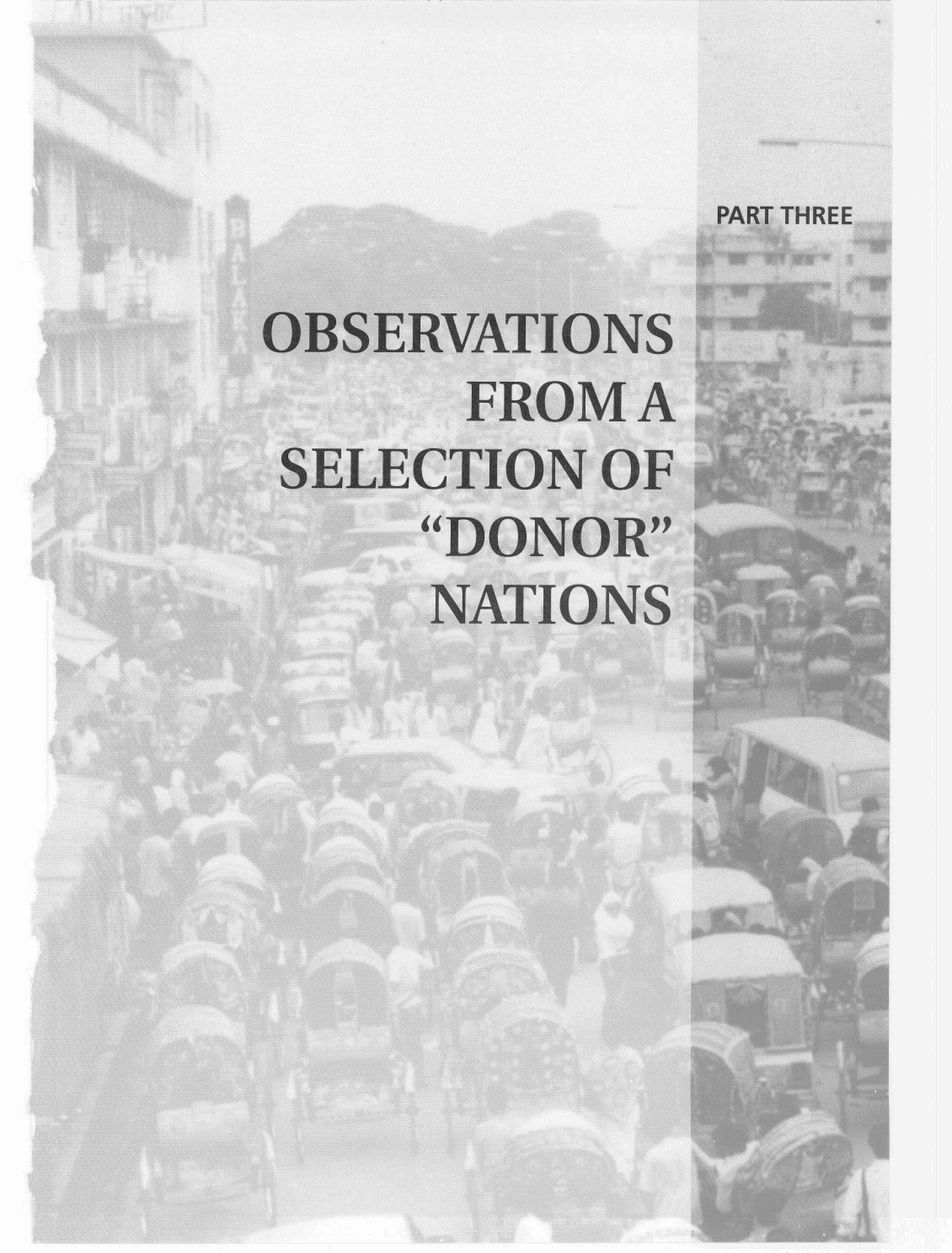
4. World Bank staff should cooperate with international organisations by arranging seminars and fact-finding missions.
5. There should be a standard project report format specific to traffic safety projects (rather than the more generalised project report form that covers multiple project types).
6. An audit evaluation is recommended.
7. A consultant report concluded that strengthening of the country's traffic safety infrastructure is important. Without full commitment by the borrowing country's government, the process will not be successful. Therefore, in the consultant's view, several preconditions are necessary before a loan should be made:
 - (a) awareness at the highest level of government of the importance of traffic safety;
 - (b) a traffic safety coordination agency must be in place; and
 - (c) adequate funds must be provided for that coordinating agency to conduct safety studies.

The World Bank plays a pivotal role in traffic safety in developing countries. By requiring a safety component in all road projects, much can be done. This can serve as a means to develop a cadre of traffic safety specialists in the recipient country, which surely must be at least one important aspect of realising "sustainability".

REFERENCES

1. Barrett, R. and Lundebye, S., (1991). *Overview of World Bank Experience*, World Bank Document ITESAFET. PAP, July 10.
2. Ross, A. and Mwiraria, M., (1992). *Review of World Bank Experience in Traffic Safety*, INU-93, Technical Paper, Infrastructure and Urban Development Department, World Bank: Washington DC., March.
3. Amundsen, F.H., (1995). *Review of World Bank Experience in Traffic Safety Concerning Motorised and Non-Motorised Traffic (1989-94); Draft Report*. World Bank: Washington DC., August.
4. Ross, A., Lundebye, S., and Barrett, R., (1991). *Traffic safety Awareness and Commitment in Developing Countries*, Infrastructure Notes, RD-6, Infrastructure and Urban Development Department, World Bank: Washington DC., September.

5. Gerondeau, C., Bouzigues, J.B, Ellinghaus, D., Hobbs, A., Lowe, P., and Wall, J., (1993). *Traffic safety in Central Europe: Bulgaria, Hungary, Poland, Romania, Czech Republic and Slovakia*, Transportation, Water and Urban Development Department, Report TWU-19, World Bank: Washington DC., November.
6. Ross, A., (1992). *Traffic Safety Checks*, Infrastructure Notes, RD-9, Infrastructure and Urban Development Department, World Bank: Washington DC., January.



PART THREE

OBSERVATIONS FROM A SELECTION OF “DONOR” NATIONS

CHAPTER NINE

Japan

A.J. McLean

International cooperation activities by the Japanese Government are conducted under a program referred to as Official Development Assistance (ODA). As in other fields, ODA in the road, and traffic safety, sector involves bilateral and multilateral cooperation.

Bilateral cooperation is in the form of either grant aid and technical cooperation or low-interest loans for developmental projects. Grant aid differs from loans in that there is no requirement to repay the grant. Technical cooperation includes the provision of experts to conduct investigative surveys, to assist in the conduct of developmental projects, and to train local personnel. Training courses are also offered in Japan for technical and management personnel from developing countries.

Three government authorities are responsible for Official Development Assistance. The Overseas Economic Cooperation Fund (OECF) handles loans. Grant aid is the responsibility of the Ministry of Foreign Affairs and technical cooperation is coordinated by the Japan International Cooperation Agency (JICA), which is itself part of the Ministry of Foreign Affairs. JICA was established in 1974 as the sole agency of the Government of Japan for the implementation of an expanded level of technical cooperation by Japan with developing countries. The actual technical cooperation is carried out by relevant Government Ministries and private organisations.

Multilateral cooperation usually comprises aid in the form of financial contributions to international organisations such as the Organisation for Economic Co-operation and Development (OECD) and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP).

In addition to Japanese Government activities in the transfer of traffic safety technology to developing countries, there are also non-government bodies, such as the International Association for Traffic and Safety Sciences, which are active in this area.

This review presents some examples of these approaches to technology transfer. It is based on discussions with staff of the Ministry of Transport

and other agencies and draws heavily on published material, notably a review of Japanese aid for road traffic safety by Nagasawa, Kitani and Umezawa.¹

BILATERAL AID PROGRAMS

Technical Cooperation on Developmental Projects

Technical cooperation on developmental projects usually has three characteristics:

1. Experts from Japan are provided to work in the other country for a limited period, often to conduct development surveys.
2. Personnel from the recipient country are provided training, either in the recipient country or in Japan.
3. Equipment and materials are supplied to carry out projects.

Whenever possible, an attempt is made to combine these three forms of cooperation in the identification of the need for, and the execution of, a particular project or group of similar projects, dealing with road transport and traffic safety. This is usually approached by the establishment of centres for technology transfer. To give some idea of the scale of the activities of a centre for technology transfer, or a "centre project" to use the common term, as many as 10 experts may be assigned to work in the other country for periods of a year or more, up to 20 local trainees will become part of the staff of the centre, and up to half a billion yen may be made available for the provision of equipment and materials.

"Centre projects" have proven to be a very effective and efficient method of technology transfer. As noted by Nagasawa et al.,¹ "the chief advantage of these comprehensive projects is the formation of 'technology bases' in the recipient countries themselves". Ideally, Japanese experts not only train local personnel but more in-depth professional development also takes place through the discussion of ways to resolve problems that arise in the course of the project. Two examples of centre projects that have a traffic safety component are described briefly below.

Philippines Transport Training Center (TTC)

The Philippines Transport Training Centre was established in Manila in 1977 to foster technically competent traffic and transport engineers through practical training. It evolved from a recognition of a shortage of road engineers in the Philippines. The recognition of this problem came about during a Japanese Ministry of Construction study, arranged through JICA, and in-

tended to prepare a comprehensive transportation facilities plan for Manila in the early 1970s. From the outset, the Centre has been directed by a citizen of the Philippines. From 1977 to 1983, the six-year duration of the project, the Japanese chief adviser was supported by a total of nine Japanese experts drawn from the Ministry of Construction and the National Police Agency and equipment was provided with a value of 600 million yen.

The activities of the TTC were centred on training courses in traffic management, traffic engineering and transportation planning. Components of the first two of these courses were directly related to traffic safety. The instructors were Filipino, with the Japanese experts assisting with suggestions and recommendations. The trainees typically were graduate engineers who were working for transport-related government agencies. Almost 400 trainees completed the courses during the six-year period.

From 1979 to 1982, seminars were conducted by TTC instructors in regional cities of the Philippines. This enabled a larger number of transport professionals (almost 600) to attend the seminars than would have been the case had the training sessions been held in Manila. It also provided the TTC instructors with first-hand experience of conditions in a wide range of regional areas.

From the beginning of the project, research and consulting activities by TTC staff were given high priority, often with the provision of equipment from Japan and the assistance of Japanese experts.

The formal TTC project ended in 1983, but Japan has continued to send research workers to the Centre on an annual basis. It is clear that this project was an excellent example of technology transfer and the benefits to both the Philippines and neighbouring countries continue to be realised. TTC receives trainees from ASEAN (Association of South East Asian Nations) countries and is evolving into a research institution affiliated with the University of the Philippines.

Road Traffic Management Cadre Training Center in the People's Republic of China

In 1984, land for a Road Traffic Management Cadre Training Center was acquired in Wuxi by concerned agencies of the Government of the People's Republic of China (PRC). The establishment of the Center was carried out under the supervision of the Public Safety Department. In the mid-1980s the PRC Government asked the Japanese Government for technical assistance to train Cadre staff in traffic management.

In a similar manner to the work in the Philippines, the Japan International Cooperation Agency (JICA) assessed the request by sending study teams to China in 1987 and 1988, resulting in the creation of the Project of the Road Traffic Management Cadre Training Center under an agreement between the two countries at the end of 1988. The aim of the five-year project was to contribute to the improvement of traffic management technology in China by means of the transfer of Japanese technology. The construction of a traffic control system, including a control room, was completed at the Center in 1991. Professionals from Japanese companies were provided on a short-term basis to help commission the traffic control system and train Chinese staff to operate it.

As the only training centre for road traffic management in China, trainees included lecturers of the Police Academy from all parts of the country as well as Training Center staff themselves. The curriculum includes not only traffic management but also traffic accident prevention, vehicle and driver management and traffic psychology. The training also includes field surveys and experimental work. Each year, 16 candidates for Chinese counterpart lecturer positions are either recommended by the Public Safety Department or selected by the Center. They are required to have either a university degree or more than five years' experience in traffic management, as well as language ability in either English or Japanese, among other attributes, and must pass an examination. Some of the Chinese lecturers have attended training courses in Japan. These courses include the observation of traffic safety education programs, lectures at the National Police Agency and visits to the National Research Institute of Police Science, a driving school and a driving licence centre.

In order to facilitate the process of technology transfer, JICA, in 1989, requested establishment of an internal Chinese committee at the Road Traffic Management Cadre Training Center. This committee has responsibility for a wide range of matters, including the curriculum, selection of trainees, project evaluation, technology transfer and public relations. A study team was sent by JICA to evaluate the project in 1989 and another team was sent in 1992 to review progress.

Traffic Safety Plan for Roads in the Kingdom of Thailand

The Royal Thai Government requested technical assistance from the Japanese Government in the development of planning for traffic safety on all roads administered by the Department of Highways (DOH). JICA assembled a study team which worked in Thailand for 20 months from May 1983. This team reviewed DOH data collection systems and methods of analysis, developed ways to identify hazardous road locations, prepared technical guidelines for traffic safety facilities, and provided guidance on long-term

planning for traffic safety. Some of these tasks were demonstrated by means of a case study and experimental work.

Group Training Courses in Japan

JICA sponsors a large number of seminars and courses in Japan each year “to provide training opportunities to engineers and administrative staff who are expected to lead the nation-building efforts of their countries”. The trainees receive technical training at various institutions in Japan, become more familiar with Japanese customs through making friends with local people, and return to their home countries to put their learning into practice. These individuals “... are also expected to serve in the future as ‘bridges’ between their countries and Japan”.¹ The following examples of seminars in the traffic safety area give an indication of the types of topics covered.

Seminars on “Safe Driving Instructor Training” and “Driving License Administration” are conducted by the Traffic Bureau of the National Police Agency of Japan under an agreement with JICA. The National Police Agency is part of the Ministry of Home Affairs. As the titles indicate, the former seminar deals with the Japanese approach to driver training both before and after a driver’s licence has been issued for the drivers of cars and heavy vehicles and also motorcyclists. The latter deals with the administration of the driver’s licence system in Japan, the Road Traffic Law and the associated penalty structure for offenders, and the Information Processing Centre of the National Police Agency.

The Japanese Ministry of Construction has offered the “Seminar on Highway Construction” annually since 1966, again in cooperation with JICA. It includes traffic safety related units in the curriculum, such as traffic engineering and the design and application of roadside barriers. More than 200 persons from 17 countries have attended this seminar.

A JICA Group Training Course in “Administration System for Motor Vehicles” has been offered annually since 1983 to a total of more than 100 participants from 33 countries.² The purpose of the course is to enable the participants to understand the administrative systems for motor vehicles in Japan including the relevant laws, rules and regulations. By so doing, the participants are then expected to devise suitable managerial and/or operational plans for vehicle inspection and registration in their own countries and to become advocates for the introduction of such plans on their return home.

Harmonisation of Vehicle Standards

While the matter of harmonised vehicle standards mainly concerns the major automobile manufacturing countries, the Japan Automobile

Standards Internationalization Centre (JASIC) also assists developing countries to establish technical standards for road vehicles, and the associated conformity assessment techniques, according to the road and traffic conditions in those countries. This is done with a recognition of the need to balance the desirability of trade liberalisation with safety and environmental issues in developing countries.

PARTICIPATION IN ACTIVITIES OF MULTILATERAL AGENCIES

As noted above, multilateral cooperation usually comprises aid in the form of financial contributions to international organisations such as OECD and ESCAP. However, Japan has also participated in seminars convened by multilateral organisations.

For example, a study tour on road accident prevention was convened by ESCAP and conducted in several cities in Japan in 1986. The seminar was attended by participants from Japan and 11 other member countries of ESCAP. The recommendations from this seminar included encouraging developing countries in the ESCAP region to establish national traffic safety councils at Prime Ministerial level, as in Japan, the enactment of appropriate motor vehicle legislation, and the development of a means to identify and correct accident blackspots. Another recommendation was that the definition of major terms relating to accidents should be standardised within the ESCAP region.

JAPANESE NON-GOVERNMENT ORGANISATIONS

International Association for Traffic and Safety Sciences

The International Association for Traffic and Safety Sciences (IATSS) is one of the best known Japanese non-government organisations involved in technology transfer of road traffic safety. Established with financial support from the founders of the Honda Motor Company, and from that Company itself, it conducts international symposia in both developing countries and in Japan on a wide range of transport-related matters. It also convenes the IATSS Forum which is held in Japan with the participants being drawn from developing countries, mostly from those in South East Asia, with financial support from the founders of IATSS. Safety is one component of the extensive study program which comprises an IATSS Forum.

The Singapore Safety Driving Centre

The Singapore Safety Driving Centre and associated activities illustrate a combination of government and non-government activity in technology transfer in the traffic safety field, specifically motorcycle operator training.

Technical cooperation with Singapore began in 1954 under the auspices of JICA. In the early 1980s the Singapore Government established a committee to investigate ways to reduce the frequency of traffic accidents. This led to a decision, in 1982, to approach the Honda Motor Company for assistance in the design, construction and operation of a motorcycle training centre based on the Japanese model. The resulting Singapore Safety Driving Centre Ltd., incorporated in 1983, was a joint venture between the Singapore and Japanese private sectors.

In 1984 the Singapore Government asked the Japanese National Police Agency, through JICA, for technical cooperation on its traffic safety program and a team of experts from Japan was sent to Singapore. One of the recommendations of this team was that the L-plate system for motorcycle licensing be replaced with off-road rider training as in Japan. The Singapore Traffic Police acted on this recommendation and the Government contracted with the Singapore Safety Driving Centre (SSDC) to conduct the off-road training, using private driving instructors whose skills and ability were upgraded by Japanese and Singaporean instructors.³

SUMMARY

Japan is one of the most active of all countries in transferring road traffic safety technology to developing countries. Its programs have displayed considerable sensitivity in ensuring that local professionals are trained to a level which will enable them to maintain new or more advanced methods of operation after the formal technical assistance program has ended. The example of the Singapore Safety Driving Centre shows that the benefits of technology transfer need not be confined to the less developed countries. Indeed, technology transfer activities in the area of harmonisation of automobile standards have benefits for Japan also, as well as for other countries which are major producers of automobiles.

ACKNOWLEDGMENTS

The writer gratefully acknowledges the assistance of Mr. Yoshiyuki Mizuno, Director, Research Division, Japan Automobile Standards Internationalization Center, Mr. Takahiro Ikari, Deputy Director, Office of International Affairs, Engineering and Safety Department, Road Transport Bureau, Ministry of Transport, and Dr. Minoru Kobayashi, Social System Research Institute Inc.

REFERENCES

1. Nagasawa, K., Kitani, N., Umezawa, M., (1993). Review of Japanese aid for road traffic safety. *Proc. Conference on Asian Road Safety*. Kuala Lumpur, Malaysia. OECD.
2. JICA, (1996). *Information on Group Training Course in Administration System for Motor Vehicle*. (Course No.: J-96-00323) F.Y. (1996). Japan International Cooperation Agency. The Government of Japan.
3. Kobayashi M. and Chua C.K., (1989). The Singapore Safety Driving Centre (SSDC). An Example of Japan-Singapore Technical Cooperation in Driver Training. *IATSS Research*, (Vol. 13: 1, 39-47)

CHAPTER TEN

United States Of America

B.J. Campbell

INTRODUCTION

The United States of America has a comprehensive traffic safety program that involves all levels of government and many private organisations:

1. The US national government: The federal government of the United States has a rather limited role overall, but does finance most government research. Its particular role of research and the setting of safety standards for the states and the automobile industry results in extensive research and demonstration projects, which in turn have resulted in hundreds of reports and manuals which comprise an extensive library of materials, some of which have the clear potential to be useful in developing countries.
2. State governments: The primary responsibility for administering traffic safety activities in the USA falls to the 50 individual states. Through state departments of transportation, motor vehicles, and police, and through state courts, the process of driver licensing enforcement and control is carried out. Most states conduct few research or evaluation studies, but in some states professional personnel are available who could provide useful assistance to officials in motorising countries.
3. Local governments: Local governments have responsibilities for traffic enforcement, pedestrian control, and city streets.
4. Universities: A considerable cadre of professionals in traffic safety are on the staff of US universities, most supported by research programs of the US Government. These professors and research specialists can provide training to those in foreign countries, through on-site lectures and projects, and through education of foreign students in academic residence in the United States.

5. Private organisations: Many private organisations in the USA have a stake in traffic safety. Some are political advocacy organisations, and a few are technical organisations. In addition, there are companies that specialise in work in developing countries, carrying out construction projects and building roads. Some of these may purport to carry out traffic safety activities.

With all these government and private organisations in operation, expenditures for traffic safety are very heavy indeed, although it is not easy to identify with certainty all the activities that are strictly safety in nature. In addition, the USA is the most thoroughly motorised of the world's large countries, and has been highly motorised longer even than other developed nations.

There is an enormous reservoir of knowledge, publications, and personnel that could provide a great deal of technology transfer of traffic safety to officials in motorising nations, if only there were the will, the budget and the administrative mechanisms to do so. However, the USA has compiled only the most modest record in providing such traffic safety technology transfer.

The following pages present information gained from interviews with officials in some of the major private and public agencies.

1. US Government agencies:
 - National Highway Traffic Safety Administration (NHTSA);
 - Federal Highway Administration (FHWA)
 - Center for Disease Control (CDC) and
 - Agency for International Development (AID).
2. Private organisations:
 - American Association of Motor Vehicle Administrators (AAMVA).
3. Universities:
 - Texas A & M University;
 - University of Michigan; and
 - University of North Carolina.

GOVERNMENT AGENCIES

National Highway Traffic Safety Administration (NHTSA)

The National Highway Traffic Safety Administration (NHTSA) is the lead traffic safety agency of the US Government. NHTSA has a mandate for activities in virtually every segment of traffic safety. This includes research,

regulation, and enforcement in the area of motor vehicle crash safety. Due to the ideological preferences of agency administrators during the initial decades of NHTSA's existence, the major focus has been in this area of motor vehicle crash safety. However, the agency also has a mandate and has a record of activities in the broader scope of traffic safety. This includes accident prevention activities as related to driver factors, occupant restraint programs for both adults and children, alcohol control activities, driver licensing, and driver education. In fact, between the activities of NHTSA and those of the Federal Highway Administration (discussed on subsequent pages), the programs cover nearly all categories associated with a comprehensive program in traffic safety.

As a result of three decades of major funding of research, demonstration projects, public information activities, acquisition of accident data and the like, NHTSA has accumulated a vast archive of program reports, instruction manuals, public information campaign ideas, and a host of other resources. Included in this are many publications and reports which could be of use, either in their present form or with modest modifications, to officials in developing countries.

NHTSA is also involved in the international aspects of traffic safety. NHTSA is the leader of the series of international efforts and conferences relating to Experimental Safety Vehicles. It is a major participant in a series of World Injury Conferences. NHTSA officials regularly confer with officials from many developed nations such as New Zealand, Sweden, France, Canada, the Netherlands, and Germany. Within NHTSA there is a specific activity of an international nature, located in the Office of the NHTSA Administrator. Mr. Clive Van Orden, an official in that office, was interviewed. It appears from discussions with Mr. Van Orden that this office deals mainly with the matter of international harmonisation of motor vehicle safety regulations. To a considerable extent this topic is inherently associated with developed nations rather than developing nations, simply because the manufacturers of motor vehicles (those with the greatest business stake in motor vehicle safety standards) reside primarily in the most highly developed and motorised nations.

However, to a certain extent, harmonisation of standards involves motorising nations as well, in that even nations who import all of their motor vehicles may have interest in setting standards in the interest of their citizens, and some of these standards should deal with safety. Illustrative of NHTSA work in this area are the activities of the Asia Pacific Economic Cooperation (APEC). Eighteen economies are represented in this forum and they include the USA, Canada, China, Indonesia, Japan, South Korea, Mexico, New Zealand, Philippines, Singapore, Taiwan, Thailand, Brunei, Papua New Guinea, Malaysia, and Chile. Within the framework of this organisation, NHTSA is participating in a road transport project whose

objective is to promote harmonisation of vehicle standards. Analysis is aimed to identify commonalities and divergences. The goal stated by NHTSA officials is to seek harmonisation and to seek participation of nations covering a range of degree of motorisation.

The goal is to elevate the standards in countries where a higher level of vehicle safety might be desired, and to harmonise the standards among nations, which will, of course, be useful to the automobile producers and to consumers. Thus, in this one area, it is clear that NHTSA is involved in some technology transfer in traffic safety that applies in part to developing nations.

However, it is also clear that NHTSA does not have a program or activity that involves comprehensive traffic safety assistance to developing nations. There is a considerable range of topics that could be considered. This could include dissemination of materials at the simplest level, but might also include training (whether in the USA or in the home country in question), as well as on-site projects. However, except for the narrow topic mentioned above, there is apparently neither mission, budget, nor staff to support NHTSA in providing traffic safety assistance to officials in motorising countries.

Dr. John Eberhard was also interviewed. Dr. Eberhard is a senior official in NHTSA and has been on the staff since the earliest years of the agency. He reports that, in his experience, activities are largely confined to providing materials in response to official inquiries, which come mostly from developed countries. Naturally, materials are sent in response to these requests. His experience is that there are few inquiries from officials in motorising nations. As illustration, it was mentioned that materials had been sent to officials in Israel, Russia, a Scandinavian country, South Korea, New Zealand, and Switzerland. Obviously this list is only illustrative, for it is certain that numerous other requests for information were honoured.

Dr. James Hedlund was also interviewed. Dr. Hedlund is another senior official with long time service in the agency. He has supervised a number of offices, including those dealing with accident data bases, and with alcohol as a safety problem. His comments are consistent with those of Dr. Eberhard. As an illustration, his recollection of the recent past calls to mind only a single contact his group had with an official from an Eastern European nation. Both Drs. Eberhard and Hedlund pointed out that NHTSA resources are shrinking in several areas, with the obvious implications that new initiatives in this area are less rather than more likely in the future.

Thus, in summary, NHTSA has a negligible level of present or past activity pertaining to the transfer of traffic safety technology to individuals and organisations in motorising countries. It would seem that NHTSA has no particular history or mission that would extend its traffic safety expertise to motorising nations where increased traffic safety is so much needed.

Federal Highway Administration (FHWA)

The Federal Highway Administration is an old time federal agency whose responsibilities include, among other things, a pivotal role in highway construction in the USA. It helps states to finance road building, finance research programs, and demonstration projects. FHWA has a role in the safety aspect of the roadways. The FHWA also has a mission and a mechanism for Technology Transfer (TT) to nations in Central and South America, many of which are motorising nations with high levels of traffic injuries and death.

The following information is based on an interview with Mr. Greg Speier of FHWA. Mr. Speier is assigned to work within the framework of the Pan American Highway Institute (PAHI), an arm of the Organisation of American States. In part, FHWA carries out its international work through this mechanism. Through the work of FHWA and PAHI, a total of 65 designated Technology Transfer Centres have been established throughout the Americas, and the Secretariat for this endeavour is provided by FHWA through Mr. Speier.

Most of the technology transfer activity accomplished through that mechanism is not in the area of traffic safety *per se*, but rather is in the broader area of highways. However, some activity deals with traffic safety. Illustrative of the safety work is the invitation to Mr. Speier by Argentina officials in 1995 to speak at a one-day safety conference. Mr. Speier made a safety presentation, and spoke Spanish. A proceedings in Spanish is being prepared. Mr. Speier is fluent in both Spanish and English. His success underlines by contrast the problem that few US traffic safety professionals can speak Spanish or any other non-English language.

A part of the TT activities accomplished through PAHI is the distribution of short articles — 15 pages or so — to all the centres. These are printed in English but so far few of them have addressed safety topics. In another project, FHWA has a contract with the International Road Federation, by which the audio portion of a considerable number of existing training videos are being translated into Spanish. Apparently three of the videos relate to safety topics. Of course, many people in South America speak Portuguese.

Mr. Speier is the only full-time person involved in technology transfer to the Americas. However, he receives part-time help from another staff member, and has a contract with a firm that provides an office operations manager and a secretary, both of whom speak Spanish. Mr. Speier also has a rotating “loaned” staff, under which someone comes from a Central or South American country and works at FHWA for a year. An attempt is made to keep three such visiting officials in residence at all times.

It should be noted that FHWA funded a pilot study (carried out at the University of North Carolina Traffic Safety Research Centre by this writer), in which the elements of a series of traffic safety courses were laid out. In this report a dozen or so topics were set forth such as could be presented in Central or South America, and suggestions were made as to course content, reference materials, and names of persons who might teach the courses.

Funds are a first and foremost barrier to more FHWA work in foreign countries. If, for example, FHWA staff were to travel to another country to provide on-site assistance (usually not in the safety realm), FHWA would have to recoup the cost from some source external to their own budget. Few of the countries in need of assistance are able to contract for it.

Other barriers cited by Mr. Speier include the turnover of officials. Political officials in some of the Central and South American countries sometimes remain in their position for about 18 months. The next appointee may wish to change program direction. Still, some endeavours are under way. Chile now has a traffic accident data base capability and has offered to process highway accident data from other countries.

Mr. Speier is highly effective in what he does, and he does it mostly with a one-person staff — himself. Not a great deal of what he does is safety related, but some of it is, and more of it could be. There is intense interest in safety in the recipient countries. Note also that the safety mission of FHWA is, naturally, confined to that of the roadway component itself. FHWA's mandate does not cover the entire safety spectrum that NHTSA does. It does not appear that there is any precedent at all for NHTSA to be involved in the TT activity of FHWA.

There would seem to be a ready-made mechanism for NHTSA to use the FHWA TT Centre mechanism to provide a broader array of TT in traffic safety. Certainly it would be useful to use this mechanism in the areas of alcohol programs, driver licensing topics, and traffic accident data issues, to name but three. However, that has not happened, and does not seem likely to occur in the absence of a clear mandate to do so, with staff assigned to support the effort. That leaves the situation with the reality that the USA has a great deal of know-how and resources that could be used in Central and South America where road accident rates are very high indeed. However, the USA is not engaged in traffic safety technology transfer to any appreciable degree.

National Center for Injury Prevention, Centers for Disease Control and Prevention (CDC)

Interviews were conducted with Dr. David Sleet, Acting Director, Division of Unintentional Injury Prevention, and Dr. Julie Russell, Team Leader for

the Motor Vehicle Injury Prevention Team (both of whom work in the topic area of motor vehicle injuries). Historically CDC has had a rather obvious international component to its activities — diseases don't pay much attention to political boundaries. CDC has an International Health Program Office which includes a Field Epidemiological Training Program. This office has CDC physicians assigned in 18 developing countries, and when in-country physicians manifest interest in traffic safety, the local CDC physician helps where possible. Given this international context, it is perhaps not surprising to find that CDC has been involved in some traffic safety technology transfer to developing nations. CDC has no specific staff or budget for such Technology Transfer; however, from time to time they have become involved.

CDC hosts many international visitors who come to CDC for consultation on motor vehicle injury problems. One CDC researcher spent a month in Japan assisting that government on the topic of causes of childhood injuries, including motor vehicle injury. Another travelled to Israel to assist in developing a book on injury in Israel. These countries are, of course, highly developed. More to the point, however, students at Emory University in Atlanta have worked with CDC staff on motor vehicle injury in Africa. Recently, six physicians from the Thai Ministry of Public Health visited CDC. They sought information to improve hospital-based data systems to identify motor vehicle related injuries. These physicians are planning a project with the Ministry of Transport and Communication to link police and hospital records on motor vehicle injuries. CDC presumably has the opportunity to encourage public health professionals who visit from developing countries to consider the motor vehicle a public health problem and to establish collaborative efforts with the Transportation ministry in their respective countries. CDC has also begun development of the World Injury Network, a computerised information and resource network that would reach many developing nations.

Through the aforesaid international mechanism, CDC has from time to time provided short-term assistance to officials in Saudi Arabia, Thailand, Spain, Colombia, Israel, Brazil, Japan, and Italy. Not all of these countries would clearly be categorised as motorising nations. Moreover, the assistance ordinarily does not extend to in-country projects of significant duration. CDC assistance includes short-term consultations on epidemiology, intervention development and evaluation, and development of data systems for ongoing surveillance.

On a longer term basis, CDC carried out a two-year cooperative study with Egypt. This project covered all phases of injury including road traffic injuries. Egyptian and US staff prepared and published a short book on the project. A second example is in Brazil, where staff provided a workshop on surveillance and evaluation of motor vehicle injuries. These examples serve

to highlight the difference between longer term projects as distinguished from the more common practice of a single lecture or lecture series.

The World Health Organisation (WHO) has an accident prevention group under Dr. Claude Romer (in Geneva). That office has designated a series of Collaborating Centres around the world, of which the Centers for Disease Control is one. Illustrative of CDC cooperation with this WHO program is the fact that WHO contracted with CDC to identify successful injury control initiatives in developing countries, and most of the examples CDC found were in the traffic safety area.

To advance TT activity, staff of the Injury Centre seek to orient those in the international office to regard motor vehicle injury as part of their mission, and have had some success in this regard. There is also awareness of the necessity to find interventions that are both effective and inexpensive — not an easy task. The work of CDC in traffic safety for developing countries is not extensive, but there is significant potential. Dr. Russell expressed the view that the medical establishment in many developing countries has good awareness that traffic safety is a significant problem in their countries, and often have the prestige to be a significant influence within their country to rouse their government to action.

Even more than FHWA, and unlike NHTSA, CDC has an international mission. There has been some technology transfer of traffic safety information to developing countries. However, these activities are neither funded as such, nor staffed. Also there is no indication of any particular cooperative efforts between FHWA, CDC, and NHTSA as regards traffic safety assistance to developing nations, although CDC does have cooperative agreements with the US Department of Transportation which would enable such collaboration to flourish were there a determination to do it. One could visualise that quite an expansion of the flow of traffic safety information could be accomplished if NHTSA and CDC were to take advantage of the FHWA Technology Transfer mechanism through PAHI, and if FHWA were to expand the traffic safety content of their technology transfer activities.

Agency for International Development

An interview was conducted with Mr. Vincent Cusamano of the Policy Office of the US Agency for International Development (AID), an agency that administers a broad range of assistance programs in developing nations. Mr. Cusamano said that AID had very few, if any, projects that could be considered traffic safety assistance for officials in motorising nations. He could not call to mind any such project.

A call to the Development Information Centre resulted in a conversation with Ms. Lindsey Miller, an official who works on the AID data base

containing records of AID projects carried out over the years. A search of that data base turned up no reference to accidents or traffic safety. There were, however, many projects that dealt with road construction and road maintenance, and it is possible that safety considerations were at least a part of some such projects. Suffice it to say, however, that traffic safety is not an identifiable part of the USAID program for motorising or developing countries.

PRIVATE ORGANISATIONS

American Association of Motor Vehicle Administrators (AAMVA)

The American Association of Motor Vehicle Administrators is a private organisation that has existed since the 1930s. It was set up by state motor vehicle administrators to address matters of inter-state coordination in administering motor vehicle and driver regulations. In the USA, matters of vehicle titling and registration, driver licensing and driver control, and enforcement of traffic laws are within the province of state government. Mr. Mike Calvin, Driver License Manager of AAMVA, was interviewed.

Mr. Calvin reported that AAMVA carries out very little activity of the sort under study here. Illustrative is the fact that Mr. Calvin had just received an invitation to participate in a Citizens Ambassador Program visit to South Africa and he will talk about driver licensing there. AAMVA has also received delegations from Japan and from China in recent times, and they report that they have sent materials to Australian state governments.

AAMVA staff believes it possible that more activities in the nature of technology transfer to motorising nations may be done in the future, partly triggered by implementation of the North American Free Trade Agreement. For example, AAMVA is preparing to bring Mexico into the process of computer-exchange of driving records, as US states do now, and as the US does with Canada.

AAMVA staff do not travel on-site to developing countries to provide training or work on projects. Nor do foreigners come to AAMVA for training. It seems that most AAMVA contacts with foreign countries are actually with developed rather than developing countries. Apparently AAMVA has no staff, funds, nor mission for this kind of work.

UNIVERSITIES AND TRAFFIC SAFETY IN THE USA

Officials at the three US universities with the largest traffic safety programs were interviewed: Texas A & M University, the University of Michigan, and the University of North Carolina. Of these, Texas A & M University is the

most active in traffic safety technology transfer, and even they show only a modest level of activity.

Texas A & M University

The Texas Transportation Institute (TTI) of the Texas Agricultural and Mechanical University is a large organisation with a staff the equivalent of approximately 300 full-time persons. Traffic safety is a relatively small part of the overall program, and is carried out through the Safety Division. Up until now, TTI has had no funded mandate to do traffic safety work in developing countries. Moreover, TTI is a contract organisation, does its work on the basis of contract funds to pay its staff, and therefore has no means to do "unfunded" work. Combine this with the fact that budget constraints in most motorising nations render the countries themselves unable to contract for such services, and the present small scale of activities is understandable.

Recently, however, the State of Texas and the Texas A & M University Board of Regents has encouraged TTI to work cooperatively with Mexico, and carrying out this "mandate" is now in the beginning stage of development. Information about TTI was gathered from an interview with Dr. Lindsay I. Griffin, III, Research Scientist, of the Safety Division at the Texas Transportation Institute, Texas A & M University. The initiative to work with officials from Mexico is doubtless a product of the North American Free Trade Agreement. Illustrative of the safety implications of this trade agreement is the fact that trucks and drivers from Mexico now have free access of entry into and use of US highways. Some US officials believe there are considerable differences between the two countries in terms of licensing of drivers and trucks. However, at that early stage of planning there was as yet no specific safety project between TTI and Mexico.

TTI is in a good position to carry out such activities, however. TTI already does a large amount of work with foreign countries, but much of it does not involve traffic safety. For example, work has been done on rail transport in China, and on pavement materials and techniques in other countries. TTI does, however, conduct some safety activities for officials in motorising nations: officials from a large insurance firm in South Korea came to TTI for a three-week safety training experience.

One member of the TTI research staff recently went to Dubai as a private consultant to conduct a course on accident investigation and reconstruction for officials there. Within the last three years, two TTI engineers travelled to Beijing to give week-long lectures on the subject of roadside safety appurtenances.

Texas A & M University also has a large number of foreign students in its engineering school and many of the engineering professors also work at TTI; therefore there is a basis for maintaining contact with these students after they return to their native countries. Indeed, by that mechanism, some of these students do continue to avail themselves of technical reports supplied from TTI.

TTI has developed a wealth of safety-relevant materials that would be of benefit in developing nations, but there is no active program or means of distributing these materials on a systematic basis. If officials from a foreign country request publications, they are provided. But there is no systematic means of making the materials known and available around the world. (It should be said that many TTI publications are listed in the US DOT TRISNET computerised library and can be accessed.) The "infrequency of requests from developing countries" is a comment made during interviews with several officials. It seems indicative that officials in developing countries do not know what to ask for or how to locate an agency or official to ask.

University of Michigan

Dr. Patricia Waller, Director of the University of Michigan Transportation Research Institute (UMTRI), was interviewed. She indicated that UMTRI carries out negligible activity of this sort, confined essentially to occasional lectures by UMTRI staff in one foreign country or the other. UMTRI has no mandate, budget, or staff, for such activities. As stated in the write-up about Texas A & M, activities in traffic safety at UMTRI are mostly financed by grants and contracts intended to fund specific activities. Thus, it would not be expected that a university program would have dedicated activities in this area in the absence of some sort of government grant or contract so directed.

University of North Carolina (UNC)

The UNC Highway Safety Research Center (HSRC) is in much the same situation as that depicted above for the University of Michigan. Some HSRC staff members have lectured in developing countries, but there are no funds for any sort of ongoing effort. Most HSRC activity has been carried out by Dr. B.J. Campbell, and his activities in developing countries were mostly mediated by GTST. HSRC did recently complete, for FHWA, a project that laid out elements of a training program for Central and South America (project carried out by Campbell). However, this report will not lead to any activities unless FHWA were to decide to allocate some staff and budget to that area of activity. There is no indication that this will be done.

The activities of Dr. Kant Bangdiwala, Professor of Biostatistics, UNC School of Public Health, illustrate the kind of thing that a professor, unaffiliated

with any particular traffic safety organisation, might carry out. Through the Pan American Health Organisation Professor Bangdiwala participated in workshop/seminars in such places as Uruguay, Colombia, Brazil, and Cuba. These activities were designed to assemble professionals, officials, and agency managers who dealt with road injuries. In addition to providing specific information, another goal was simply to set the stage for officials of various ministries to assemble together and consider a problem that inherently cuts across agency lines.

SUMMARY

It is clear the USA is a nation with much potential for providing useful assistance in traffic safety to officials of motorising nations, but it is also clear that the USA, in fact, does only a negligible amount of this sort of work. The few activities under way are incidental in nature. NHTSA is doing the least, and it might be argued that they are equipped with the talent and the history that would make one hope they would be doing the most. CDC has some modest amount of activity in this area, but the US AID agency apparently does not include traffic safety in their funding activities. FHWA has a mechanism for technology transfer, but few of the activities to date have pertained to traffic safety.

The FHWA Technology Transfer Centres could provide a mechanism for delivering traffic safety assistance to motorising nations. Certainly there is a strong concern for traffic safety among officials in Central and South America. The established Technology Transfer Centers, with a coordinator already resident in FHWA, would seem to provide a natural vehicle for a strong entry by the USA into such a traffic safety assistance effort. FHWA, along with NHTSA as well as the Centers for Disease Control (CDC), have much to offer. They have staffs of many senior level experts in traffic safety, decades-long experience in the production of research results, demonstration reports and other resources. These potentially could be adapted for use in Central and South America, and the Caribbean as well as other world regions. The Technology Transfer Centres also offer a natural mechanism for exchange of traffic safety assistance among the participating nations.

However, there seems to be no such US activity, nor any contact among the three or four federal agencies in this regard.

Thus, it seems that the United States of America, with resources and results in traffic safety as great as any nation, will not, in the absence of a significant policy change, ever have a vigorous program of sharing its traffic safety knowledge with officials in developing nations.

CHAPTER ELEVEN

Canada

Peter Knight

THE CANADIAN INTERNATIONAL DEVELOPMENT AGENCY

The Canadian International Development Agency, CIDA, was established in 1968 as the federal agency responsible for delivering most of Canada's official development assistance (ODA) or foreign aid. In "Canada In the World", which is a government statement, the Canadian Government makes it clear that it is committed to making progress to the ODA target of 0.7 percent of GNP when Canada's fiscal situation permits. This same publication makes it clear that "Canada's ODA is committed to support sustainable development in developing countries to reduce poverty and contribute to a more secure, equitable and prosperous world".

Twenty-five percent of Canada's ODA is targeted at basic human needs, particularly in Africa, Asia and the Americas. The highest proportion of this assistance is to be provided to Africa and particularly low-income countries. Central and Eastern European countries in the former Soviet Union will continue to receive support "but not at the expense of ODA priorities".

CIDA is charged with responsibility for delivering the program while the Department of Foreign Affairs and International Trade (DFAIT) is responsible for policy direction. To better manage the new challenges in international stability and security, the Government will "improve coordination between DFAIT and CIDA to bring more coherence to the way in which Canada addresses global issues by establishing with DFAIT, a bureau of global issues".

CIDA is deeply committed to improving the health of women and children as is clearly outlined in the Canadian Government publication "Strategy for Health" (November 1996) and CIDA's "Report on Programs in Support of Children 1994-1995", published in 1997. The role of trauma and its effect on the population of developing nations is clearly understood but priorities in these identified countries currently demand major focus to be placed on the control of infectious diseases, HIV/AIDS, tuberculosis, malaria,

poliomyelitis, respiratory infections, infantile diarrhea and malnutrition. At this time Canada's ODA has been largely applied to dealing with this huge problem.

Traffic safety has, until now, and into the future, not been part of Canada's initiative. CIDA does have involvement in China on a government-to-government basis. Mr. Charles Pellegrini, P.Eng., is the CIDA manager of this project in China. The China project is largely associated with decisions regarding building of roads, where CIDA is offering advice in road design and transport planning to the Government of China. Any contribution to traffic safety, Mr. Pellegrini says, is purely incidental. There does not appear to be any highway traffic safety planning or involvement in any of the countries to which CIDA and ODA make contributions.

CIDA has offered assistance to private Canadian engineering companies to raise funds but these are not as part of ODA. There is no traffic safety aspect involved in any assistance to such private engineering companies.

There are a number of non-governmental organisations (NGOs) involved in overseas development but according to CIDA officials, there is little in-built traffic safety component in any of the projects.

The transport section of CIDA, which is under the direction of Mr. Pellegrini, has eight project managers associated with the China desk. These managers work and function in China but are under the direction of Mr. Pellegrini, at CIDA Headquarters in Hull.

TRANSPORT CANADA

A meeting was held with Mr. R.W. Sanderson, P.Eng., Chief of Road Systems of the Traffic Safety and Motor Vehicle Regulation Directorate of Transport Canada.

Transport Canada, under the Motor Vehicle Safety Act, is the federal agency which is responsible for the setting and maintenance of safety standards and regulations for new vehicles manufactured or imported into Canada. Each provincial government has a Ministry of Transportation which is largely responsible for the design and maintenance of roads and enacting highway traffic legislation and regulations.

The federal, provincial and territorial governments work closely through the Canadian Council of Motor Transport Administrators (CCMTA), the Transportation Association of Canada (TAC) and the Canadian Association of Chiefs of Police (CACP). These groups exchange information and develop consistent national practices and programs.

Transport Canada, together with provincial and territorial governments, industry and the Canadian public, as well as police forces across the nation, have been responsible for the National Occupant Restraint Program, which has been responsible for raising the usage rates of vehicle restraints across Canada to better than 90 percent of vehicle occupants.

Specific programs aimed to reduce the dangers associated with impaired driving, high-risk road users and novice drivers, have been developed and promoted by this group of agencies. A National Safety Code, under the Motor Vehicle Transport Act, has been developed for trucks and buses to ensure compatible Canadian commercial vehicle operating standards. In Canada, according to the Minister of Transport, Honourable David Anderson, "considerable sums of money are spent on safety research, data and policy exchange and encouraging a national approach to safety standards and programs". Negotiations are also under way with the United States and Mexico, under the North American Free Trade Agreement, to promote North American harmonisation of commercial vehicle safety.

A recent traffic safety forum, held in Toronto in October 1996, was a project endorsed by the federal, provincial and territorial ministers of transportation to encourage a commitment to "Road Safety Vision 2001", a project designed by the federal and provincial ministers of transport in September 1996. The object of Road Safety Vision 2001 is to make Canada's roads the safest in the world. It is apparent that Canada, nationally, through such active and focused programs, has already achieved a high standard of traffic safety, both in terms of personal safety (defined as deaths per 100,000 of population) and traffic safety (defined as deaths per 100 million kilometres travelled). Canada has therefore great experience at both the federal and provincial government levels at designing and administering successful traffic safety programs.

Discussion with Mr. Sanderson and Dr. Brian Jonah of the Road Safety and Motor Vehicle Regulation Directorate confirms that while there are no definite planned projects to transfer such successful "know-how" to rapidly motorising nations, Transport Canada does attempt to distribute its knowledge through national and international conferences, and through its membership on national and international organisations such as the Organisation for Economic Co-operation and Development (OECD).

THE ONTARIO MINISTRY OF TRANSPORTATION (MTO)

The Ontario Ministry of Transportation, has considerable highway safety expertise and has provided the safety expertise to a Canadian engineering firm which was tendering for an overseas highway project. The MTO's contribution was entirely associated with the development of highway safety technology transfer. Nevertheless, there is within the MTO, and probably

within other Canadian provincial ministries of transportation, a very considerable expertise and experience in the development and maintenance of traffic safety projects. Although not pro-active in their approach, each one of these ministries has a section which would be capable of responding to a request for highway safety advice and assistance.

Ontario Ministry of Transportation expertise is available for public/private partnerships, assistance to firms bidding for projects in external markets and for showcasing opportunities for Ministry partners and clients at trade shows and conferences.

CANADIAN POLICE COLLEGE

The Canadian Police College acts as a law enforcement, education and training service of the Royal Canadian Mounted Police (RCMP). It is involved in the training of police officers from federal, provincial and municipal police departments across Canada. At the request of the Estonian traffic police, a two-week course was held in Estonia to develop collision analysis and crash investigation within the Estonian police force. This course of instruction was taken to Estonia by the Canadian Police College faculty. It was arranged through the Canadian Ministry of External Affairs and the RCMP International Training Program.

The training coordinator, Sgt. Don Shannon from the Ontario Police College, was responsible for the training delegation that went to Estonia in 1997. A small number of the Estonian police candidates were chosen to undergo further teaching experience either in Estonia or in Canada with the object of enabling the Estonians to initiate training of further Estonian police officers in this field of crash investigation. The course was a modified Canadian Police College course designed to suit the needs of Estonia and, obviously, left out specific Canadian law. Training manuals were provided from Canada, together with other course materials.

It is hoped that this successful initial course will help to establish a viable course to be run by Estonians with periodic further participation by the Canadian contingent. In approximately a year's time a further more advanced level course will be provided by the Canadian police force. It is possible that some members of this Estonian police force will attend the advanced level course for accident investigation, to be held at the Canadian Police College at a later date. It should be noted that language did not present a problem, as adequate translation facilities and interpreters were available.

A similar course was held in Mexico in 1997 with the same objectives. This course also was highly successful.

Training assistance for this course was arranged by the Foundation for International Training.

THE CANADA SAFETY COUNCIL (CSC)

The Canada Safety Council is Canada's national safety organisation. It is a non-profit safety organisation, whose funding essentially is obtained from individual private sources, including contributions, grants, sponsorships from large corporations, sale of training courses and publications. The Canada Safety Council mission is to be a leader in the national effort to reduce preventable deaths, injuries and economic loss in the traffic, work, home, community and leisure environments. It is an independent voice for safety and has a proven base of successful programs. It works in co-operation and partnership with the police, private sponsors, NGOs and the media. It has a high public recognition and an excellent image.

Motor vehicle collisions are the leading cause of accidental death and injury in Canada and the Canada Safety Council has developed three driver improvement courses. These are:

- the Professional Driver Improvement Course (PDIC);
- Defensive Driving Course now available as computer-based training; and
- the Motorcycle Training Program,

all of which are available in French and English.

These programs are delivered across Canada by some 3,000 qualified instructors who work through cooperating agencies.

Driver Improvement Courses have been carried on outside Canada by request of the country in the following locations:

- the Caribbean and Barbados, through a local retired safety professional;
- Haiti, through a local corporation;
- Germany, to Canadian forces stationed there; and
- West Africa, through a corporation in the oil and gas industry.

The Canada Safety Council is interested in marketing these programs outside Canada, but at the present time do not have the resources to do this pro-actively. The CSC would however, be interested in pursuing the opportunity at the request and invitation of the right partners.

ACKNOWLEDGMENTS

In preparing this report we received assistance from many of the named people as well as many others. We thank all of the people who have provided such assistance and given freely of their time, energy and thought.

CHAPTER TWELVE

France

Frank Haight

INTRODUCTION

During the period of European colonialism, France administered an enormous Empire. Although widely dispersed geographically — from the Caribbean to the South Pacific — by far the largest component was African. The French influence in Africa is even today quite substantial, whether measured in economics, politics, culture, language, technical assistance or in other ways. However, as we will see, the traffic safety assistance provided by France is by no means limited to the 18 Francophone nations of Africa.

Technology transfer of traffic safety measures from France to other countries is implemented by a number of different agencies, funded by a variety of sources. Among these, some are private sector, some public, but the majority neither clearly one nor the other.

The leading agency, Institut National de Recherche sur les Transports et leur Sécurité (INRETS), is the successor to Organisation National pour la Sécurité et Transport (ONSER). It is headed by a director, who reports directly to a cabinet officer. INRETS is thus responsive to government policy. Nevertheless, it does retain independence in research and technology transfer, especially when carrying out projects funded by other organisations. For example, research and technology transfer projects commissioned by the World Bank are responsible primarily to the Bank.

Although INRETS plays a central role in French traffic safety activities, it should be noted that it does not represent the totality of French initiatives in developing countries. Certain projects are the results of direct links between recipient nations and other agencies in France, for example: Laboratoire Central des Ponts et Chaussées, CETUR which became CERTU (Lyons), Centre d'Etude Technique et l'Equipement (CETE) (in each Département), Département de Sécurité de la Circulation Routière (International Affairs).

Technology transfer by INRETS (starting in 1982) is organised in a systematic way, rather than entirely on a country-by-country basis. It consists of

three main stages: classifying the particular problems of developing countries, development of 'recipes' for different categories of problems, and finally, training teams of local experts to carry out solutions. The leader of projects for traffic safety in developing countries is Nicole Muhlrads, in co-operation with Sylvain Lassarre.

As part of the first stage, a data base was formed, starting in 1991, which provided information on 82 developing countries, 10 East European countries and 25 industrialised countries. For each country, it showed the relative wealth, the population, the level of motorisation and the number of road accident victims. Most of this information was obtained by bibliographic research, although some data was gathered specifically for the purpose. In spite of some differences — for example in definitions and in time periods covered — it was felt that the data was sufficient for comparison between the countries. For example, it permitted a distinction between the problems of Latin America, those of Asia and those of Africa.*

The second theme was addressed by means of "diagnostic" investigations in particular countries: superficially in Morocco (1979–80), Turkey (1981), Burkino Faso (1993), more deeply in the Ivory Coast (1983–84), the Philippines (1985–1986) and Niger (1989–1990). In addition, two specialised diagnostic sessions were held: in Tunis on safety in the urban milieu in 1988 and in Algeria on safety on major highways in 1990. Also a pilot project was carried out in Casablanca in 1990.

In cooperation with teams from other institutes, especially with the Overseas Unit of the TRL in Great Britain, the VTI in Sweden and the TØI in Norway, the various diagnostics were tailored to particular countries.†

The practical part of the INRETS work lies in the third stage, e.g. on-site work with local people to use the identified principles and information for training traffic safety professionals. This part was carried out in two parallel tracks. The first consisted of training sessions in individual countries, with local officials from diverse professions and institutions. In these meetings the results of the first two stages were presented, explained and discussed. The discussion focused on the local needs, difficulties and problems, as viewed from the general perspective. The idea was to develop specific plans that would engage participation of opinion leaders and professionals in the country. These sessions were held in the Ivory Coast in 1984, in Algeria in 1990 and in Tunisia in 1992.

* This information was presented at the Sixth Latin-American Congress on Public Transportation in San Jose, Costa Rica (1992), the 12th World Congress of the International Association of Traffic Medicine in Helsinki (1992) and at an International Congress of Driver Behaviour in Santiago, Chile (1994), and was published in the proceedings of these conferences.

† Presented at a number of conferences: Cairo (1986), Stockholm (1989), Addis Ababa (1989), Kuala Lumpur (1990), Rabat (1993), Munich (1990), Tallinn (1992), Tel Aviv (1991).

The key to success in these programs was in systematic preparation: first, compiling a list of agencies and individuals dealing with traffic safety within the country and second, assessing which data probably would be available from local sources.

The second part of the plan involved bringing policy makers from a few different countries together in France for discussion and comparison of problems. A first three-week session was held in 1991. Also, INRETS hosted civil servants from a variety of countries. As a result, a decision was made to convene some 60 professionals from selected developing countries of South East Asia, Central America, Africa and the Middle East. This in some cases led to cooperation between the countries themselves, notably between the CNPAC in Morocco and the Indian Institute of Technology.*

There were no cases in which the programs were evaluated. If there was no demonstrable effect on traffic safety, that was surely not because of any failure of INRETS, but rather owing to:

1. the well-known difficulties of evaluating safety projects anywhere; and
2. the lack of a requirement for evaluation studies in the terms of reference.

In any case, the fundamental goal of these efforts was not immediate change in the parameters characterising safety, but rather the development of a cadre of officials having the authority and commitment to carry on in the recipient country when INRETS staff had gone.

These general principles can be illustrated with two country studies (Cote d'Ivoire and Philippines) and two preliminary data lists (Morocco and Turkey).¹

Written in clear and concise English, these documents give not only an overview of the INRETS projects of the period between 1979 and 1986, but also a detailed explanation of the rationale:

1. The measures proposed should be realistic and acceptable in the local context.
2. The proposed institutional structure should enhance cooperation between the responsible bodies.

* One situation cited was a tendency of officials of developing countries to treat the program primarily as a stepping-stone to their personal advancement rather than as a commitment to improving traffic safety. Remarks to this effect were also heard in the Netherlands and in Norway. The theme seemed to be "promotion by means of a trip to Europe", somewhat reminiscent of the "B.T.A." "degree" popular in the '50s and '60s. Of course, the experience of self-promotion via traffic safety is not unknown in industrialised societies.

COTE D'IVOIRE

The Cote d'Ivoire project was funded by the World Bank and by the Cote d'Ivoire Government in 1983–84. INRETS provided consultants, and the cooperation of various local agencies including the Department of Sociology of Abidjan University and the Military Fire Brigade.

The basic safety measures proposed included among many others:

1. Use computers to replace the existing data system.
2. Require two-wheelers to pass a competence test.
3. Design a traffic safety information plan.
4. Develop a system of marking and signing, especially for rural roads.
5. Maintain dirt roads on a systematic basis.
6. Improve pedestrian protection in urban areas.
7. Improve junction layout.
8. Organise random vehicle checks, especially for heavy trucks.
9. Set up a national emergency telephone number with a dispatching centre in Abidjan.
10. Create a course in emergency medicine for those most likely to be at an accident scene.
11. Create a children's information program.
12. Design a number of proposals for research (blackspots, speed, alcohol, etc.).

The report of these projects concludes with the following rather discouraging remarks:

"The Cote d'Ivoire Safety Study was, to our knowledge, the first attempt at a comprehensive approach to safety problems in a developing country. As such, it provided an opportunity for a first field-test of a new methodology, and proved valuable for research purposes. From a practical viewpoint, however, favourable conditions for safety action were not met: local skills and manpower were not sufficiently available, economic conditions were difficult and on a downward trend, and motivation of the decision makers did not seem high enough in terms of action. While it is not for us to decide what the priorities of a government should be, we can only regret . . . that the situation did not allow us to perform any follow-up of the five year safety program. Some measures may have been applied among those proposed, perhaps with success, but no evaluation results have been made available."

THE PHILIPPINES

The Philippines study (1985–86) was carried out by a private consultant, with the cooperation of INRETS. It was funded by the World Bank and the Philippine Government, and covered two experimental regions including the city of Cebu and some rural areas. The safety diagnosis, using the same principles, identified the following targets: pedestrians, commercial vehicles, two-wheelers, overtaking manoeuvres, and rural parking. The “accident factors” included a wide variety of circumstances with heavy emphasis on driver behaviour.

The analysis of institutional traffic safety interests in the Philippines was especially thorough, and included ten different agencies:

1. the Ministry of Public Works and Highways;
2. the Land Transportation Commission;
3. the Constabulary Highway Patrol Group;
4. the Integrated National Police;
5. the Health Intelligence Service;
6. the Fiscal Office;
7. the Metro-Manila Commission Traffic Operation Centre;
8. the Safety Organisation of the Philippines;
9. the Philippine Red Cross; and
10. miscellaneous provincial, municipal and local authorities.

It is worth noting that the INRETS team found that — in contrast to Cote d'Ivoire — the study benefited from better working conditions, including very competent and dedicated Filipino colleagues. “This enabled us to overcome most of the difficulties related to the lack of data on arrival. There is great hope that practical implementation of the integrated program will start as scheduled.”

NIGER

A third country study by INRETS was carried out in Niger, with funding provided by the World Bank.² In brief, the report covers a series of projects initiated by the Government of Niger and funded by the World Bank in the years 1989–90. The INRETS involvement was greater than in the studies described earlier, with three or more full-time people on site for periods varying up to a year. Niger, with an area nearly twice that of Texas, a population of 7.5 million and only one significant city, had acquired a traffic safety problem with less than 2,000 miles of paved road and (in 1988) slightly fewer than 25,000 total vehicles. In fact, with 222 to 255 annual fatalities

depending on which statistics are used, Niger lies just about on the Smeed (veh/pop) (killed/veh) line* once so much in favour.

Surprisingly, there seems to have been enough data available for the INRETS team to compile, in considerable detail, a series of tables by type of vehicle, region of the country, age/sex of victim, "cause", severity, etc. Several aspects of the traffic safety situation in Niger can be inferred even if the data is not entirely reliable. First, from 1974 to 1988, the number of fatal accidents had about doubled (from 96 to 198) while the number of people killed had grown by only about one-third (from 169 to 245), the trend being fairly steady from year to year. Whether this is interpreted as resulting from lower vehicle occupancies, from improved emergency medical services, from urbanisation (over half the fatalities were in the capital Niamey) or from some other cause, INRETS wisely does not say.

The terms of reference for the project allowed six man-months of effort. This, it was concluded, was insufficient. Although a complex schedule of recommendations was made (cf. Tables 51–59), the work was complicated by the lack of information. This made it necessary to proceed incrementally in fact-finding and interpretation for recommendations. As the final report states:

"The experts of INRETS must therefore underline that it was not possible, within the limits of the project, to create a global plan of action which would be immediately operational, although we did establish a detailed diagnostic based on our principles. From this basis, many complementary studies would no doubt be necessary in order to find appropriate preventive measures, or even to coordinate the different actors in Niger to continue the program."

The experience of INRETS was summarised in a 1984 report written with the participation of Sylvain Lassarre (of INRETS), Farida Saad (of the Laboratoire de Psychologie de la Conduite), Richard Muskaug (of the Norwegian Transport Økonomisk Institut) and Andrew Downing (of the UK

* Reuben Smeed of the UK Transport and Road Research Laboratory (and later Professor at University College London) studied the statistics of road fatalities in the immediate post-World War II period. He discovered by curve-fitting that some data could be explained by the formula:

$$D/V = (0.0003) (VIP)^{2/3}$$

where D = number of deaths
 V = number of vehicles
 P = population

That seemed to give a good empirical fit for British data in the preceding few decades, as well as for certain other countries. Although accepted as near Gospel for some time, the formula has subsequently been found to give very bad fits for much data. Its "theoretical" foundation was demolished in a detailed analysis by Andreassen (Accident Analysis and Prevention, Volume 23, Number 5, pages 343–351, October, 1991). Some writers were even so misguided as to suppose that Smeed intended his formula to be a guide to whether a given country had "too many" or "too few" traffic fatalities. It is clear from the writings of Smeed that he never contemplated such an interpretation.

Transport Research Laboratory).³ Being a fairly recent publication, it incorporates some considerable experience (1983–94) of major European research institutes in their study of traffic safety in developing countries. Furthermore, that experience has been distilled, for the World Bank and European Union, into some principles. Such principles — whether or not one accepts these specific ones — seem to be lacking in much traffic safety work.

The INRETS principles were designed, at the request of the sponsors, to apply to three types of situations of special importance for traffic safety in developing countries: first, those applying to national policy; second, those applying to large conurbations; and third, those applying to traffic on urban arterials. Although the principles were designed for developing countries, their authors believe that they could be equally applicable elsewhere. In rough outline, these planning principles are as follows;

I. National policy on traffic safety:

1. Objectives.
2. Areas of work:
 - (a) Accidentology, i.e. knowledge of the data, knowledge of the cost, knowledge of stakes, knowledge of “unsafety” mechanisms
 - (b) Institutional issues: division of responsibility, decision procedures, research procedures, regulatory authorities, educational authorities
 - (c) Previous experience: programs, effects of policy
 - (d) Preparation of national policy.
3. Stages of the work:
 - (a) Preliminary diagnosis
 - (b) Accident diagnosis
 - (c) Widened diagnosis
 - (d) Development of a program.

II. In an urban milieu:

1. Objectives.
2. Area of action.
3. National/local interactions:
 - (a) Centralised responsibilities
 - (d) Decentralised responsibilities.
4. Actors concerned:
 - (a) At the national level
 - (b) At the local level.

5. Requirements for the development of safety policy:
 - (a) Applicable to the existing situation
 - (b) Compatible with central/local division
 - (c) Assuring compatibility of local actions
 - (d) Having the technical and human factors needed.

III. On urban arterials:

1. Objectives.
2. Areas of work
 - (a) Knowledge of urban accidentology
 - (b) Policy for pilot studies.
3. Field of study.
4. Method of study:
 - (a) The network, accident factors
 - (b) Pilot studies and their evaluation
 - (c) Comparison and generalisation of results.
5. Choice of city.
6. Study team.

The approach to technology transfer by INRETS is remarkable in its theoretical basis, and its application to a variety of circumstances. It is also useful in showing in outline form the modifications suggested by a number of on-site investigations.

REFERENCES

1. Muhlrad, N., (1987). Traffic safety research for developing countries. Methodologies and first results. *Synthèse INRETS* No. 7 — English Translation. August 1987.
2. Lassarre, S., Muhlrad, N., and Saad, F., (1983). La sécurité routière au Niger: une application des methodologies de gestion intégrée de la sécurité routière. *Synthese INRETS* No. 21. January.
3. Muhlrad, N., (1994). Etudes diagnostiques et projets-pilots de sécurité routière en pays en développement: Des termes de référence. *Rapport INRETS* No. 181.

CHAPTER THIRTEEN

Sweden

Peter Knight

Sweden has a population of approximately 9 million people. The Swedish Government has emphasised, and does emphasise, the importance of highway traffic safety. This emphasis has been carried over to the motor manufacturing industry of Sweden. Both Volvo and Saab have developed investigative engineering teams to evaluate the factors involved in crashes involving their own vehicles. The knowledge gained from such investigations is built into new vehicle models, with the objective to improve the crash worthiness and the safety of these vehicles.

There are approximately 4 million vehicles in Sweden and the annual number of fatalities on the roads is approximately 600. On this basis, personal safety in Sweden, that is deaths per 100,000 of population, would be approximately 7. This number is lower than either in the USA (19) or Canada (10). Sweden has thus achieved a very considerable know-how in traffic safety.

The Swedish Traffic Safety Office (RSO) was responsible for all traffic safety matters not dealt with by other authorities within Sweden. The RSO however, was closed and incorporated into the National Road Administration (Vagverket) three years ago.

Sweden has made significant contributions to transfer of learned safety principles and practice to rapidly motorising nations. These contributions have been made by two Swedish Government agencies, each of which has a functional subsidiary. The Swedish National Road Administration (Vagverket) is responsible for road traffic safety and is directly responsible to the Swedish Government. Swedish National Road Administration provides the overall administration for its subsidiary, SweRoad, which provides consulting services to foreign countries within the road traffic and transport sectors. VTI (VAG-OCH Transport-Forsknings Institutet), which is the other agency, is the Swedish National Research Institute. Its subsidiary, VTI Utveckling AB (VTI Transport Development Ltd), carries out international training and education, and organises conferences.

SWEROAD

SweRoad was founded in 1981 as a limited company owned by the Swedish Ministry of Transport and Communications and administered by the Swedish National Road Administration. The business concept of SweRoad is to provide consulting services to foreign countries within road traffic and transport sectors. It works in close cooperation with road authorities in developing, as well as developed, countries. SweRoad receives approximately 25 percent of its funding from the Swedish foreign aid program (SIDA). The rest of SweRoad funding is derived from the World Bank, Asian Development Bank, EU-phare (Brussels) and contract consultancies. Although SweRoad has a small permanent staff only, due to its being a subsidiary of the Swedish National Road Administration, it has access to a considerable manpower resource which enables it to recruit personnel for specific projects. Since its inception, SweRoad has engaged approximately 500 road and traffic experts for projects in several different countries.

SweRoad identifies its main fields of activities as:

- Institution Development and Management Support;
- Planning and Design;
- Construction Management Support and Supervision;
- Traffic Safety Programs and Implementation;
- Maintenance Planning and Organisation;
- Road and Traffic Environment — Impact Analysis;
- Research and Development Management; and
- Training Programs and Implementation.

Due to its expertise and extensive breadth of involvement, SweRoad has been very successful in competing for traffic safety contracts worldwide.

The particular interest of the GTST delegation, was in SweRoad's contribution to traffic safety. SweRoad incorporates the full scope of traffic safety with the exception of the medical aspects. It is involved in schools, where it contributes to education by involvement in driver licence curricula. It also assists motorising nations in regard to highway regulations, vehicle inspection, road planning, design and engineering. SweRoad thus assists motorising nations in their development of an integrated and coordinated traffic safety program. This program involves all the participating authorities and organisations in a joint effort aimed at improving the performance of the roads, the vehicles and education of the road users.

SweRoad becomes involved in a country's traffic safety problems essentially in three ways:

1. as a result of a direct approach to SweRoad from the government of that country.

2. as a partner of the contracting engineering company which has been awarded the project contract and recognises the need for a safety component.
3. at a request from the project funding agency, such as the World Bank.

SweRoad has provided assistance with traffic safety projects in Botswana, Cambodia, Indonesia, Jamaica, Jordan, Laos, Lithuania, Mozambique, Saudi Arabia and Zimbabwe. It has also been involved in Thailand, the Philippines, Estonia, Latvia, Russia, Georgia and Croatia. In addition to assisting in comprehensive national traffic safety studies, education, regulation, and licensure, SweRoad assists in the local development of traffic safety research and practice.

SweRoad is also aware that it is imperative that to be successful in achieving any improvement in traffic safety, the local government of the country which is receiving assistance must recognise the need and priority for the inclusion of such a safety program. Without strong local government involvement and commitment, SweRoad acknowledges little will be achieved on an ongoing basis. Involvement and commitment of the funding agencies to the safety components of any highway construction project is also important, as this emphasises to the government of the recipient country that it must take responsibility to carry out the total project design. Failure to receive such commitment from a potential recipient could well result in a negative funding response.

The medical and associated costs resulting from highway trauma are generally stated to be between 1 percent and 2 percent of a nation's GNP. Many nations in Eastern Europe, Africa and Asia are motorising at a very high rate. For example, Albania today has approximately 15,000 vehicles but it is estimated that this number will be approximately 200,000 in three to four years. The impact of such rapid expansion on health programs may not be fully appreciated or anticipated. Vehicle safety standards are often poorly regulated and without careful regulation of such standards, this impact on the health services could be even more significant.

SweRoad is capable of advising in the establishment of specifications and regulations. SweRoad stresses that interest in traffic safety by the local authorities is essential to control highway deaths and injuries with all the associated costs. SweRoad considers it is vital to involve the highest level of government to understand and promote traffic safety. To assist in focusing on such concerns, SweRoad undertakes training programs for administrators. Such courses, of approximately five weeks duration, may be carried out in countries outside Sweden. International courses in road and traffic management are also undertaken in Sweden as well as overseas.

In fact, such courses are part of SweRoad's consultancy assignments. The purpose of such courses is to train a nation's own personnel so as to reduce that nation's dependence on foreign experts. One such course held in Sweden involved 150 Russian engineers who had never been out of Russia and saw their role as being important in road maintenance, but had no concept of their role in traffic safety.

Swedish foreign aid (SIDA) finances courses to emphasise the importance of raising awareness and recognition of the cost of road trauma and its consequences. Each year SIDA provides financing to send young Swedish traffic safety engineers from a Swedish university to spend one year in a foreign country as a junior expert to participate in a development project. Such enterprise is considered an important part of Sweden's future ability to develop networks of trade and also for Sweden to be aware of what is happening elsewhere in the world.

The Swedish Government thus exports expertise with a view to developing and expanding trade. Such traffic safety contributions are a potentially important avenue for the mutual good of Sweden and the involved nations of the world. In developing overseas projects, SweRoad investigates the local problems and conditions within the potential client's country. Seminars are then carried out in order to inspire trust, to develop and establish contacts and to convey information. At a later date SweRoad may return to carry out major projects in that country.

In Thailand this process occurred. After an initial investigation of the local conditions and problems, seminars were given and later SweRoad returned in association with the appointed road building contractors. In this situation SweRoad carried out services in Thailand as a sub-consultant to the Thai partner, at whose request SweRoad participated. As a consequence of this partnership, traffic safety received a greater emphasis.

The SweRoad Traffic Safety Director is Mr. Christer Mansjo.

VTI: VAG- OCH TRANSPORT-FORSKNINGS INSTITUTET

VTI is an independent governmental research institute responsible to the Ministry of Transport and Communications. The Institute has its own board of directors and is headed by a Director General.

VTI is the Swedish National Transport Research Institute and carries out applied research on commission from the Swedish Government and other parties. VTI also promotes the implementation of research results in Sweden and abroad. The Institute has an annual expenditure of approximately 140 million Swedish kroner. All research is funded by clients. The costs of development, and international scientific publishing, as well as administrative costs, are partly

financed by Swedish Government grants which amount to approximately 20 to 25 percent of the total budget. Approximately 40 percent of research-funded projects are related to traffic safety. The research carried out by VTI is in the fields of traffic engineering, road construction, maintenance and operations, vehicles and road users. VTI also carries out research in rail transport and the economic and environmental impact of transport systems. VTI is involved in international research and development projects and contributes at expert and committee levels.

The Institute also arranges international conferences, seminars and courses in Sweden and abroad and annually organises international courses in traffic safety. VTI has arranged and carried out annual international training courses in Eastern Europe for more than 10 years. In 1995 VTI arranged a traffic safety course in association with the Swedish National Police College. The Institute was responsible in 1995 for arranging conferences in Prague (Czech Republic) and Bangkok (Thailand).

VTI (the research institute) is actively involved in R&D funded by the European Union. It is probable that by the end of 1997 this section of the Institute will be active in 20 major European consortia, 15 of which are related to traffic safety. The Director of International Coordination at the research institute of VTI and managing director of VTI Utveckling AB is Professor K. Asp.

VOLVO

The Volvo group is the largest industrial group in Scandinavia and is among the world's leading automotive producers. The company produces passenger cars, heavy vehicles and transportation equipment such as trucks, buses, construction equipment, drive systems for marine, industrial and aircraft engines.

The Volvo Car Corporation has promoted the sale of its vehicles worldwide based on and emphasising the importance of active and passive safety in their design and construction. The safety division of Volvo in Goteborg has approximately 100 members. This division is particularly involved in the design and incorporation of new and improved active and passive safety features based on research involving investigation of crashed Volvos. Volvo states that all its vehicles are built to the same high safety standards, irrespective of the local operating safety standards of the country into which the Volvo car is to be imported.

Education is a secondary task for this division, but annually in Sweden it carries out safety education seminars and courses at different levels and for different groups. Volvo also runs a safe driving program. This program is a full-day course designed for education and instruction of the public in safe highway driving. The course is held in two places in Sweden. Volvo

Sweden responds to requests from overseas distributors to take part in meetings and congresses held in their respective countries. Volvo is a contributing participant and partner in several international working groups and organisations involved in traffic safety.

A Volvo traffic safety engineer was a speaker at the Medical Traffic Congress in Costa Rica in 1986. A number of Volvo safety engineers visited and lectured on safety restraint usage in Puerto Rico. It is of interest to note that at that time this country's seat belt usage, despite a mandatory law, was 4 percent. The current usage rate now exceeds 75 percent. Similar assistance has also been given in Malaysia, China, South Africa, Argentina and Brazil. Volvo also sponsors congresses but is responsive to requests and usually not proactive. Volvo, for a time, organised and awarded a prestigious annual traffic safety award which was open to international competition.

Volvo has been associated with the Karolinska Institute of Stockholm and the WHO collaborating centre in an initiative to create an international forum to discuss traffic safety utilising a multidisciplinary approach to demolish the barriers between technology, medicine and society. The first two such conferences on transportation traffic safety and health took place respectively in Sweden in 1995 and in Belgium in 1996 and focused on man, machine and the environment. The third such conference was held in Washington, D.C. in December 1997. This conference focus was on prevention and health, governmental and non-governmental roles and future strategies for integrated actions to reduce traffic-related injuries. The combination of a motor manufacturer, a large hospital research organisation and the World Health Organisation, is a very encouraging approach to a multi-dimensional problem. The future of traffic safety will certainly require a multitude of actions at regional, national and global levels and this current approach is very appropriate. The senior safety research engineer in automotive safety with whom we met, and from whom further information may be obtained, was Mr. Johnny Korner.

ACKNOWLEDGMENTS

In preparing this report the GTST delegation was received by Mr. Christer Mansjo, the traffic safety director of SweRoad, Ambassador Christer Jacobson and Professor Kåre Rumar, director and head of the traffic safety section of the Swedish National Road Administration international secretariat and Mr. Johnny Korner of Volvo Car Corporation. Unfortunately it was not possible to meet with Professor Asp, the managing director of VTI, but he has kindly reviewed the section on VTI and provided additional information and helpful assistance in its completion.

We acknowledge and thank these people for their kindness and hospitality and for sharing the above reported information with us.

CHAPTER FOURTEEN

United Kingdom

B.J. Campbell

The United Kingdom has a considerable history of traffic safety assistance to motorising countries, and this assistance is conveyed through a variety of government and private organisations and universities. This record of service is illustrated by the sampling of interviews conducted in England which included officials at:

1. the Transport Research Laboratory (formerly of the Ministry of Transport);
2. the Royal Society for the Prevention of Accidents, a non-profit organisation chartered by the government;
3. Birmingham University; and
4. the private consulting firm named Ross-Silcock.

These illustrate the range of activities and organisations in the UK, providing various forms of traffic safety assistance to motorising nations.

THE TRANSPORT RESEARCH LABORATORY (TRL)

The Transport Research Laboratory was formerly part of the Ministry of Transport, but has now been privatised. TRL has a long history of research across the broadest array of topics. Included at TRL is an Overseas Unit whose specific mission is research and dissemination services to overseas clients. This is an activity originally aimed mostly toward developing countries but which has been expanded to include East European and emerging nations. Within the Overseas Unit is a Road Safety Group, active since 1972. Information about this unit was obtained in major part through an interview with Dr. Brian Hills, Head of the Road Safety Group. Also of particular use was a paper by Dr. Hills and others, entitled, "Road Safety in Developing Countries: An Overview".¹

Dr. Hills cited several problems in motorising countries that must be overcome in order to advance the cause of Road Safety. A primary problem is absence of an accident data system, and without such a data system it is

impossible to characterise the accident problem adequately, or to calculate the cost and benefits of safety initiatives.

A central approach of the Road Safety Group, consistent with the need in client countries and the research charter of TRL, has been to assist motorising countries to establish an accident data system. This Microcomputer Accident Analysis Package (MAAP) entails adapting the local accident report form and accident reporting procedures, and installing software for processing and analysis of accident data from the participant countries. This system, adapted for local use, has been installed in more than 20 countries and can be made available in Arabic, Chinese, French, and Spanish in addition to English.

In many instances, copies of the entire data base are conveyed to TRL where there is full analysis capability (as well as being retained locally). Extensive software has been developed such that cross-tabulation tables and related graphics can easily be generated. Using his desk top computer, Dr. Hills was easily able to call up the data base from a given country, and to generate "hazardous location maps" on his computer screen.

This is an important capability for a developing country, for in countries with limited resources, it is thought that a good place for initial emphasis is the introduction of low-cost improvement schemes at hazardous locations. Such efforts have been introduced in TRL projects in Malaysia, Pakistan, Papua New Guinea, etc.

The underlying accident case data is, of course, stored in digital form so that research analysis may be carried out, of the sort for which "canned" programs are insufficient (merely because it is impossible always to anticipate the kind of questions that will come up). To facilitate use of the data system, TRL trained the local police in data collection and perhaps data entry. Some analysis may be done by the road transport officials in the local country, and sometimes TRL helps with the analysis.

Assistance efforts are not confined to establishment of data bases, however. For example, traffic planning and highway design in motorising countries too often includes little attention to safety. That is what led TRL to collaborate with the Ross-Silcock company (covered later in this chapter) in an extensive guidebook called "Towards Safer Roads in Developing Countries", which was published several years ago.² This "red book" is a long series of two-page descriptions of various traffic safety design concepts, shown in text and pictures. Approximately 7,000 copies have been distributed worldwide, and a slide series that covers the same materials has been developed and distributed.

A significant goal of the slide series is to change the philosophy of road engineers in motorising countries in question. It is part of the attempt to change their self-image so that they are not just professionals who build roads, but professionals who build safe roads. The slide package is for use by engineering professionals in developing countries. For example, TRL provided a copy of the slide series to the Road Safety Councils in Papua New Guinea, Uganda, and the training units in the Department of Roads in a number of developing countries.

In other projects, training materials were developed addressing child pedestrian safety. This included a tutor pack and a teacher's manual entitled "Safe Ways". The materials were developed in a form that can be readily photocopied — black and white rather than elaborate four colour processes. That illustrates the need to offer help of a kind and in a format that can be sustained beyond the end of the project itself.

The Road Safety Group states that the problem goes deeper, however, and cite what they characterised as a lack of awareness of traffic safety issues. Their research on child pedestrians in some developing countries indicates that children are less likely than in the UK to receive advice on pedestrian safety from parents or teachers. Further, in one or two cases, pedestrian safety education kits prepared for *all* teachers were used by only 4 or 5 percent of them. In fact, says the Road Safety Group, low school attendance may indicate the wisdom of community-based programs instead of, or in addition to, school-based programs.

Police enforcement of traffic law is also of fundamental importance, but may be lacking in developing countries. For one thing, police are often not mobile in that they lack vehicles and are stationed on foot at intersections. Thus, there is not much they can do to apprehend motorists who misbehave. However, following the introduction of motorised road patrols in Pakistan and Egypt, a reduction in accidents was reported.

Lack of any substantial police enforcement of traffic safety may contribute to a lack of self-discipline among many road users. When this is so, low-cost measures that are not self-enforcing such as road signs and markings may be less successful.

Another project involved the training and re-training of bus drivers in Pakistan. Again, indicating the importance of enforcement, it was seen that many bus drivers reverted to old, bad habits when observed unobtrusively.

In another project, a member of the Road Safety Group is working at the Institute of Road Engineering in Indonesia. The aim of that collaboration is to inaugurate an accident investigation and countermeasures program.

Despite formidable problems, the opinion at the Road Safety Group is that such traffic safety efforts are important because, in many developing countries, road accidents are estimated to comprise a cost of one percent to two percent of the Gross Domestic Product, surely a cost burden that must be addressed.

The effect of privatising of TRL is nowhere more evident than in the funding mechanisms by which the Road Safety Group now operates. Prior to privatisation, overseas activities were supported by the Overseas Development Administration, in the form of direct grants or appropriations. Since privatisation, in order to carry out the work they were set up to do, TRL must compete for funds along with others in the private sector.

The Road Safety Group carried out four contracts for ODA, due for completion in March, 1997. Now the TRL traffic safety professionals are engaging in proposal preparation to a variety of sponsors, thus shifting to a new way of doing business.

Another source of funding is the World Bank and the Regional Development Banks. Interestingly, with this new class of sponsors, the accident data deficiencies in many countries become relevant anew. World Bank economists may ask cost benefit questions, such as how to justify the safety need for 2-metre-wide shoulders. It is difficult to provide objective justification for such in the absence of a data system (or even in the presence of one, this writer observes). On the other hand, the World Bank usually requires a safety component in their road construction projects, and this bodes well for funding of safety projects.

In a project for the Asian Development Bank, TRL jointly with Ross-Silcock have prepared a manual comprising "Road Safety International Guidelines".³

This is a detailed manual on organising a traffic safety program in a developing country, and addresses topics such as coordination and administration, accident data, role of insurance, planning and design of safe roads, spot improvement programs, safety education for children, driver training and testing, publicity campaigns, vehicle safety standards, legislation, enforcement, medical services, and accident costing.

The report lays out the needs for addressing road accident problems in an action plan including raising awareness, setting prioritised actions plans, five-year programs, goals and targets, funding, and evaluation.

Staff of the Road Safety Group recognise certain barriers to success in the work they do. One cited was the fact that when officials in developing countries receive specialised training that makes them more effective in traffic

safety there, the same elevation of skills makes them more eligible for other assignments and often they move into other work which puts the immediate traffic safety interests back.

Another problem is that some officials in the motorising countries do not view traffic safety as a specialty area that holds as much career promise as some other specialties. This may block some promising people from pursuing work in traffic safety. (This problem is seen in fully motorised countries as well.)

Another challenge stems from the need for professionals from the provider countries to remain in the motorising client countries for an extended period. Dr. Hills observed that some of the best results have been realised when provider country staff have remained on site for *years* rather than weeks, and even so, the local traffic safety capability has sometimes become less than robust once the provider country staff returned home.

In the future, the Road Safety Group of the Overseas Unit of TRL will be operating in a new environment, as the result of the privatisation process. TRL has always approached their overseas work from a standpoint of research, but in this new era, there is also a definite tug in the direction of being management consultants. One of the tasks of the Road Safety Group is to find the best balance between these roles. Dr. Hills strongly states his conviction that TRL should retain the research orientation that has defined TRL activities these many years.

TRL has continued to have a major overseas program in which it has provided a considerable range of traffic safety assistance to various motorising nations. It has worked in a large number of countries in Africa, Asia, and South East Asia. Policy as to the manner in which they will function in the future is now at somewhat of a crossroads, forced by the privatisation process. Their clear advantage for the future lies in their cadre of experienced staff, and their considerable history of projects in a variety of subject areas.

THE ROYAL SOCIETY FOR THE PREVENTION OF ACCIDENTS (ROSPA)

The Royal Society for the Prevention of Accidents was established in 1917, during World War I based on the impetus of pedestrian casualties mainly caused by bus accidents during the city blackouts necessitated by zeppelin raids over London. An interview was conducted with Mr. David Rogers, the Traffic Safety Adviser with ROSPA. ROSPA is an independent, private sector group organised as a charity with a long history of campaigning for accident prevention measures, and more recently, on issues which will assist in the reduction of both casualty severity and numbers.

ROSPA develops training and educational materials and conducts a variety of courses designed to enable professionals to improve their skills in accident prevention. The majority of this work has been UK-based, but has included several special courses for foreign nationals. Further courses are planned in the UK and exploratory discussions are now under way to export the course. ROSPA offers a large number of safety pamphlets, brochures, books, and posters for sale, many aimed at children, and not at all confined to traffic safety.

In addition to written materials, ROSPA offers many training courses including driver services courses such as defensive driving, minibus driving, advanced driving, skid control training, chauffeur courses. Such courses are aimed at companies who employ drivers of any kind. This selection includes a three-day introductory course, a two-week comprehensive course, and a five-day advanced course. ROSPA revenues from all sources were about 7 million pounds during a recent year.

The organisation is intended to provide a private sector influence in the accident prevention arena. ROSPA has a staff of about 150 in the Birmingham home office and regional offices in Wales and Scotland. Their safety activities include the topics of home, industry, roads, and ferries. Because of their reputation, ROSPA receives and responds to a large number of public inquiries — some 10,000 per year. The fees charged in connection with training courses and sale of instructional materials offset expenses, and any residuals are allocated back into ROSPA program activities.

About 40 percent of ROSPA funds for traffic safety activities are received from the Department of Transport, and these funds are limited to domestic activities. Indeed, about 90 percent of ROSPA traffic safety work is domestic rather than foreign-directed.

ROSPA is not currently a research organisation but rather one that aimed toward implementation. Thus, in some cases, TRL develops information or procedures and ROSPA implements or distributes them. Child pedestrian research, development, and implementation is a prime example. ROSPA has been instrumental in the collation and evaluation of "good practice" across Great Britain. In concert with the Department of Transport, TRL, and practitioners, ROSPA has developed, produced, and distributed teaching materials to assist in enhancing the levels of knowledge, understanding and skill of child pedestrians. ROSPA offers a two-week course in traffic safety and has prepared a related manual. As a result of repeated offerings of this course, ROSPA has by now reached a good proportion of the officials in England who do this kind of work. A one-week follow-on course has also been developed.

Foreign work is a relatively recent addition to ROSPA activities. Mr. Rogers has visited Bulgaria, Romania, and New Zealand. A four-person ROSPA delegation to Bulgaria had the task of assisting national traffic safety professionals reappraise their existing traffic safety policies and practices, and produce a revised strategy. The UK Foreign Office asked ROSPA to carry out this task, financed through the "know-how-fund". Mr. Rogers said it was important not to go into Bulgaria with any notion of *instructing* local officials. Rather, the hope for project success made it vital that the external experts listen and attempt to understand the existing situation, and then to provide input to the ongoing review under way in that country. Mentoring was considered a better, more acceptable form of help.

Since the UK Department of Transport is unable to fund "out of country" activities, any such work must be funded in other ways. ROSPA has conducted two sessions of the two-week traffic safety course for Indonesian officials, with the content adapted to the needs of Indonesia. The Indonesian Government paid for these courses, given in England. Mr. Rogers argued for such a practice on the grounds that it was possible to bring in many more expert faculty for lectures by virtue of the course being given in England, than would have been possible if a few core faculty had travelled to Indonesia. Also, Mr. Rogers stated his belief that the Indonesian officials benefited from being able to see safety designs in place in England, through various field visits during their visit.

These two courses are the only foreign courses given so far. ROSPA would like to do more, but need funds to permit them to do so. Also, some ROSPA documents, manuals, etc., produced for local use in the UK, could be adapted for use in developing countries but ROSPA lacks any investment funds to adapt the materials. Thus, ROSPA is an organisation with a training mission, but lacks the mandate and the funds to begin a major program of traffic safety service to motorising nations.

BIRMINGHAM UNIVERSITY

A third type of institution, a major university, provides another example of a means for providing useful traffic safety assistance to officials in motorising nations. Information for this section was provided through an interview with Professor Murray Mackay.

The Birmingham University School of Highway and Traffic Engineering has regularly offered a course directly related to traffic engineering and traffic safety problems in motorising countries. Such offerings began in the 1960s and this course has been attended by 30–40 students per year. By now the course has reached 1,000 or more students, representing many foreign countries.

Some indication of the reach of this course of instruction is indicated by the fact that senior road officials in a number of countries (Hong Kong, the United Arab Emirates, and Malaysia, for example) are all University of Birmingham graduates. While at the University, many of these graduates also gained research experience on one or the other of the ongoing safety research projects then under way at the University's Accident Research Unit. Many of the students used such topics as the basis for their doctoral research.

The fruits of this experience are indicated by an example of a Birmingham graduate now an official in Malaysia. This official has been active in Malaysia in promoting seat belt and helmet use. He is also active in recruiting the medical community to become involved in the broader aspects of traffic safety.

Of the foreign students who attend this program at the University of Birmingham, most are financed by their respective governments or through British Foreign Aid. This is a reminder of the fundamental problem that many of the motorising nations who are in great need of traffic safety assistance are poor nations whose priorities may not extend as much to traffic safety as some might wish.

ROSS-SILCOCK ENGINEERING AND MANAGEMENT CONSULTING FIRM

A fourth type of organisation is the for-profit private sector firm, and the Ross-Silcock firm illustrates the role such firms can and do play in providing traffic safety assistance to officials in motorising nations. Information for this section was provided by interviews with Dr. Alan Ross and Mr. Chris Robson of the Ross-Silcock company.

Illustrative of the activities of this organisation is the fact that Dr. Ross and several members of his staff had just returned from a workshop-seminar in Bangkok (officials from 23 countries present) in connection with projects for the Asian Development Bank (ADB) and for the UN Economic and Social Commission for Asia and the Pacific (ESCAP). He and his project team had presented the results of their studies to assess the traffic safety situation and needs in a large number of Asian countries. The ESCAP project involved collection and analysis of accident data from 56 countries, and for the ADB an in-depth survey of 17 countries. In addition to survey activities which do not require a significant long-term presence in the countries, Dr. Ross and his colleagues have recently carried out implementation projects in Fiji and a number of other countries which entailed significant time in-country.

The involvement of Ross-Silcock in traffic safety in developing countries started in earnest about 12 years ago through projects of the World Bank. Whereas some of their consulting is in the realm of safety management, much of their work is more specific to the operational activities of the countries in question. Ross-Silcock reports that they have carried out traffic safety activities in Algeria, Armenia, China, Croatia, Fiji, Ghana, Indonesia, Jordan, Kenya, Kuwait, Nigeria, Nepal, New Zealand, Pakistan, Papua New Guinea, the Philippines, South Korea, Sri Lanka, Swaziland, and Vietnam, as well as regional studies covering groups of countries.

In the view of Ross-Silcock, a first order of business in providing useful traffic safety assistance to a motorising country is simultaneously to carry out an inventory of present safety activities and also to raise the awareness of local officials of the magnitude of their safety problem and of some possible approaches to its management. Dr. Ross believes that in many cases there is really no awareness of the accident problem as an addressable national priority. He said that, even though in some cases road accidents impose a large burden on the national health system, this fact may not be fully appreciated by appropriate ranking officials.

A central part of raising awareness and carrying out the inventory is simultaneously to try to secure cooperation among the various interests. Here one needs to utilise existing organisations to gain understanding of the local administrative mechanisms. Without that effort the enterprise is regarded as unlikely to succeed. This inventory process calls for fact-finding in the ministries and in the private sector. A central feature is the appraisal of the accident data collection system to learn if it can successfully respond to all the agencies that need to use accident data. An effective accident data system is deemed to be an essential component of any plan to improve traffic safety.

Throughout this process is the task of assembling a local working group. These representatives from key agencies with traffic safety responsibilities should work toward coordination and consensus. Later, it is useful for the expert team to devote perhaps four weeks to fact-finding, and then to hold a national seminar to focus official awareness and media interest in the problem.

All of this must be carried out within the framework of the very real barriers that exist. In some of the poor countries, the pressures for funds in other areas of health, nutrition, etc. may prevent the country from addressing the problem of road accidents. The pay for police and other civil servants is frequently quite low. This may mean that these officials must hold second jobs on the side to make ends meet.

In order to address these problems Ross-Silcock employs a number of full-time staff who are experts on various traffic safety subjects. For activities that require specialists not on the permanent staff, a "pool" of part-time specialists is maintained (driver licensing or vehicle inspection, for example). Their services are contracted as appropriate for service on the expert team.

Illustrative of the view that the local situation must be understood, Ross-Silcock staff are sometimes on-station in a country for extended periods of time. A project in Peru had a duration of only one year; therefore Ross-Silcock staff were in and out of the country on trips of shorter duration. Their project in Fiji had a duration of three years, and one Ross-Silcock staff member was in residence in Fiji for two years. Dr. Ross made periodic visits for a total of 5–6 man-months. Others who were specialists on particular subjects went to Fiji for periods of a month at a time (2–3 man-months total). The long-term specialist was involved in establishing and training a traffic safety unit within the highway department. Dr. Ross observed that project staff should not remain in-country too long, since the idea is to establish the capability locally rather than to provide the capability from the outside.

Since Ross-Silcock is a private, for-profit firm, it follows that the source of funds to do their work comes in the forms of contracts from various public entities. Many of their original projects were financed by development funds, provided as a part of foreign aid to motorising countries, but Dr. Ross states that governments are increasingly recognising the need to obtain specialist traffic safety advice and are more willing to use Development Bank Loans for such purposes.

The proposals are required to be originated by the government of the country seeking the assistance, and sometimes Ross-Silcock staff may be asked by the government to assist local officials in developing proposals and packaging projects, particularly in those instances where local officials are perhaps not extensively experienced in such proposal preparation.

When the World Bank or Regional Development Banks finance a traffic safety project, that organisation or the borrowing country may compile a short list of firms with traffic safety experience. In such cases, Ross-Silcock bids against the others on the short list. If the traffic safety component is relatively small, some large engineering firm may bid as the prime contractor, with Ross-Silcock written in as a sub-contractor. If traffic safety is the prime component of the work to be done, then Ross-Silcock alone or jointly with others will submit a bid.

In assessing the future of traffic safety assistance programs, Dr. Ross cites his belief that staff of the Regional Development Banks are now more attuned to traffic safety as a legitimate and needed part of their efforts, and

the same applies to ESCAP and other international organisations. In many cases, according to Dr. Ross, aid-funded road rehabilitation programs to improve the running surface can lead to a deterioration of safety along the road unless specific efforts are made to include safety elements. The Development Banks increasingly include safety audits of roadway designs as a part of the efforts to avoid worsening the situation.

One very important factor is to ensure adequate monitoring and evaluation during implementation to ensure that sustainability and institutional impact are achieved by the project. Dr. Ross stated that all Ross-Silcock projects are monitored during implementation on the basis of performance indicators related to sustainability and institutional impact.

REFERENCES

1. Downing, A.J., Baguley, C.J., and Hills, B.L., *Road Safety in Developing Countries: An Overview*, TRL.
2. Ross Silcock Partnership, (1991). *Towards Safer Roads in Developing Countries: a Guide for Planners & Engineers*. Transport & Road Research Laboratory; Crowthorne.
3. *Road Safety International Guidelines*, (1996). (ABD Regional Technical Assistance Project -RETA 5620), August.

CHAPTER FIFTEEN

Norway

Frank Haight

There are several governmental and quasi-governmental agencies in Norway that are involved with providing assistance to developing countries in the area of traffic safety. Among these are the Public Roads Administration, the National Society for Road Safety, the Norwegian Agency for International Development (NORAD) and the Institute of Transport Economics (TØI). This chapter reports on a visit to TØI in 1996, with the valuable and much appreciated comments and corrections provided in 1997 by Mr. Terje Assum.

In spite of the word "Economic" in its name, TØI — a private research institute — does not deal exclusively with economic issues, but is involved in nearly all aspects of transport, including safety. Working on a contract basis, TØI has carried out a considerable share of Norway's technical transfer in this field, although the political responsibility rests with NORAD. Among other projects, TØI has provided long-term assistance to projects in several African countries. In the case of its assistance to developing countries, the work of TØI is most often funded by other agencies, chiefly NORAD, the World Bank and the Southern Africa Transport and Communications Commission (SATCC).^{*} The latter is a commission of the Southern Africa Development Community (SADC).

Administratively, TØI is divided into four departments: transport economics, transport planning, transport analysis and regional planning and finally traffic safety and engineering, the department which includes "Traffic Safety in Developing Countries" as one of its stated fields of activity. In 1994 TØI had a total staff of 96 permanent employees, of which 63 were engaged in research. The budget that year was NOK 51 million, of which 93 percent came from contract research.

^{*} SATCC consists of Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe.

TØI is well known in transportation circles world wide, and has cooperative links with other principal European transport research organisations: VTI and SweRoads in Sweden, OECD, INRETS in France, TRB in the USA, TRL and PTRC in the UK, among others.

One of the earliest projects of TØI in the area of technology transfer to Africa was assistance in planning and publication of the proceedings of the first African Road Safety Congress, held in Nairobi, Kenya. This conference, under the sponsorship of the United Nations Economic Commission for Africa jointly with the Nordic countries, took place in August 1984. Adebayo Adedeji, Under Secretary General of the United Nations, in the Foreword to the published Compendium of Papers, wrote of his gratitude "... especially to the Governments of Norway and Finland, who in addition to technical assistance in the form of expert lectures also provided funds for the publications of the Compendium". It is important to bear in mind, in discussing the Compendium, that TØI was not in control of the selection of papers, or of the contents of the papers.

This Compendium of Papers from the conference comprises about 300 pages consisting of more than 50 separate reports.¹ These individual contributions are of widely varying quality and relevance to the topic. Some papers are important historically. One, for example, documents the well-known but not easily accessible Transport and Road Research Laboratory (TRRL) computerisation of Egyptian road safety data. Another explains the failure of some anti-drunk driving legislation in Finland; yet another recommends much the same type of program for Africa. The International Road Federation recommends more (and better!) roads.

A quick overview of the contents shows the following kinds of papers:

1. *from European and American participants*, some accumulated African data (from TRRL of UK), partly new, but much dating back to the 1950s and of uncertain provenance, summaries (mostly optimistic) of the safety trends in their home countries. There was a noticeable tendency to explain trends in fatality rates in terms of the policies and interventions of government, without a great deal of discussion of other possible explanations. For example, the road fatality peak of the late 1960s to early 1970s, experienced in virtually every developed country, was attributed by one Norwegian speaker to "the comprehensive national program for traffic safety". Some speakers attempted to modify their recommendations (mostly to adopt "successful" programs in Europe or the US) with consideration of special African circumstances; few if any managed to do so.
2. *from African participants* there were some interesting statistics, often more related to "development" of the road network rather than to its

safety. These data, sometimes quite interesting, were too often followed by purely idiosyncratic opinions of cause and cure. Many papers employ Smeed-like diagrams and charts.*

NORAD, as well as TØI, provided technical assistance to the SATCC Working Group, starting in 1984. Various fact-finding missions were carried out, as explained in documents published in 1987.²

First, a traffic safety census of all nine countries was collected at SATCC headquarters in Maputo,[†] during January and February of 1985, and augmented by site visits to Swaziland, Tanzania and Zambia. A draft report was presented to the Group's meeting in November 1985 in Blantyre, Malawi. The basic recommendation was to establish a National Road Safety Board (NRSB) in each country, a Road Safety Agency (RSA) and local Road Safety Boards. These agencies should cooperate in preparing a short-term and a long-term safety plan. The census showed that the NRSB and RSA status of member countries varied considerably in their development.

In 1985 TØI organised a fact-finding mission to investigate the role of laws and regulations in countries, of the SATCC region. The summary report begins with a survey of the countries individual differences in law and regulation.³ The authors conclude that although there are a number of variations — even contradictions — between the countries, the basic problems remain the same, and should be reconciled with the two Vienna Conventions on Road Traffic and Road Traffic Signs and Signals. They believe that the two major problems are alcohol and speeding, perhaps not coincidentally, the issues most salient at that time in Western countries.

Then, a number of examples are given of the difficulties in harmonising laws and regulations in the region. For example, two of the countries do not have specific rules of the road. Signing is of several different types; the driving licences are “of different models and categories, and vary in substance”. The report proposes ways to harmonise laws and regulations, based on the two Vienna Conventions.

The Vienna Conventions are then worked over section by section and paragraph by paragraph, with proposed modifications for the SATCC countries. Illustrative of the root differences in safety considerations in these countries compared with Western European countries is a proposed section [Part I, Section 3, paragraph (d)] which defines the word “driver” to mean “any person who drives a motor vehicle or other vehicle (including a cycle), or who guides cattle, singly or in herds, or flocks, or draught, pack or saddle

* For an explanation of Smeed's analysis, see p.120 of Chapter Twelve.

† Maputo, Mozambique, while within the SATCC Territory, enjoys convenient access to the Union of South Africa for travel by conference delegates.

animals on a road". Similarly, the definition of "motor vehicle" includes "any power driven vehicle normally used for carrying persons or goods by road, etc." with the only exclusion being agricultural tractors. It also appears that the laws and regulations are intended to cover all parts of the country, not just legal thoroughfares.

TØI also reported on the traffic safety situation in Swaziland, Tanzania and Zambia during January and February 1985.⁴ It includes the reporting forms currently in use in those countries. Among many other suggestions, is a recommendation for a four-part system: accident register, road register, vehicle register and driving licence register. These parts were given as parts of a comprehensive road safety improvement project. Only accidents with death or personal injury are proposed to be recorded. (N.B. For death, the 30-day rule is recommended.)

The discussion on drunk driving starts with the statement that "Drunken driving is a serious problem which concerns road safety, obedience to the law and the role of the alcohol in society."⁵ (A typically Scandinavian approach. As the late H. Laurence Ross has commented, "drunk driving is perceived as a traffic safety problem in the US but as a social behavior problem in Scandinavia.")

The report continues with a statement of several Euro-American diagnoses of the problem, with appropriate countermeasures and penalties. One interesting aspect is that "impairment" seems to be defined to refer exclusively to impairment of vehicle control, not to impairment of attitude. The appendix quotes some SATCC member states' legislation and comment. It appears that while many drivers are drunk (at least in comparison with Norway), very little is being done about it.

TØI advisors then move on to an investigation of the vehicle testing programs of SATCC countries. Their report provides analysis on a country-by-country basis.⁶ Each country is described under the headings "Legal Aspects", "Present Practice", "Personnel" and "Testing Station and Equipment". With a few exceptions, the practice seems to consist of spot checks by the police.

With these special topic reports in hand, TØI, in cooperation with (the then) TRRL, assisted in planning the Second African Road Safety Congress, which was held in 1989 in Addis Ababa, and in compiling the 419 pages of the proceedings.⁷

The papers from European authors cover much the same ground as in the First Compendium; for example, with more interest in manipulating data than in assessing its reliability, with more interest in curve-fitting than in public health. Certain other papers from Europe and America hardly touch

on African problems, but rather boast of their own nation's successes. The contributions from African sources contain what appears to be some new and informative statistical tabulations, which include a considerable amount of data.

Apart from the data provided, too many of the speakers from African countries took simplistic views of cause and effect, tending to blame their fellow countrymen for vague deficiencies such as "inattention". If true, this does not reflect on Africa as much as on the gradual process of motorisation. The same style of analysis of "causes" of accidents was being employed until quite recently in countries of Europe and America.

In a personal communication (3 October, 1997), Mr. Assum informs me that TØI has also engaged in three-step systematic work: (a) state-of-the-art report for each SATCC country; (b) proposals for national road safety programs; and (c) manuals for further road safety work, including the SATCC Book of Road Traffic Model Statute, The SATCC Manual for Learner Drivers, The SATCC Highway Code and The SATCC Road Traffic Signs Manual. Unfortunately, these publications were not available for comment when this chapter was being prepared.

Apart from giving help with African safety congresses and further SATCC projects, TØI has also sent research workers and observers into the field. One example is a recent analysis of traffic safety in Cameroon.⁸ The author deals at some length with all aspects of traffic safety and its administration, including medical treatment of trauma statutory law and traffic control. It concludes with a 14-point program to be fulfilled in five years, and, most importantly, discusses how such a program can be financed. A summary of the report follows (apologies for any errors in translation):

Chapter 1 of this report discusses three earlier studies of traffic safety in Cameroon. There is extensive discussion of the purposes and objectives of these studies; more to the point, there is an attempt to analyse the consequences of the studies. Briefly, nothing happened. Here is why. Nobody cared once the reports were finished. There were no funds to carry out the projects, and as a result no equipment and training. The reports took little account of the realities of the situation in Cameroon, and proposed changes that were too abrupt to be realistic. Traffic safety is far from the principal objective of the Ministry of Transport. Some of the reports were written as though they constituted the end of a project rather than its beginning, in that there was no definite plan of actions to carry out the recommendations. It was absurd to expect to achieve a European level of development in one sector alone — for example in driver licensing. The administration itself seemed to have unrealistic ambitions, which were then accepted uncritically by the consultants. The latter were more concerned to fulfil the unrealistic terms of reference

of the administration than to provide a plan capable of implementation. "To build a building one cannot start with the roof before having built the foundations and the walls."

Chapter 2 is a diagnosis based on experience (and common sense!). First the traffic safety bureaucracy is taken to bits, with all its bureaus, plans, decrees, responsibilities, programs and actions. Next, the author travels about the countryside as an intelligent observer. In one place, he observes that the traffic lights don't work, quite naturally because of the inefficiency of the local road authorities. Then, he continues, that it doesn't matter anyway, if the police and gendarmes ignore the regulations anyway. At the crossroads of Ndokoti, often cited as particularly dangerous, the author finds that taking into consideration the way the crossroads is utilised, accidents seem to be remarkably rare.

Next comes the safety budget. For example, 200 one year, zero the next, 25 the following. Next the insurance system.

In Chapter 3, the service available: "naturally" there is no trauma service at the hospitals. First aid is free, but any further treatment must be at the cost of the injured or his family. "Some people suggested that even first aid depended on the ability to pay, but we were not able to confirm this."

In Chapter 4, the available accident data is displayed, with caution and reservation regarding its reliability and in Chapter 5, the author wrestles heroically with inadequate data to produce a cost figure: 0.7 percent of the Gross Domestic Product.

Chapter 6 discusses, in detail, the tangle of legal and administrative procedures too complex to explain here. The main point is that statutory law and regulation should be separated.

Before giving recommendations, the problem is summarised: "Rural roads are in bad condition. The urban road network is in bad condition. Urban traffic circulation is chaotic. Control of vehicles is inefficient. People are transported in deplorable conditions. Police and gendarmerie lack both means and motivation. The situation in the hospitals is deplorable."

The recommendations provided include a 14-point program that is considered realistic to be fulfilled in five years provided: (a) there are 41 man-months of expatriate technical assistance; (b) progress is monitored by an external consultant after two years; (c) an annual budget of 1.25 FRF is available; and finally (d) that a form of taxation (e.g. 1.25 percent on car insurance premium) is enacted to provide the budget.

Some of the initial ideas for TØI assistance programs to developing countries are given in a small leaflet.⁹ Mr. Terje Assum, the TØI Research Officer in charge of traffic safety assistance to developing countries wrote in his personal communication with the author that "we consider the lack of research, monitoring and evaluation as one of the main problems of improving road safety in developing countries". In addition, the inside back cover of the leaflet is of interest in identifying and explaining five Norwegian traffic safety agencies: the Institute of Transport Economics (TØI); the Norwegian Institute of Technology (NTH); the National Society for Road Safety (TT); the Association of Consulting Engineers (RIF); and the Public Roads Administration (SV).

REFERENCES

1. First African Road Safety Congress. *Compendium of Papers*. (unpublished).
2. Vaaje, T., (1987). *Organising of Road Safety Work in Southern Africa*. TØI: Oslo. January.
3. Ostvik, E., (1987). *Road Traffic Laws and Regulations in Southern Africa*. TØI: Oslo. January.
4. Vaaje, T., (1987). *Road Accident Recording Systems in Southern Africa*. TØI: Oslo. February.
5. Vaaje, T., (1987). *Drunken Driving in Southern Africa: Problems and Countermeasures*. TØI: Oslo. March.
6. Filseth, J., (1987). *Motor Vehicle Testing in Southern Africa*. TØI: Oslo. May.
7. Second African Road Safety Congress. Addis Ababa, 16–20 October 1989. *Compendium of Papers*.
8. Maskaug, R., (1994). *Plan d'actions pour la sécurité routière au Cameroun*. TØI Report 264, September.
9. *How to Improve Traffic Safety in Developing Countries*. Undated.



CHAPTER SIXTEEN

The Netherlands

Frank Haight

The principal traffic safety research agency in the Netherlands is The Institute for Traffic Safety Research, commonly known as SWOV (i.e. Stichting Wetenschappelijk Onderzoek Verkeersveiligheid), with offices in a suburb of The Hague. SWOV has been in existence for about 35 years; and nowadays, like many similar institutes, has turned more and more towards privatisation and contract research as its major source of funding. However, in cooperation with the Dutch Government there are plans to return to the old position.

With the gradual liberalisation of political and economic life in Eastern Europe, the Netherlands has played an important role in developing contacts in the traffic safety communities. Although some of this work can be regarded as bilateral assistance (because of SWOV personnel involvement), many of its activities have been funded by other agencies: the World Bank, OECD, the European Union, the Dutch Government, etc. For this reason it is not clear that the cooperation between SWOV and East Europe can properly be considered "Technology Transfer to Developing Countries".

In addition, some of the countries involved can hardly be considered "developing" although a few may be. Almost without exception the countries of Eastern Europe are classified by Berger and Mohan as "high-income countries".¹ Thus the contribution of SWOV lies principally in showing what Western Europe and the United States have been doing for the past half-century. There is not the culture gap as experienced between Europe and Africa.

Specifically, it is doubtful that research workers on traffic safety in Eastern Europe, although labouring under a variety of constraints before 1988, can have remained entirely ignorant of the important traffic safety changes taking place in the West since the mid-'60s. Publications (such as those of SWOV, TRL, INRETS, VTI, for example) may have been scarce or restricted in Eastern Europe, but they were not entirely inaccessible. Therefore the work of SWOV is not so much technology transfer (across a cultural chasm) as information transfer (across a politically constructed chasm).

In 1993, an engineer from SWOV presented a paper at the 24th International Scientific Conference on Transport Planning and Traffic Engineering, held in Prague.² He showed some typical data, mostly involving the changes in fatality rates over time. He proceeded to outline several low-cost remedies; such as improved signing, blackspot treatment, and junction re-alignment. These and other such measures could be easily adapted to conditions in parts of Eastern Europe. He then proposed that an infrastructure design manual be written, specifically for Eastern Europe, which would address these problems, and suggest solutions. He offered the collaboration of SWOV in planning such a volume, first by organising an international committee, and then holding an international symposium.

The symposium, organised by SWOV and funded by OECD, was held the following year in Prague with participation of 45 representatives from 11 Central and East European (CEE) countries. The proceedings were published by SWOV in two volumes.³ The first volume contains statements from the CEE participants, outlining the nature and scale of traffic safety difficulties in their own countries.

The second volume, which is about 350 pages in length, contains "lectures" by participants from Western institutes: 2 from England, 2 from Denmark, 1 each from Germany and the OECD, and 7 from SWOV.* These topics cover familiar ground, and mostly have already been published elsewhere.* One SWOV participant shed some light on the practical difficulties with the well-known Woonerven (traffic calming zones). In addition to design difficulties and funding problems, pedestrian safety remains not entirely solved.

Although there is no further mention of the handbook or manual in these proceedings, there is a call for further conferences and workshops, and some encouragement is offered to possible organisers: Organisation for Economic Co-operation and Development (OECD), Permanent International Association of Road Congresses (PIARC), EU-phare (a program of the European Union with Code name "phare"), World Bank, European Bank for Reconstruction and Development (EBRD) specifically.

Also in 1994, SWOV was involved in two planning projects with Eastern European countries: Hungary and the Czech Republic.⁴

These are two quite different proposals. The Hungarian portion, after outlining various documents of understanding and coordination and listing the people involved, consists mainly of lists of institutions in Hungary and the Netherlands. The document provides an analysis/listing of agencies in

* For example, the contribution of the United States consists of exactly the following words: "NCHRP Report 350. Recommended procedures for the safety performance evaluation of highway features."

the two countries: the counterpart of SWOV is KTI (Institute for Transport Sciences or specifically Kozlekedes Tudomanyi Intezet).

The report concludes with a discussion of data bases: how the information is collected, stored, analysed and retrieved. A number of deficiencies are identified, with possible solutions. It is suggested that SWOV experience could usefully be transferred to Hungary.

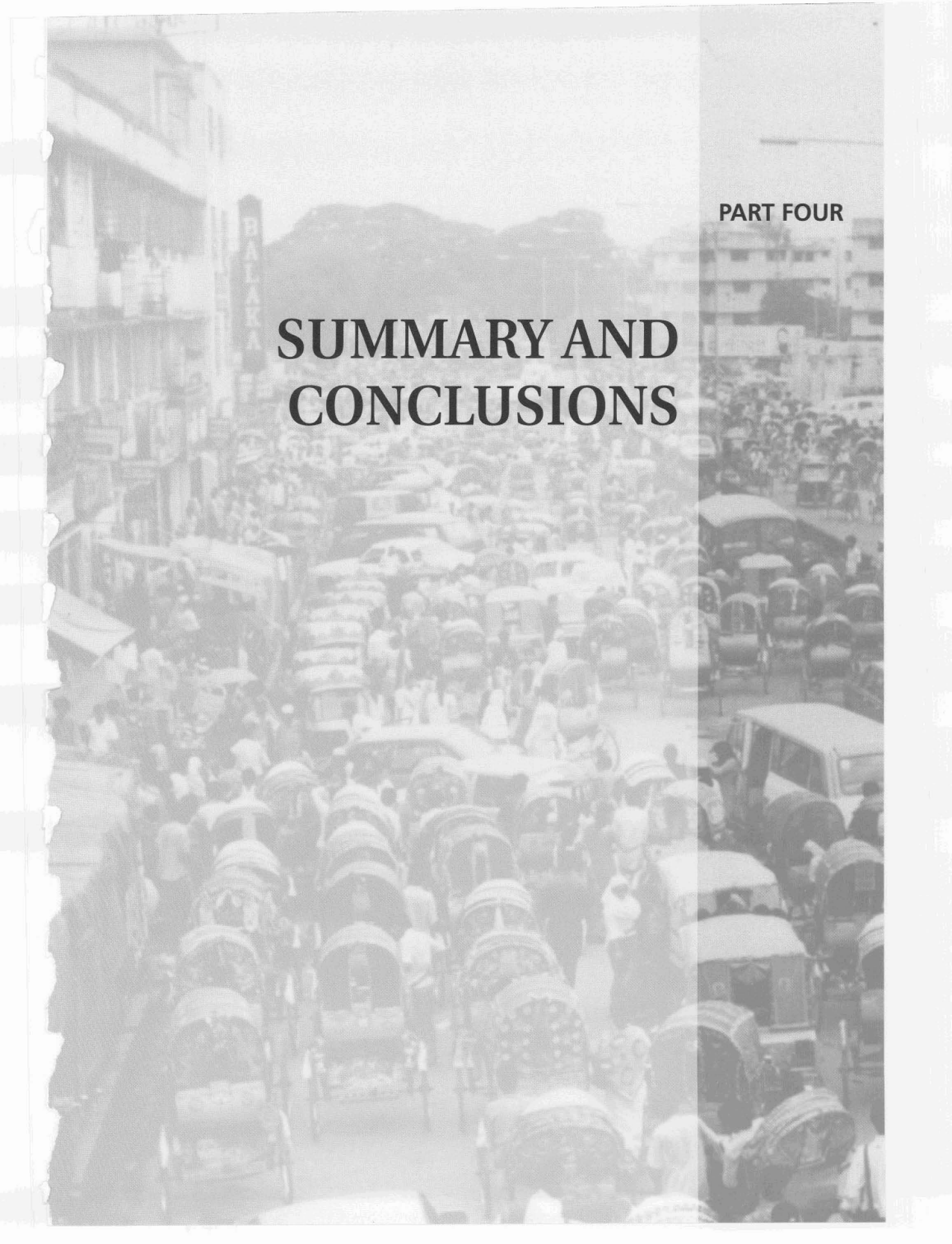
The portion of the document dealing with the Czech Republic is quite different, being longer and more specific. It begins with some traffic safety data. In 1993 there were 1,355 fatalities recorded, using the 24-hour rule. The fatality rate is given as 0.02 per vehicle kilometre on motorways and 0.04 per vehicle kilometre elsewhere. Next, a discussion of the 1993 World Bank report is summarised. The Bank estimates the "financial and economical loss for the community" in 1991 at 535 million ECU.

The second part of the report deals with blackspots, and credits the most advanced methodologies to Great Britain, the Netherlands and Scandinavian countries. As far as the Netherlands is concerned, there are seven steps: data collection, data analysis, formulating hypothesis, testing the hypothesis, supplementary investigation, determination of probable cause and proposing countermeasures.

REFERENCES

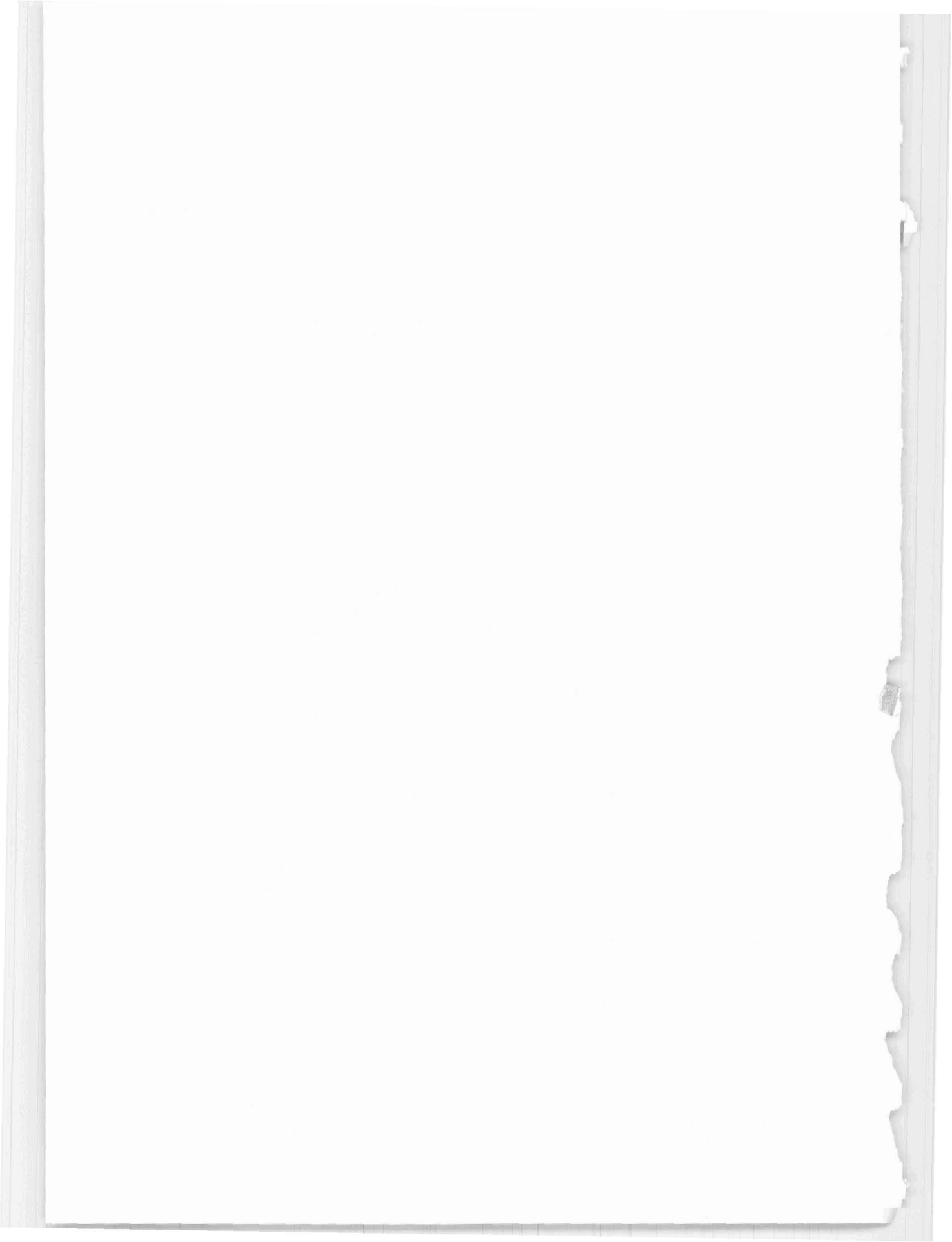
1. *Injury Control: A Global View* Berger, L.R. and Mohan, D. Oxford University Press, Delhi. 1996 pp. xiii +278.
2. Slop. Marinus *The LOCOSAFE Project: A Manual for Traffic Engineers*.
3. *Infrastructure Design and Traffic Safety*. Proceedings of a workshop held in Prague, Czech Republic, October 12-14, 1994. Vol. I SWOV D-94-14 I, Vol. II SWOV D-94-14 II.
4. *Feasibility study into exchange of traffic safety expertise: Part I: Cooperation with Hungary*. (Written by Peter Hollo, M. Brouwer and P. Wesemann.) *Part II: Cooperation with the Czech Republic*. (Written by Josef Mikulik and Karel Valik in cooperation with SWOV).





PART FOUR

SUMMARY AND CONCLUSIONS



CHAPTER SEVENTEEN

Through A Kaleidoscope Darkly

B.J. Campbell, P.R. Knight and I.R. Johnston

This may seem an odd title for a closing chapter. However, it captures our frustration while at the same time serving as an analogy for our key conclusion. When we first conceived this project, we believed it possible to identify successful and unsuccessful cases of traffic safety technology transfer from motorised to motorising nations, to determine what were the elements for success or failure, and to offer these principles for consideration by those working in the field. That objective was abandoned as we realised the number and complexity of factors that came into play and their myriad combinations that result — like the shaking of a kaleidoscope — in only partly predictable outcomes.

The adoption of knowledge into practice is a fascinating topic of study. The people who generate new knowledge, the institutions in which they work and the processes they use, are typically independent of the people, institutions and processes charged with the implementation and operation of community service or public interest programs. This creates a gap which needs to be filled.

In a commercial enterprise, R&D is funded specifically to develop competitive advantage through the invention of new products or processes. Even here, there is a large literature on the difficulties of balancing the value of unfettered creativity with the commercial dictates of time to market. Move to an area of public interest, traffic safety, then add the complexity of transferring knowledge across geographical and cultural boundaries and the analogy to the kaleidoscope becomes more apparent.

Effective knowledge transfer requires the recipient to not only have a need but also a desire to meet that need; it needs their hearts as well as their minds.

This message comes through strongly in many of the “reflections” that constitute this volume. Perhaps the most telling example is the lament of the INRETS staff at the failure of their efforts on the Ivory Coast; recall the quotation from Chapter Twelve: “... favourable conditions for safety action were not met; local skills and manpower were not sufficiently available, economic conditions were difficult and on a downward trend, and motivation of the decision makers ... did not seem high enough ... in terms of action.”

It is not sufficient to decide, altruistically, to help a motorising nation improve its level of traffic safety. Help should only be provided when the appropriate institution in the motorising nation acknowledges that a problem exists, decides that solving that problem is a genuine priority and believes that the solution lies in adapting the knowledge and experiences of others.

The discussion of the World Bank's attempts to “force” traffic safety planning and action by making them conditions of infrastructure development loans underscores this conclusion (Chapter Eight). Bank officials admit that the “power of the purse” has serious limitations and are evolving a set of principles to guide attempts to enforce safety systems as part of the infrastructure developmental process.

To win “their” hearts and minds, however, may present great problems, particularly when “they” feel that coercion and force is being used to that end. However, acceptance by the public of safety measures may enable political action to occur. Grass roots pressure may, in fact, force government action. Instances have been cited (Chapter Ten) where citizen groups, or organised segments of society, have played a pivotal role in helping communities to achieve such understanding and to appreciate the benefits resulting from changed attitudes and behaviour. The examples given in Chapter Ten of the role of groups, such as MADD and others, which helped to pave the way for legislation to more effectively deal with the impaired driver, should not be underestimated. With the cooperation of students in many North American schools SADD (Students Against Driving Drunk) groups were formed and this groundswell of public opinion enabled tougher legislation and enforcement to be accepted.

There are many other examples where grass roots pressure has helped and even resulted in governments acting for the benefit of all. The role of the Royal Australasian College of Surgeons (RACS), together with other citizens, was of great importance in the state of Victoria leading the world in seat belt legislation and other safety legislation, that has greatly reduced fatalities and injuries on Australian roads. The American College of Surgeons (ACS) embraced the ATLS course. This method of dealing with acutely injured persons has saved many lives and much morbidity of individuals who suffered trauma on the roads and elsewhere (Chapter Seven).

Neurosurgeons and physicians helped the public to understand the need for head protection for motorcyclists and, more recently, cyclists.

For citizen groups to be successful it is important that they should have the guidance of knowledgeable professionals, a basic funding mechanism and that their actions and plans should be appropriately coordinated. Under these circumstances well-informed and motivated citizens, whose hearts and minds have been won, may play a significant role in promoting highway safety at many levels within their communities and countries.

We found one example where the motivation for rapid transfer was commercial need. In the Czech Republic the level of vehicle safety design standards changed quickly and dramatically as the local automobile industry was acquired by an international company which wanted to market its Czech-manufactured products globally. It had, therefore, to meet international safety standards (Chapter Six).

While it could be argued that international vehicle safety design standards do not incorporate all the relevant new knowledge, it is undeniable that the safety of Czech vehicle occupants has improved substantially. International standards in all fields of traffic safety represent the results of compromise between national interests and the commercial interests of global industries; such standards will always lag behind advances in knowledge because of the need to consider other priorities and conflicting interests. The idealist, especially in the international arena, will achieve little. Progress is almost always incremental.

Many traffic safety professionals accept the need for compromise in the area of international standards and protocols yet seem unable to perceive the relevance of setting traffic safety progress in the context of a developing nation's other economic, public health and transport priorities.

Understanding the wider economic, social, cultural and transport context is fundamental to planning what knowledge to seek to transfer and deciding upon effective strategies for that transfer.

The contribution by Mohan and Tiwari (Chapter Four), coming as it does from the perspective of a recipient nation, is eloquent testimony. It is not as though the conclusion is not accepted — conceptually — by most professionals in the field; the difficulty seems to lie in its application. Chapters Five (the planning project in China), Eight (the role of the World Bank), Twelve, Thirteen and Fourteen (country studies of France, Sweden and the UK respectively), contain entreaties to involve the “locals” and examples of implementation tactics, but also comment on how difficult it is to succeed.

It seems to us that the missing element is a general failure to **embrace** the place of traffic safety in the transport and public health priorities of the recipient nation when it is discordant with the view of what consultants from motorised nations believe that role should be. Without a preparedness to embrace a dissonant priority, compromise is unlikely. Without compromise, progress is unlikely.

Here we may do well to recall the long-term strategy of the Japanese (Chapter Nine). The Japanese tend to place their experts in the recipient country for extended periods of time to work with the local professionals and foster genuine understanding as well as lasting relationships. This is coupled with training in Japan for these professionals, training which is updated regularly. While we uncovered no hard evidence that this strategy led to more effective knowledge transfer, it appears an excellent way of embracing local needs and priorities.

Let us look for a moment at the flip side of the same coin. The reader will recall from Part 3 that some motorised nations have a long history of attempts to transfer traffic safety knowledge to motorising nations (for example, France, the United Kingdom, Sweden and Norway) while others appear to have made little systematic effort (for example, the USA and Canada). All these countries have substantial foreign aid programs so it is not that they do not share a commitment to assist less developed countries. Why does this aid include traffic safety in some cases but not in others? We believe it is because different donor countries have different foreign aid objectives and different social, political and cultural values. If this is so, why do we find it so hard to accept that different motorising nations place different priorities on traffic safety and therefore approach our (often unsolicited) attempts to help with differing levels of enthusiasm?

The "power of the purse" must become more effectively applied if it is to succeed as a strategy to help increase the priority of traffic safety in many motorising nations.

The reality of funding underlies most of what is or is not happening in traffic safety assistance efforts. First, most (though not all) motorising nations are also low-income countries. Resources to increase safety are therefore in severe competition with the most basic of concerns related to nutrition, health, internal security, and other competing needs. When funds are available in the transport area, there is a great desire to build roads, this being a key to economic development, the over-riding imperative.

In motorising nations at higher income levels, problems still abound because the higher income in these nations may be a relatively recent change, and there is much inertia in the system. It takes decades to upgrade the road system in a country, and institutional changes do not occur quickly.

Even so, road accidents constitute a serious burden on the health care system in most motorising nations. In some countries early in the process of motorisation, road accidents and traffic injuries cost about one or two percent of the country's Gross Domestic Product. That figure is useful, to an extent, in trying to energise the necessary internal and international interest in improving the situation. But it may well be insufficient since it is not clear where the "saved" money will go if traffic accident costs are reduced. It seems likely that the "savings" will be manifested only in terms of a slight reduction in the rate of growth in health system costs. Presumably the police will not benefit from any such savings, nor is the road building community likely to do so. However, the dimensions of human suffering are evident as a compelling force to government officials and citizens alike. This concern with human as well as monetary costs is at the core of the growing program of the American College of Surgeons in providing Advanced Trauma Life Support courses in a widening sector of the world (Chapter Seven).

In view of all this, it often falls to the high-income countries or to international funding sources to provide traffic safety financial assistance. This is frequently done as a component of road building projects. Of course, considering the enormous scale of road construction projects, safety is an incidental component. When traffic safety funding is provided as a modest but important component of a road construction project, there are implications as to the kind and quality of traffic safety expertise that is delivered "on the ground". Often the main contractor is one of the international construction firms that have been involved in so many major public works projects all over the world in recent decades. Sometimes in such a project there is a teaming arrangement in which the traffic safety component is handled by a truly senior and experienced organisation. But that is not necessarily true. It is, of course, not to be expected that such construction firms will have an in-house staff of safety experts. Therefore, if there is a significant traffic safety component in the contract, the international firm must recruit the services of traffic safety experts for the project. The level of expertise so obtained may or may not be satisfactory. Sometimes the traffic safety component involves staff who are actually quite unfamiliar with the subject.

This situation suggests the desirability that highly motorised and high-income countries provide some level of government support for traffic safety assistance to motorising nations, at least for some time into the future. If there is a dedicated staff and mission for traffic safety assistance within the provider nations, then it is more likely that bona fide traffic safety expertise will be delivered to the projects, for there more likely will be a stable pool of senior specialists from which to draw. This is said in the belief that just as experienced safety professionals are essential for progress in

one's home country, so it is that specific experience in "overseas" work is equally important. Since a major challenge in assistance to motorising nations is to understand the local situation, and to find ways effectively to apply initiatives from other countries, then it is obvious that there is a rather demanding "learning curve" for professionals who would spend time residing in motorising countries. If the nature of funding mitigates against retention and seasoning of capable staff, then the alternate becomes one of sending inexperienced people on such missions, to be replaced by successive waves of inexperienced staff in the future. This militates against the establishment of a capable community of safety professionals in the recipient country.

It would seem that an increasing burden for provision of funds is falling on the World and Regional Banks and the few other international organisations in a position to do so. An indication of World Bank awareness of the funding problem is apparent in one of their major projects in Eastern Europe, described in Chapter Eight. In that project not only were safety initiatives considered, but attention was paid to means for financing traffic safety. A similar concern was addressed in the chapter on China (Chapter Four). International lending organisations cannot support traffic safety in motorising countries indefinitely. In the long run each country must provide sufficient funds to maintain the required level of safety for their road transport system. Since the road transport system is a large economic enterprise, it is natural that the government would look to road users for revenues to operate it safely.

Finally on the matter of financing traffic safety assistance to motorising nations, it is to be noted that absent from any current active program of financial support are those multinational corporations with a clear stake in traffic safety — most notably the automobile industry, insurance industry, and the family of industries that have a major stake in construction of roads and other major public and private works. On a small scale, several of these have been involved, but the level of involvement is not commensurate with the size of the traffic safety problem in motorising countries or the financial scale of business involvement in the motorisation of those countries.

Insufficient effort is being given to the training of professionals and administrators, thus the long-term human infrastructure for ongoing knowledge transfer is not being established.

Chapter Seven discussed what can be achieved as a result of international networking among concerned professionals — in this case, health professionals, focusing on the problem of improving trauma care. It is apparent that the involvement of such professional groups within motorising nations can and should be of great benefit. This benefit will only occur if those

professional bodies which understand the functions and priorities that may exist in their own countries are recruited and involved from an early stage in the motorising process.

Then there are short-term activities like training, conducted either in the provider nation or the recipient nation. Some training is intensive and "micro" in nature, such as the two-week course on accident investigation provided in Estonia by police officers from Canada (Chapter Eleven). It would seem that short course training might have a lasting beneficial effect if the subject matter were very specific to an ongoing activity in the recipient country.

Some training has longer term implications, like the university course for road transport and safety in developing countries, offered for foreign students in residence at Birmingham University in England (Chapter Fourteen).

The fact that several universities around the world offer a course here or a seminar there is indicative of the fact that there is essentially no place where comprehensive training in traffic safety is available to officials in motorising nations. The difficulty lies in the fact that there is no funding to put such a centre in place and then to wait for the demand and utilisation to develop, and there is no obvious demand clamouring for establishment of such a centre. Yet if such a centre were established, there seems little doubt that a large group of eager students would be available. Funding would have to be provided for faculty, both local and imported, and scholarship money for students since many countries would find it difficult to send students to such courses. Perhaps the World Bank or impacted multinational corporations could appreciate the value of creating such an institute under its auspices.

Nevertheless one can visualise a training centre where short and long courses could be developed in motor vehicle administration, driver licensing, police traffic enforcement, pedestrian education, evaluation techniques, blackspot identification and correction, etc. Such a centre could also provide a locus for local research into the unique problem of motorising countries. That could include such things as the identification of low-cost but effective approaches, crashworthiness considerations for small motorised vehicles such as three-wheeled scooter-type taxis, research to achieve a low-cost helmet for cyclists, and even "theoretical" research considering whether the traditional measures of accident rates (accidents per unit registration, or accidents per unit travel) are equally applicable across a spectrum of countries.

Ideally such centre(s) would be affiliated with established schools of engineering where a course of study in transport engineering may already be available. It would be even better if such a centre could also be in

conjunction with a university where medical and public health training are also available.

The establishment of one such centre and provision of funds for five years or so would be an interesting project for sponsorship by one or more of the multinational corporations.

The ultimate goal must be long-term effectiveness of traffic safety knowledge transfer.

It seems that there is a tendency on the part of officials from the donor nations to ascribe success and failure to a readiness on the part of local officials to undertake new efforts, and ability of the institutions to absorb the new or upgraded activities. This is described by World Bank officials in terms of "sustainability". That term is used to address the question of the project having a chance of functioning successfully after the donor country officials have gone home and the funded project has ended. In the hope of realising this "sustainability", officials interviewed in the various countries emphasised the importance of:

1. involvement and enthusiasm on the part of local middle level officials who would actually administer the new efforts, and support for those efforts by senior level administrators;
2. adapting the initiative as much as necessary to the needs and capabilities of the local situation; and
3. establishing the necessary multi-ministerial mechanisms, perhaps by a Traffic Safety Council with representation from all ministries involved.

Most officials interviewed agreed that sometimes the presence of factors such as listed above are enough to bring about success, but sometimes not. It is not surprising that this should be so. In highly motorised countries, the same kinds of barriers have long existed, such that new initiatives may have to be instigated against the tide of interests in individual ministries, and have to be adapted to regional needs, and may or may not succeed.

In the final analysis, most of what is offered to motorising countries is largely made up of what worked in the highly motorised countries, adapted to local needs as much as possible. However, Mohan and Tiwari argue (in Chapter Four) that in some crucial respects the experience in motorising, low-income countries is unique. They argue that the vehicle mix that prevails in China, India, many nations in Africa and elsewhere is truly unique and that now-highly motorised countries never had a comparable traffic environment with which to contend.

Many such recipient nations have a combination of poor roads with very high traffic volume, and a very heterogeneous mixture of motorised and non-motorised traffic, not seen in highly motorised nations. In the USA, there was a time when much more of a mixture of motorised and non-motorised traffic prevailed. Though pedestrians now account for 13 percent of traffic fatalities, they accounted for more than 40 percent in the 1920s. However, it must be conceded that the USA never had simultaneously to contend with high levels of population and modern, high-speed motor vehicles and a wide variety of road users. In the now-highly motorised countries the onset of motorisation was at a time when motor vehicles themselves were relatively new, and certainly under-powered relative to the present.

So what is the point? According to Mohan and Tiwari, this means that there is an inherent limit to the applicability of initiatives from highly motorised nations, even if adapted as much as possible to the needs of the recipient nations. They assert the need for original research dedicated specifically to road accident problems in motorising nations. Research was necessary to identify effective initiatives in highly motorised nations, and a similar research program is necessary in motorising nations, they say. The lack of research knowledge specific to a motorising nation is part of the reason, perhaps, why experts from outside sometimes fail to provide useful assistance.

Focus on traffic safety.

Each motorising nation is beset by numerous problems, which produce conflicting demands on available resources for their solution. However, the rapid increase in motor vehicle numbers in these nations will result in large and increasing direct and indirect costs, injuries and deaths. These costs, as well as the direct effect of road trauma on health treatment facilities, will cause increasing difficulties for nations to provide appropriate comprehensive health care for the general population.

As nations solve what they perceive as other more pressing problems, the broad and deep costs of motorisation will become apparent. From what may at present appear to be a relatively neglected position, this problem will attain an importance that will demand to be addressed. Different nations will, almost certainly, reach this point at different times and at different levels of their development. The need to deal with the problem, however, will require that it be faced, sooner or later, by each motorising nation.

When the problems posed by motor vehicles, in any nation, assume a recognised high priority, it is essential that broad and focussed traffic safety assistance be available. The task at hand, for all nations, is to prepare and be equipped for when that time arrives.

Postscript

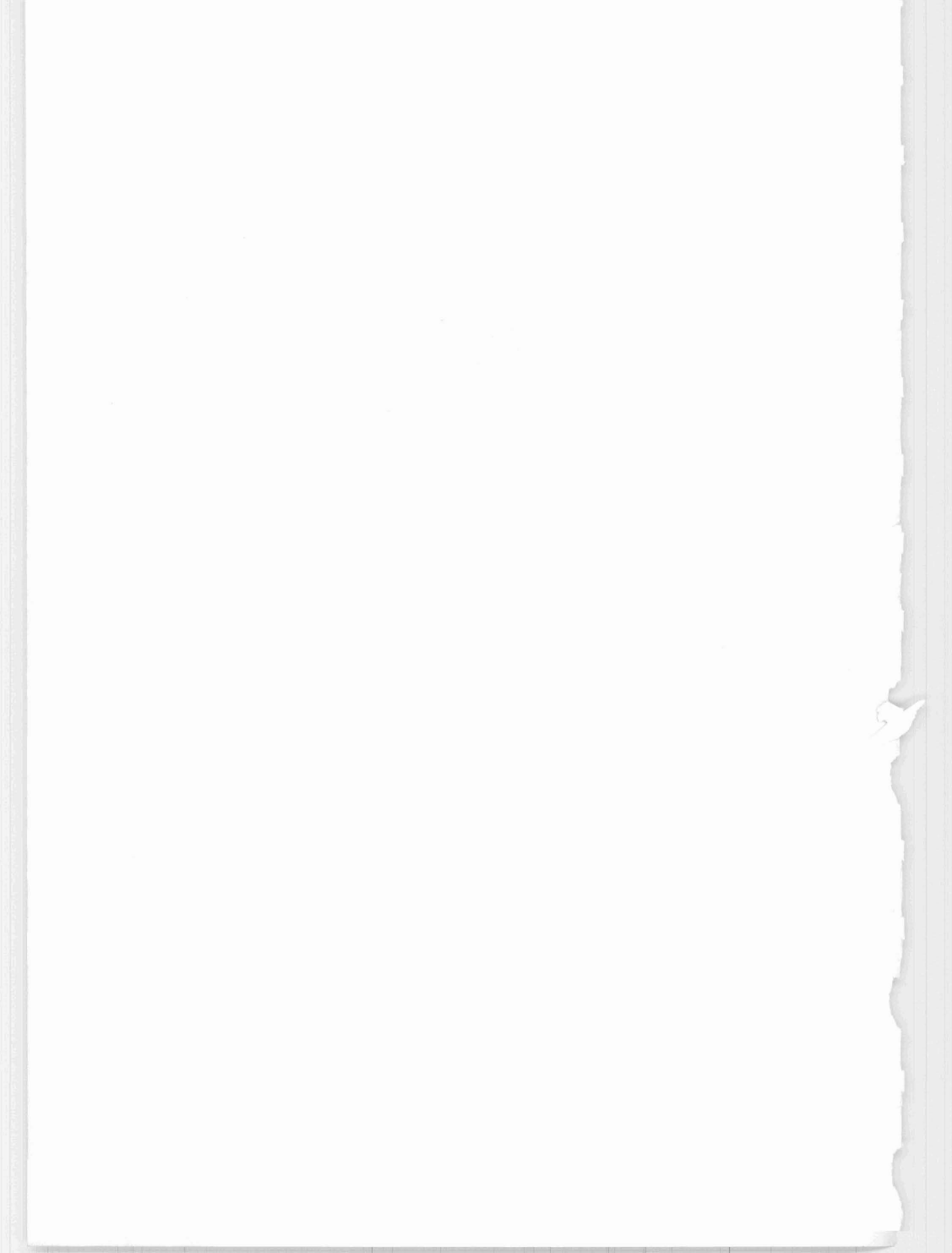
Peter Knight (Trust Chairman)

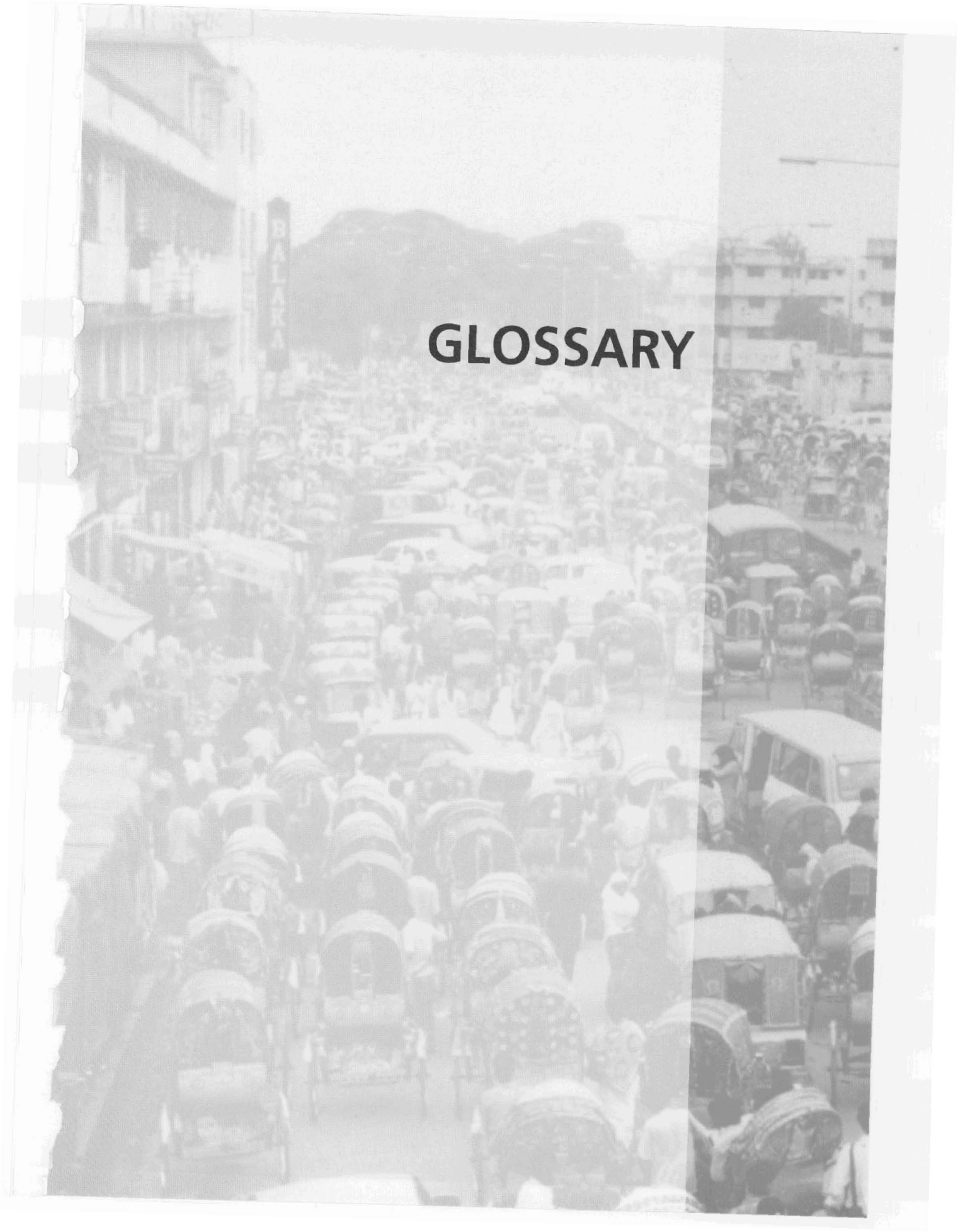
As noted in the Preface, this volume marks the closure of the Global Traffic Safety Trust. The Trust was formed in 1988 after successful publication of a book by eight professional colleagues brought together by Gordan Trinca at the Royal Australasian College of Surgeons.

In Australia, the Royal Australasian College of Surgeons (RACS) has been a leader in addressing the problem of highway trauma. It has supported the establishment of a Trauma Committee whose activities and influence have spread throughout Australasia. This has been an inspiring example of a professional body of health care professionals accepting the challenge and dealing with an identified problem. GTST had its registered headquarters at RACS. We thank the College for its support, encouragement and ongoing involvement in the activities of GTST.

The Trustees, who have enjoyed each other's friendship, support and mutual sharing over the last thirteen years, consider it a privilege, pleasure and honour to have had the opportunity to extend their range of professional activities beyond the norm through their participation in GTST.

GTST was formed through the generosity of Mr. J. Takada of the Takata Corporation of Japan. For the ten years that GTST has been active he has played an enormous role in making it possible for the Trustees to carry out the several projects in various parts of the world. The Trustees gratefully acknowledge this tremendous support as well as the friendship and generosity of such a benefactor.





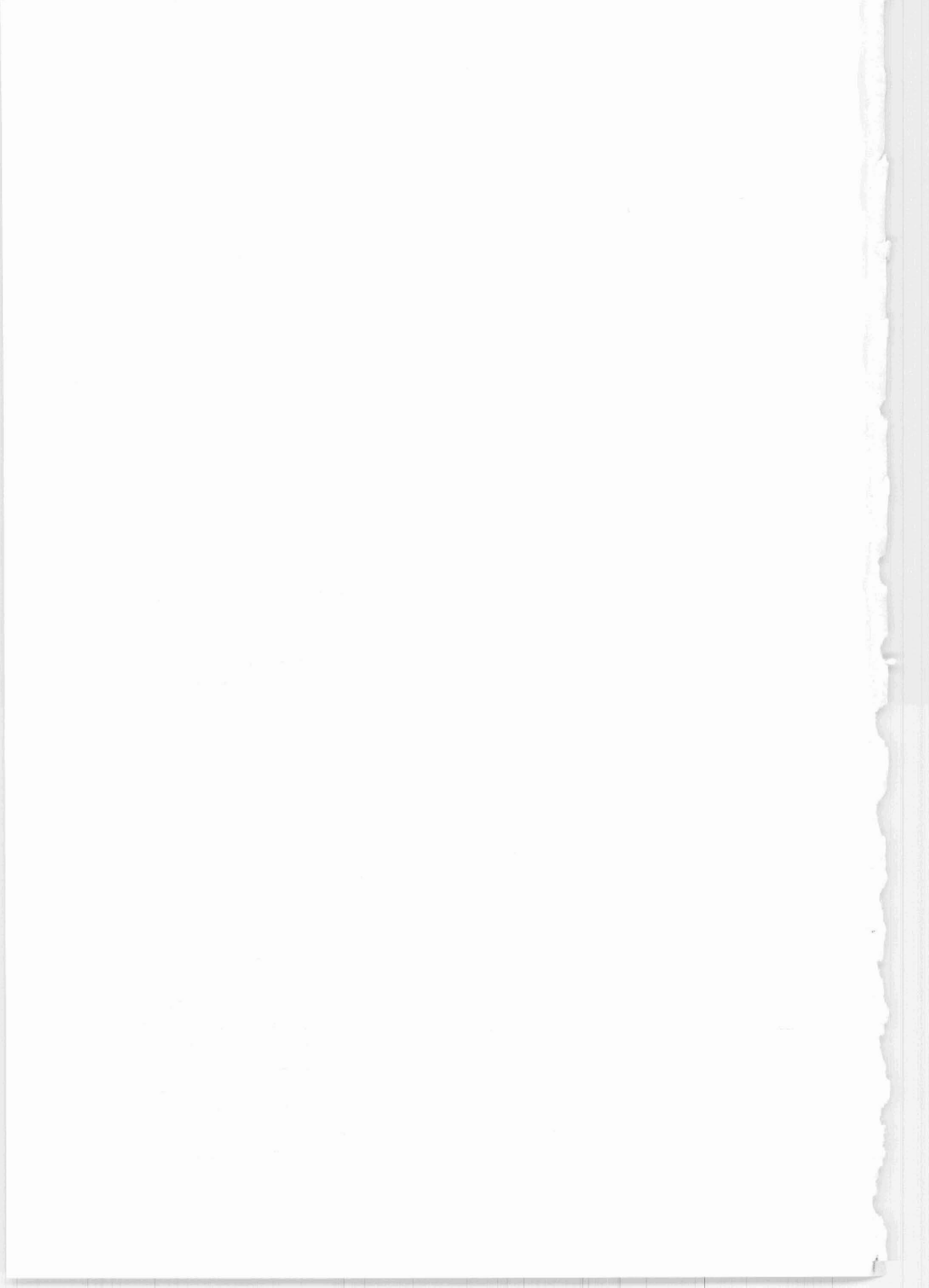
GLOSSARY

Glossary

AAMVA:	American Association of Motor Vehicle Administrators
ACS:	American College of Surgeons
ADB:	Asian Development Bank
AID:	(US) Agency for International Development
ANZCA:	Australian and New Zealand College of Anaesthetists
APEC:	Asia-Pacific Economic Cooperation
ASEAN:	Association of South East Asian Nations:
ATLS:	Advanced Trauma Life Support
CDC:	(US) Center for Disease Control
CEE:	Central and East European Countries
CIDA:	Canadian International Development Agency
CNPAC:	Centre National de Prevention des Accidents de la Circulation
CSC:	Canada Safety Council
DFAIT:	(Canadian) Department of Foreign Affairs and International Trade
DOH:	(Thailand) Department of Highways
EBRD:	European Bank for Reconstruction and Development
EMST:	Emergency Management of Severe Trauma
ESCAP:	(United Nations) Economic and Social Commission for Asia and the Pacific
EU-PHARE:	A program of the European Union with code name "phare"
FHWA:	(US) Federal Highway Administration

FRACS:	Fellowship of the Royal Australasian College of Surgeons
GNP:	Gross National Product
GTST:	Global Traffic Safety Trust
HSRC:	University of North Carolina Highway Safety Research Center
IATSS:	International Association for Traffic and Safety Sciences
INRETS:	Institut National de Recherche sur les Transports et leur Sécurité
JASIC:	Japan Automobile Standards Internationalization Center
JICA:	Japan International Cooperation Agency
KTI:	(Hungarian) Institute for Transport Sciences (or specifically Kozlekedes Tudomanyi Intezet)
MAAP:	Microcomputer Accident Analysis Package (of TRL)
MTO:	(Ontario) Ministry of Transportation
NGOs:	Non-Government Organisations
NHTSA:	(US) National Highway Traffic Safety Administration
NORAD:	Norwegian Agency for International Development
NRSB:	National Road Safety Board
NTH:	Norwegian Institute of Technology
ODA:	Official Development Assistance (e.g. Canada's or Japan's)
OECD:	Organisation for Economic Co-operation and Development
OECF:	(Japanese) Overseas Economic Cooperation Fund
PAHI:	Pan American Highway Institute
PIARC:	Permanent International Association of Road Congresses (now the World Road Association)
PRC:	People's Republic of China

RACS:	Royal Australasian College of Surgeons
RCMP:	Royal Canadian Mounted Police
RIF:	(Norwegian) Association of Consulting Engineers
ROSPA:	(UK) Royal Society for the Prevention of Accidents
RSA:	Road Safety Agency
RSO:	Swedish Traffic Safety Office
SADC:	South African Development Community
SATCC:	Southern African Transport and Communications Commission
SIDA:	Swedish Foreign Aid Program
SSDC:	Singapore Safety Driving Centre
SV:	(Norwegian) Public Roads Administration
SWOV:	Stichting Wetenschappelijk Onderzoek Verkeersveiligheid; Institute for Traffic Safety Research (the principal Dutch traffic safety agency)
TØI:	(Norwegian) Institute of Transport Economics (Transport Økonomisk Institut)
TRB:	(US) Transportation Research Board
TRL:	(UK) Transport Research Laboratory
TRRL:	(UK) Transport and Road Research Laboratory (now TRL, see above)
TT:	(i) Technology Transfer; (ii) (Norwegian) National Society for Traffic Safety
TTC	(Philippines) Transport Training Centre
TTI:	Texas Transportation Institute
UMTRI:	University of Michigan Transportation Research Institute
VTI:	Vag-Och Transport-Forsknings Institutet
WHO:	World Health Organisation



**Reflections on
the Transfer of Traffic Safety
Knowledge
to Motorising Nations**

Since the formation of the Global Traffic Safety Trust (GTST) in 1988, a number of projects have been undertaken by individual trustees, as well as collectively, to address particularly the issues raised in the publication "Reducing Traffic Injury — A Global Challenge". During some of the invited visits to various countries it became apparent that documentation was lacking of successful and less successful contributions that have been made to assist nations undergoing rapid expansion of their transport systems. To whom could countries turn for advice and assistance? With this as a concept, the GTST undertook to carry out limited surveys of different countries. This monograph is the result of these activities and is the final combined effort of the eight trustees of the GTST: it is an outline of where and what type of help may be sought.