PIARC – C13

ROAD SAFETY

Thursday 23 October 2003 (8.30 – 12.00 a.m.)

SESSION AGENDA & INTRODUCTORY REPORT

22.13.E

SESSION AGENDA

1. **Introduction**

Ir. Peter M. W. ELSENAAR (C13 Committee Chairperson/THE NETHERLANDS)

2. **Road Safety Audits**

Dr. Ian APPLETON (C13 member/NEW ZEALAND)

3. **Safety Concepts and IRTAD**

Mr. Michel PEETERS (C13 member/BELGIUM)
Mr. Josef MIKULIK (C13 member/CZECH REPUBLIC)

4. **Road user's behaviour**

Mr. Randy SANDERSON (C13 member/CANADA)

5. **Road Safety Manual**

Mr. Carl BELANGER (C13 member/CANADA-QUEBEC)

6. **Summary of Innovation Session**

Mr. Hans-Joachim VOLLPRACHT (C13 member/GERMANY)

7. **Summary of Developing countries Session**

Mr. Stuart YERRELL (C13 member/UK)

8. **Conclusion**

Ir. Peter M. W. ELSENAAR (C13 Committee Chairperson/THE NETHERLANDS)

9. **Panel discussion**

Moderator:
Ir. Peter M. W. ELSENAAR (C13 Committee Chairperson/THE NETHERLANDS)

a) **View from the road user**

Mr. Max MOSELY (Fédération Internationale de l'Automobile/FRANCE)

b) **Strategy of the World Health Organization**

Dr. Margie PEDEN (World Health Organization/SWITZERLAND)

c) **The role of enforcement**

Mr. A. A. M. HELLEMONS (TISPOL/THE NETHERLAND)
Mr. David ROWLAND (TISPOL Organisation/UK)

d) Campaigning for Road Safety and its effects

Mr. José MIGUEL TRIGOSO (Prévention Routière Internationale/PORTUGAL)
Mr. Joop GOOS (Prévention Routière Internationale/PORTUGAL)

e) Partnership and the role of the Private Industry

Mr. Josef SCHLEICHER
(Global Road Safety Partnership, DaimlerChrysler /GERMANY)

f) Panel discussion with the audience

g) Closure of the Session

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INTRODUCTION TO THE WORK OF PIARC COMMITTEE C13

In road crashes each year about 1 million people are killed, 50 million are injured. The global costs for a country are estimated at 1 to 2% of the GNP and world-wide about 500 billion dollars. The WHO has calculated that if no action is taken then, by 2020, traffic accidents will be the third highest cause of premature death in the world. One would expect that road safety is high on a national priority list.

This is, however, in a lot of countries not the case because:

- The problem seems complex and the public seems to become used to road crashes like with storms, earthquakes etc. Knowledge of remedial measures and or their implementation is sometimes poor.
- The organization that invests in road safety does not get the return on investments because the profits occur in other areas.
- Road safety interventions are only effective if they contain a multi-disciplinary approach with active coordination of all disciplines in the field of vehicles, roads, behaviour, enforcement, emergency services, insurances, etc, which means that road safety activities are certainly not restricted to Ministries of Transport but also involve Justice, Internal Affairs (police), Health, Finance, etc.
- It is overlooked that a proper monitoring and a set of cost effective counter measures can create a much more favourable situation. Low cost engineering projects have shown to give an economic rate of return in excess of 100-200%.

With its activities the Committee C13 intends to contribute to a global reduction of road crashes. This can only be realized if decision-makers and experts will follow up this work on a national level, and PIARC is an effective organization to share and transfer knowledge.

In the very past the PIARC Road Safety activities were very much focused on roads and infrastructure. Nowadays, road safety is seen as a multi-disciplinary problem that needs cooperation between all disciplines involved and properly coordinated approaches.

With this philosophy in mind, Committee 13 has worked on the various special items in the PIARC Strategic Plan 2000-2003. These are:

- Road Safety Audits: an update of the state of the art
- Human Factors in Road Design: a new approach in road design guidelines
- Evaluation of Road safety Concepts: a proposal for an approach, including in depth safety statistics analyses.
- User Behaviour Enforcement & Persuasion: recommendations for implementation
- Road Safety Manual: Introduction of this common knowledge base produced by PIARC C13.

In a later stage, the Committee 13 was challenged by various partners to produce a booklet to advocate road safety activities by high-level decision-makers in developing countries and countries in transition. This booklet now is issued in the English and French language.

The C13 Committee worked on these items in 6 working groups: the reports and results of these working groups are given in this report. The Chairman and Secretariat would like to acknowledge the working group Chairman for drafting the chapters of this report.

In its activities Committee C13 has given priority to:

- Carrying out the **Strategic Plan** Program
- The **Safety Manual** which is part of this plan, but it is also the database of common knowledge in C13 that is made available to all safety experts, and should be updated periodically,
- **Road Safety in developing countries**, as crashes are increasing in those countries whilst they are decreasing in most developed countries. This effort was done in cooperation with C13 and with the Global Road safety Partnership, a program initiated by the World Bank, the Red Cross and the World Health Organization.
- Implementation of road safety knowledge, C13 has initiated **conferences** and has been present at numerous conferences and seminars.
- **Advocacy of safety activities**; road safety activities will only take place if there exists in a country public and political awareness. With the booklet (chapter 7) PIARC has contributed to this effort.
- **Cooperation with other international organizations** like OECD, IRF, PRI, ECMT, ETSC, TRB, WHO, etc. It is important that all these organizations cooperate and spread the same messages to decision-makers. World Health Day 2004 is an excellent opportunity to demonstrate this cooperation.

On its call for papers C13 has received over 30 individual papers, which are published on the CD-ROM and are being used in the process of preparing for the Durban Conference in 2003.

REPORT OF WORKING GROUP A: ROAD SAFETY AUDITS

What is Road Safety Audit?

"A road safety audit is a formal examination of a future road or traffic project or an existing road, in which an independent, qualified team reports on the project's crash potential and safety performance."

This is the definition from the Austroads *Road Safety Audit Guide*, second edition, published in 2002.

The essential elements of the definition are that it road safety audit is:

- a formal process and not an informal check,
- carried out by people who are independent of the design,
- carried out by people with appropriate experience and training, and
- restricted to road safety issues.

Brief history and current use

Road safety audit (RSA) had its origins in the United Kingdom in the 1980s, following the development of Accident Investigation and Prevention (AIP) techniques and the requirements of successive legislation for highway authorities to take steps to reduce the possibility of accidents on their roads. AIP teams in County Councils, from initially investigating problems on existing roads with great success, turned their attention to preventing accidents on new road schemes. Formal processes were developed and in 1990 the Institution of Highways and Transport published its *Guidelines for the Safety Audit of Highways*. Those guidelines have since been revised in 1996.

In 1990, the Design Standard HD 19/90 and Advice Note HA 42/90 were introduced by the UK Department of Transport as part of the Design Manual for Roads and Bridges. This made safety audit mandatory on trunk roads and motorways schemes from 1991 onwards. In 2000 the UK Highways agency commenced a thorough review of the UK safety audit practice with a view to a radical overhaul of the Standard and Advice Note.

Keen interest in road safety audit in New Zealand and Australia in the early 1990s saw the publication on the Transit New Zealand Manual in 1993 and the first edition of the Austroads Guide in 1994.

Institute of Transport Engineers

The Institute of Transport Engineers (ITE) produced an "Informational Report" in 1994, summing up the current status of road safety audit throughout the world. The ITE report confirmed that much of the safety audit expertise at the time was in the UK and Australasia. The ITE report noted that there was great scope for implementing road safety audits in developing countries, especially if they were linked to the infrastructure investments being made by funding agencies such as the World Bank.

International Road Safety Audit Forum

In 1998 Austroads hosted the first International Road Safety Audit Forum in Melbourne. The role for the forum arose from discussions among an international group of road safety audit managers who had identified common safety audit issues in several countries, and the need for a consolidation of experience into guidance for other countries. The Forum attracted 180 delegates from 14 countries. A central feature of the Forum was the drafting of a communiqué based on discussion emerging from the presentations and from more detailed feedback from the workshop sessions.

Road safety auditing was widely regarded as an important road safety management tool, and it is clearly in different stages of development in many countries. In the rapidly motorising countries, the safety audit approach has an important role and its implementation will benefit from lessons learned in other more experienced countries. The process is still evolving, even in the more experienced countries, and research efforts must continue to assist in refining the process and realising greater road safety benefits. For these reasons, an international network of practitioners in road safety audit is seen as a useful mechanism to spread information about the process, promote it and advance its adoption.

PIARC C13

In the quadrennium 1996-99, Committee 13 set up a working group on road safety audit, led by Lene Herrstedt of Denmark. It comprised of members from France, Hungary, New Zealand and Switzerland. The working group gathered information on current practice in different member states. The report to the World Road Congress in 1999 included experience from Denmark, New Zealand, France and the USA. The report has been published by PIARC in 2001.

Current Use

Formal safety audit procedures have been developed in a number of countries, following the initiatives taken in the UK. During the early 1990s, work was carried out in Australia, Denmark and New Zealand. Since then, national and local governments Canada, France, Greece, Hong Kong, Iceland, Ireland, Italy, Malaysia, the Netherlands, Peru, Singapore, the USA and others have been investigating the development of road safety audit. Some countries have prepared national guidelines, and have formally adopted road safety audit as a national policy.

Working Group A activities

Working Group A has considered the following topics:

- Promotional documents
- Road Safety Audit in Developing Countries
- Existing Roads Audits

In addition working group members have contributed to conferences and workshops.

Promotional documents

There are many manuals on road safety audit, and some have already been mentioned in this report. Consequently, there is no need to prepare another manual. Instead the working group felt that there was a need to prepare advice on how to set up a road safety audit programme. The advice needs to be provides at two levels – for politicians and decision-makers and secondly for the practitioners and engineering manager. Examples of such material have been sought.

It is envisaged that the advice for decision-makers will be a short document of only 2 sides of A4 whilst the advice for the engineering manager can be longer, perhaps 4 sides of A4.

Road Safety Audit in Developing Countries

PIARC has as one of its principal objectives to assist developing countries. The question was raised in the working group as to whether road safety audit is a valuable tool for developing countries. In this discussion, a distinction must be made between the safety audit of projects, which is a well-understood process, and the safety audits of exiting networks, which is not a well understood process.

One view was expressed is that road safety audit is a sophisticated process. As countries become more motorised, then their road networks "mature" over time. Thus less developed countries have a relatively "immature" roads network and more developed countries have relatively "mature" roads networks. This view suggests that less developed countries need rather basic road safety programmes, while more developed countries need sophisticated road safety programmes. As road safety audit is seen as a sophisticated process, then it may be suitable only for the more developed countries.

The counter argument to this as follows: the degree of motorisation experienced by each country follows a similar S shaped curve over time. Countries like the USA and the Netherlands are near the top of the curve and maybe nearing saturation. Developing countries are near the bottom of the S shaped curve. The maturity of the road network will follow a similar S shaped curve, presumably lagging behind in time the curve for the degree of motorisation.

Many developing countries have just started or are about to start a rapid increase in motorisation, and so the road network will soon follow a similar phase of rapid growth. It is in this period of rapid growth that it is important to get good road safety designed into the network at an early stage. Thus it is important to bring a road safety audit programme in early, to ensure the safety and the quality of the network. This applies specially to the road safety audit of new projects.

A second counter argument to the initial proposition that road safety audit is not applicable to developing countries is as follows: What road safety programmes are seen as important for developing countries? Examples might be:

- Road Users: Driver training, driver licensing
- Vehicles: Road Worthiness
- Road: Appropriate standards
- Organisations: traffic enforcement, crash data.

However, crash data is often lacking in developing countries. For accident investigation studies good crash data with good location information are essential. In the absence of good data, road safety audits of existing networks can be used instead. However these types of audits are not well understood. The next section discusses this issue.

Road Safety audit of existing roads

Most, but not all, countries that have adopted road safety audit started with the audits of projects. Only some countries have moved onto the audits of the existing networks. These audits are not so well understood as project audits and there are a variety of methods that only help to confuse.

There are many words in use to describe these audits, for example:

- Safety audit of existing roads
- Safety Reviews
- Safety Assessments
- Safety Inspections

Perhaps the different words are used to describe processes with different purposes. At one end of the spectrum the audit may be used to provide a general overview of the adequacy of the safety provisions provided an authority. Recommendations from such an audit would be addressed to policy matters. At the other end of the spectrum, the audit might be used to identify very specific maintenance issues those results in a schedule of items for the maintenance contractor. One would have to ask whether the latter is truly an audit.

There are a variety of methods for conducting these audits, for example, is a sample of roads chosen and how is that sample drawn or are all roads examined? A key component of the methodologies is the use of data – what is recorded and how is it reported?

The audits raise a question of liability? If an authority is advised of a deficiency in an existing road, what is the legal position if the authority does not address the deficiency?

A frequently asked question is whether an audit of an exiting road is a duplicate of an accident investigation study. The authors' view is that both are valuable, the audit is pro-active aiming to prevent accidents, while the latter is re-active, responding to known accidents. As noted above, in situations where there is poor crash data, then the audit becomes the primary tool.

Conferences and Workshops

Working Party A members have contributed to conferences and workshops. For example:

- Spanish National Road Safety Conference, Oviedo, October 2001.
- The International Workshop o Transport Safety, Berlin, April 2002
- Intertraffic Asia 2002 Conference, Bangkok, June 2002

REPORT OF WORK GROUP B: HUMAN FACTORS IN ROAD DESIGN

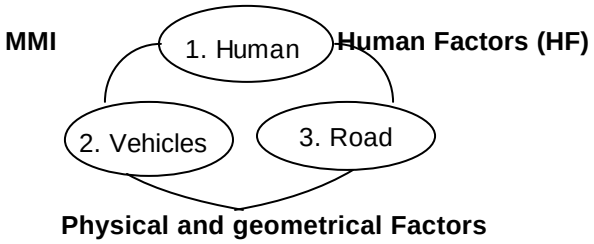
Background

Most accidents occur because of drivers' mistakes. Some driver errors are judgement errors but others are system induced.

The working program of Committee C13 contained amongst others the topics: "Road design standards related to safety" and "User behaviour analysis", that means their wishes, abilities and limitations. To address both these topics, Work Group B of C13 has been working on "**Road Design Standards related to the behaviour of road users**" or shorter: Human Factors in Road Design.

It is well known that Human Factors have an enormous influence on the safe handling of technical systems. In many technical subjects like household machines, vehicles, ships, aircrafts and in the world of production, the Man-Machine-Interface (MMI) is well explored and special design standards are developed to prevent human errors or at least to create a forgiving design.

The road transport system is a triangle of three key components, which are users, vehicles and roads. Each of these factors can contribute individually to road crashes and requires attention. However very often there is not only one single element responsible for the accident, but interactions or combinations of them.



We define the interfaces:

- Between user and vehicle as Man-Machine-Interface (MMI) (subjects of the car industry).
- Between vehicle and road as Physical and geometrical Factors (well defined in several
- Guidelines and they are the tools of road engineers) and
- Between user and road as Human Factors (HF).

Human Factors - the interaction between road users and the road are not very well described. As far as we can establish from the design guidelines they have been considered more or less only from the technical side. As a result, even in new designed sections and intersections, we still find black spots. We have not reached the goal of a self explaining road design with sustainable safety. A better approach would be to start with the human physiological and psychological abilities and limitations in road traffic and use them as the basis of engineering design. Unfortunately, at the moment, our knowledge about these Human Factors is scarce. To address this weakness we have reviewed world wide research results to fill the gaps.

Results

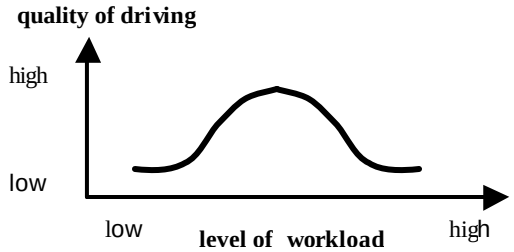
With the external help of the Technical Universities of Aachen and Dresden and a private psychological consultant in Potsdam, the Work Group collected, analysed and summarised about 470 experimental studies concerning patterns of perception, information processing and other mental processes which all have an impact on drivers mistakes. These studies are rarely approached from the perspective of accident prevention. All of them provide a huge amount of information. To assess all these different studies an operational logical structure had to be developed. This has 3 important functions:

- to inform the planners and the executive staff in road design,
- to lead them to a better understanding of road users,
- to generate communication and discussion about human factors in road design world wide

Five main human factors have been defined:

HF I. Strain / Workload

The quality of driving depends on the level of workload. A low level of workload leads to a low quality of driving because of undercharge. A high level of workload leads to low quality of driving because of overcharge. A middle level leads to high quality of driving and fewer mistakes.



Examples:

- ***Monotony***

Monotony in the road environment leads to a decrease of attention and is compensated by an increase in speed (see also HF IV: Choice of Speed). The absence of visual variability because of fogginess or darkness or very long and monotone approaching sections causes a lack of workload and attention.

- Capacity Limits in Information Processing
The capacity for information processing is limited. For instance, no more than 7 +/- 2 independent signals can be processed at the same time and not more than two traffic signs at one place can be identified correctly. Under time pressure only a few decisions can be made reliably.

- **In which situation will the driver be under- or overloaded with information or decisions so that we can expect fatigue (sleepiness) or mistakes?**
- **Which design guarantees an optimum workload?**

HF II. Perception

Perception does not work like a digital camera. Humans can only absorb some of the stimuli from the environment. What they perceive is filtered, selected and condensed.

The perception system considers unconscious information about spatial depth. It completes patterns and fulfils them to known and expected figures. That is why optical illusions can lead to an incorrect estimation of speed, direction, lane width, size and curves.

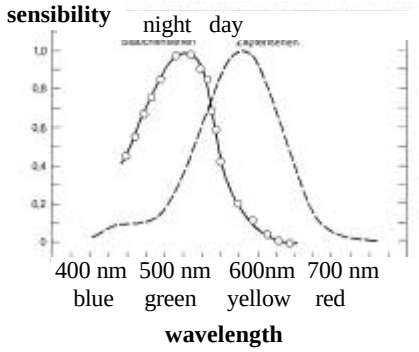
Examples:

- ***Curve illusions***:
The radius of a curve seems smaller if a curve is combined with a hilltop. It seems bigger if a curve is combined with a valley.

- Illusion of distance / perspective:
Distance gets under- or overestimated if a real convergence is interpreted as increased depth. For example, if the orientation lines of markings, road edge or crash barriers are not parallel.

- **How can we avoid optical illusions?**

- ***Perception at night:***
Perception is restricted and delayed in darkness. Thus the speed rises spontaneously. Also the thresholds of perception rise especially for elderly people. The driver needs more and stronger stimuli to react correctly.
In darkness (and fog) drivers compensate the deficit of perception with higher speed. Furthermore, in darkness drivers have a different sensibility of colours than at daylight. For example, red signs can be very difficult to detect whilst blue signs can be detected more easily.



Different sensibility of colours at night (Goldstein, 1997)

- **How can we avoid perception deficits at night and**
- **How can we support especially elderly drivers in darkness when their perception is reduced and delayed?**

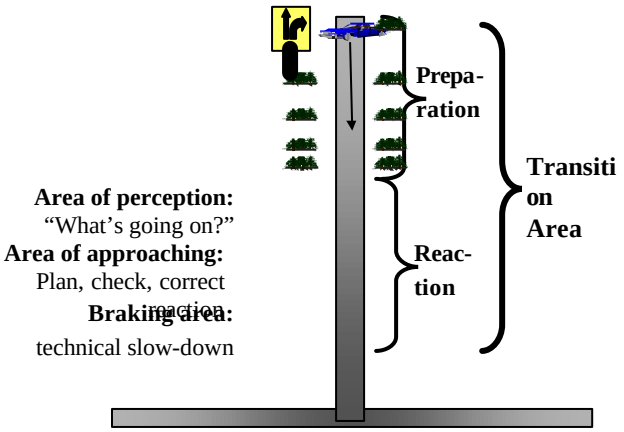
HF III. Orientation and Anticipation

Humans sort out signals into categories. Similar signals are grouped together and similar signal groups are responded to by similar reactions and driving behaviour. The more recognisable signal groups ("features") of a road type are the faster and more decisively drivers react.

Road alignment, lane width and road equipment, the points of orientation, signposting and the design of sections and intersections have to agree with the expectations of drivers. That is why we have to use **invariant and recurring features**, signs, road covers and "furnishings" **for different road types**! But:

- **How should we design the different categories and functions of urban and interurban roads?**

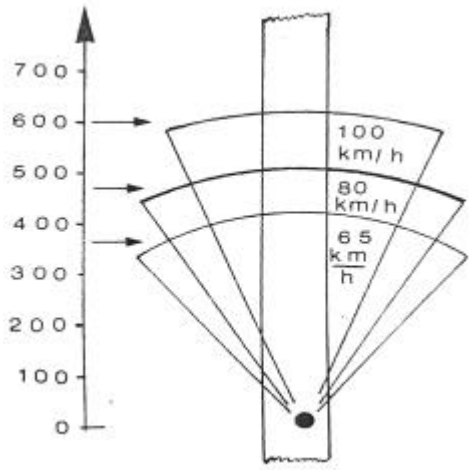
Drivers tend to make mistakes when there is a difference between the expected and actual situations. They need time to plan, check and correct their reaction in front of critical points such as curves, intersections or changes from main road to secondary road, from rural to urban areas, changes in traffic density, changes from section to intersection/entrance ways.



- **We have to design transitions to lead drivers from one situation to the next, but how?**

HF IV. Choice of speed

The choice of speed is mostly an automatic process that depends on different factors. How is this process determined by road geometry and surrounding? A low density of contrasts and a design that consistently meets expectations leads to an increasing speed. There is an interrelation between speed, point of fixation and field of view: The faster the speed, the further the point of focus and the smaller the field of view. Conversely, the further that drivers can see and the smaller the field of view, the faster they will drive.



The faster the speed, the further the focus (m) and the smaller the field of view (Roth, 1973)

- **How should we support the design speed by an appropriate design of the road and the surrounding?**

HF V: Balance

Road users can not move exactly on line. The real line of movement is a flat sine curve. An appropriate balance is important to prevent “a head collisions” or “off road accidents”.

What helps or disturbs the driver to find and to keep the vehicle in an optimal line of movement (straight on, in curves, on bridges, along steep slopes, in avenues etc)?

Our review of these main factors shows a wide range of results and suggests that there are many possible classification schemes. Each considers the impact of different human factors on our understanding of human behaviour and the implications for engineering designs. Every factor is based on different studies and they are based on common abilities of humans. That is why they are independent of cultural experience and learning. They include patterns of perception, information processing and other mental processes, which are valid for all nations and human beings, because the functions of the human cerebral processes are the same in every culture.

Our results will be included in the Technical Sheets within the PIARC Road Safety Manual. These have the following common structure:

- Human factor: common description illustrated by photos, diagrams, etc.
- Facts that are important for road design and accident prevention
- Common advice that has to be taken into account in design
- Recommendations with bad examples and good solutions **for new and existing roads**.

Within the special Durban session for Innovations, our work group will give some answers to the questions above and will present an overview with examples of dangerous situations and good solutions.

Political Aspects

The road transport system, which is adapted to human nature, is an important political issue. Development of road safety policy was one of the Committee's topics at the World Road Congress in Kuala Lumpur. Two articles on this subject were published in Routes/Roads 2002 I et II. These hypothesised that Road Safety Politics move in 8 phases combined with four generations of measures:

1. Legislation
2. Infrastructure
3. Vehicle Safety
4. User behaviour

Until now we have concentrated on influencing road user behaviour by a combination of laws, information, education and enforcement.

But basing road design on Human Factors offers a new approach that would generate a new generation of measures. More than that, it would change countries' road safety politics and start a new political phase.

But why?

First of all it refutes the view of the guilty road user, which is fundamental for lawyers, judges and most politicians in our countries. They may assume that the road user is omnipotent and solely responsible if an accident occurs. But accidents may not be just judgement errors but may be system induced because of a failure to adapt the design to human nature. If for that reason the road user is less responsible for an accident, who takes the blame? That question could lead to a revolution in the jurisdiction of road accidents.

Secondly, less responsibility attached to road users would imply more responsibility for road administrations and road transport authorities either by jurisdiction or by law.

Thirdly, it would force scientists of engineering and psychology to work in interdisciplinary groups with international exchanges

And finally it will offer a cost-effective way to a safer road transport system for all countries, both developing and developed.

REPORT OF WORKING GROUP C: EVALUATION OF ROAD SAFETY CONCEPTS

Introduction

At the World Congress in Kuala Lumpur in 1999, the PIARC C13 Committee presented various studies illustrating a scientific assessment of actions conducted in the field of road safety.

These studies led to the creation of a working group called « Databases on Accidents and Assessment » in order to meet the following objectives:

- Give emerging countries references on practice elsewhere concerning the setting up of databases on accidents as well as pieces of advice on efficient management ;
- Give some methodological elements to organise evaluations of road safety actions.

Well informed to act properly: Information systems on road accidents

Information systems on road accidents are always intricate. They are however essential to take adequate road safety measures:

- Evident accidentology enables to conduct objective analyses and to propose rational solutions. Potential accidentology or accidentology which people feel, on the contrary, leads to placebo solutions ;
- The accident is a failure in the man-vehicle-road system. The information system has to integrate all the data, which are relevant to describe the state of each of the three components at the time of the accident. The integration has to happen in such a way that their interactions can be understood. It is the interactions themselves and not the basic data that help to understand the accident mechanism. They also characterize the multicausality, which is at the origin of the accident.

Information systems on accidents are also intricate because they belong to an administrative or legal body.

Many developed countries have private or public research organisations (car manufacturers, insurance companies, private motorway managers) that have their own databases on road accidents. Most of the time, the setting up of an information system supplied with these different databases is a difficult or even impossible process for economic or legal reasons.

Most public databases managed by States or public authorities are intricate because of their full coverage of the needs. They are used both for statistics publications and targeted studies and are managed jointly by a vast number of actors: police, road managers, and economists.

This causes a number of well-known disadvantages:
ignorance of the full system by one of its actors; cumbersomeness of the « information collection – control – authentication – use and recirculation » chain ; political arbitration between the evolution objectives of the system.

All thus provide compelling reasons to make recommendations to emerging countries that develop their own knowledge system.

Working Objectives of the Group 2

The PIARC C13's Working Group 2 decided to concentrate its works and reflections on the following tasks:

- Use a questionnaire sent to the PIARC member countries in order to give examples of practice and to show the databases' common principles.

- Provide essential methodological advice on the management and use of databases to assess road safety actions.

- Make recommendations to emerging countries on the basis of the experience made by the countries, which developed their own information systems on accidents.

The Problem of Databases on Accidents

This chapter is useful for decision-makers that have to invest in the creation or reorganisation of a database on accidents.

a) A database on accidents does always belong to a broader information system that notably includes:

   - a geographical database for the accident position determination ;
   - a database on road traffic.

   It is crucial that these databases are equally consistent and reliable. Simple examples:

   - The same event (accident, traffic) has to be located geographically through the same system of reference.
   - The geographical division (not only in the cities but also in the country) has to be the same.

   It is also worth recalling that a database on accidents that is not linked to traffic will not enable to work on the concept of rates, which is essential in the comparative analysis.

b) An accident database includes data that seem easy to collect but that are in fact very technical.

- There are thus objective and assumed data. The objective data seem quite easy to collect reliably. However, this easiness is often quite confusing. For instance, the difference between day and night can be established according to the calendar or on the basis of luminosity measurements. The first method is objective, but deceptive. The second is a more scientific one, but is impossible to implement systematically. The assumed data often enable to establish the responsibilities and the degree of seriousness at the time of the accident. A posteriori corrections are unusual.

- It is thus crucial to create very accurate systems of reference and protocols to define and codify the data when they are collected.

- The data collected concern the three system components: driver, road and vehicle. Each of the three data groups has its own technological sophistication level, but it is often someone who only knows one of the three who has to collect the data. Consistency checks thus have to be integrated in the data collection or use.

c) What is involved is a collection – control - authentication – use chain in which persons with different professions and motives play a part. The information system is rather shared than dedicated. The system management thus needs not only to be technical but political as well.

The Working Group's survey among member countries

The C13 committee has launched a questionnaire among member countries. Technical articles describing the bases were also used. A sample of 13 answers was examined. The examined file is available in electronic form.

The survey results are summarized here:

a) The developed countries have several independent accident data collection systems, but they rarely share an information system. The road and medical authorities and the insurance companies all have their own data. They however use them on an individual basis. Sometimes, only the geographical reference system is the same, and so are standardised definitions.

b) Public databases (established for official statistics, special needs of administrative bodies, cooperation with the research sector) either belong to the police authority or to the road operator. There is a variety of situations.

c) The local level is usually in charge of the collection and centralisation occurs at the national level, either for all the data or only for those used on a central basis. The databases were centralised in the past, and it is difficult to decentralise them afterwards.

d) Public data on accidents are used for official statistics, communication purposes and studies. Each country has its own rules as far as data circulation and prices are concerned.

e) Private data also exist, but are confidential (insurance companies' databases, for instance).

f) Countries now work to standardise data and create international databases. Examples: CARE database of the European Union.

g) Unreliable data are the main cause of bad quality databases.

Conclusions and recommendations

Following to its survey and to the works conducted within the working group, the C13 committee proposes and advises as follows:

a) To enable comparisons between countries, international cooperation has to go on as far as databases on accidents are concerned. The cooperation process has to encourage :

   - the creation of common definitions and reference systems;
   - if it is impossible, conversion rules between the data of the different countries.

b) The databases must be accessible on the Internet in order to enable the international technical community to access them for comparative studies.

c) The reliability of databases on accidents may be improved by actions such as :

   - Standardisation of geographical localisation;
   - Standardisation of the physical data on the man-road-vehicle system;
   - Training of the persons who are in charge of collecting data in the field;
   - Cooperation between the different authorities.

d) Centralised data systems have to be avoided as much as possible or restricted to the sole requirements of comprehensive statistics. Scientific assessment studies can indeed be conducted on samples.

A database on accidents has to be designed within an information system so that traffic, geographical, demographic… data can be imported according to the same geographical reference system.

REPORT OF WORKING GROUP D/E: USER BEHAVIOUR, ENFORCEMENT AND PERSUASION

The Working Group first met in October 2000 in Budapest. It was noted that the Executive Committee was concerned with education as a mass media campaign as opposed to the education of children. The objective of the Working group was defined as:

What educational techniques, enforcement methods and communication methods have been used to successfully affect a long term change in transportation users? Further, which of these are applicable in emerging/developing countries?

The Working Group members decided that a survey of PIARC member nations was required to gather certain information regarding the ranking of safety measures. This was felt to be necessary since the measurement of effectiveness is important particularly to enable countries considering any recommended change to rank the cost and effect of such changes. The implementation of changes often will result in costs to society in either economics or restrictions on personal freedom such that the general population may not desire the improvement to safety. These cultural or economic factors are not consistent throughout the PIARC member nations.

Experience has taught that education, enforcement and communication/persuasion activities can produce long-term benefits in user behaviour. Likewise, experience has taught that without enforcement, some road users will never adopt optional practices regardless of circumstances. Road user safety has been increased through initiatives to increase the usage of restraint systems (seat belts and child safety seats); to decrease driving while impaired; to provide for standardized testing of motor vehicles, and to decrease driver violation rates (speeding, red-light-running, following too closely, etc.). Documenting and prioritizing these experiences can assist developing countries in applying these known safety programs without going through a lengthy research and development or trial and error phase.

For developing countries, the process can be made much simpler by providing to them a catalog of answers to the basic questions of:

1. How do you affect change in safety, and
2. What does it cost in terms of social or economic change?

The working group suggested that success is most easily measured in terms of the gap or difference in the desired level compared with the actual level in a number of different counter-measures.

At the second meeting of the Working Group in May 2001 most of the discussion centred on producing the questionnaire; what the product should be; and a timetable to have the results by November 2002.

The first decision was that the product would be a Synthesis rather than a Handbook: Chapters of the Synthesis would include: Introduction; Purpose; Methods used to gather information; Findings; Discussion. The Synthesis should cover Education, Enforcement and Communication (Marketing & Distribution). It should also identify who the intended audience was and what decision-makers had to be involved to implement the policy / program.

In general the questionnaire sought to capture the following information on the various Road Safety Programs:

1. What were the Targets or Goals
2. What measures were implemented
3. Were they successful – Yes or No – and provide comments
4. What was the measured change in behaviour
5. What is the difference between 1 and 4 - (defined as Policy Deficit)
6. What obstacles were encountered - e.g. institutional barriers, politics, etc.
7. What measures are planned to close the gap (Policy Deficit)
8. What is the relative priority ranking of measures in 7
9. Comments/ Remarks
10. References and Availability

This included asking details of each country's experience with the following Road Safety Programs:

- Speed Management
- Impaired Driving
- Red Light Running
- Following too Closely
- Restraint Use
- Helmet Use - cyclists & motorcyclists
- Vehicle Safety Inspections
- Daytime Running Lights
- Demerit Point Systems
- Driver Training & Licencing
- Other Programs

The Draft questionnaire was distributed for comments to the Working Group immediately following the meeting and to the entire C13 Road Safety Committee in June 2001.

The Final Questionnaire was distributed to the C13 Road Safety Committee in July 2001.

Both English and French versions of the Questionnaire were provided as well as the option to respond electronically or by printing out the Questionnaire and returning a paper copy. The deadline for reply was August 31, 2001.

For the Programs identified above, the respondents were asked:

- to identify whether they were implemented as Enforcement, Education/Outreach or Policy/Legislation programs; and
- to provide, using one or more of the programs identified, details to outline the goals of the programs and the actual results achieved; the time frame; level of effort (monetary, time, other resources); future work etc. and the lessons learned.

Of the 16 responses received to the questionnaire, the following shows the distribution of programs reported in detail:

PROGRAM	Number Reported
Impaired Driving	5
Restraint Use	5
Red Light Cameras	5
Speed Control	5
Helmet Use – Motorcycle & Moped	2
Daytime Running Lights	2
Pedestrian Strategy	1
Traffic Calming	1
Following Too Close	1
Graduated Driver Licences	1
Truck Safety Inspections	1
Driver Training – public vehicles	1
School Education	1
High Friction Surfacing	1

Initially it was believed that there would be a large number of responses and in particular that there would be a number of responses in similar program areas to enable the Working Group to develop guidelines on what worked and what did not. Unfortunately there were not enough programs to analyse to accomplish this step.

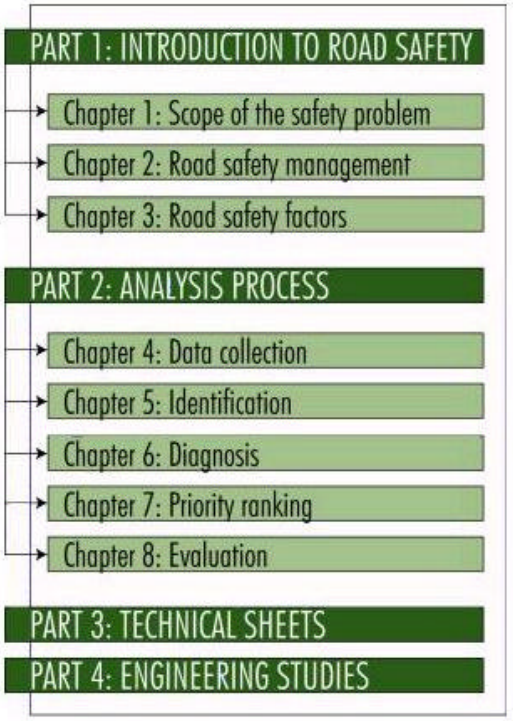
The Working Group at its November 2002 meeting made the following recommendations:

- That an electronic database be established to document the Road Safety Program information compiled through the questionnaire;
- That the Working Group be continued to add to the Road Safety Program database and further develop the proposed Synthesis of Best Practices;
- That the Working Group develop presentations for the Developing Countries Special Session and the Plenary Session at the Durban Congress in October 2003.

REPORT OF WORKING GROUP F: PIARC ROAD SAFETY MANUAL

Committee 13 of the World Road Association has developed a Road Safety Manual for transportation engineers and technicians. The objective is to regroup, in a single document, a wide array of state of the art knowledge that explains the impact of road engineering on road safety. The manual is made up of 4 main parts:

Table of Contents



Part 1 introduces the reader to the field of road safety. The objective is to ensure that engineers have a fair understanding of the possibilities and limits of their actions.

- ***Chapter 1*** describes the extent of the problem in terms of fatalities, costs and trends. In 1999 alone, an estimated 800 000 people died on road accidents while 29 million others were injured. Even worse, more people die on roads every year. Clearly, strong actions must be taken immediately to reverse these trends.

- ***Chapter 2*** summarises key principles of road safety management, based on the experience of developed countries, which have succeeded in reducing their road accident toll. It is interesting to note that several similarities can be found in initiatives taken by these countries to organise their actions.

- ***Chapter 3*** describes the contribution of each of the main components of the "safety system" (human, road environment, vehicle and socio-economic factors) and explains how failures of this system may result in accidents. Understanding the mechanisms leading to accident occurrence is a fundamental requirement to the proposal of effective remedial measures.

Part 2 describes a sequential process to assist in the choice of actions that may improve road safety. The process is composed of five steps:

- ***Data collection*** (Chapter 4) - describes the principle data that must be gathered in order to identify and treat (or prevent) road safety problems. Emphasis is placed on the discussion about accident data, but the chapter also stresses the need to link accident information to other types of data (geometric features, traffic conditions). Recent technical advances are described that greatly facilitate the linkage of databases.

- ***Identification*** (Chapter 5) – presents several methods of identification of safety problems. Until recently, most road safety engineering actions were reactive in nature, i.e. aimed at the correction of sites where accidents had already clustered. In several countries, a greater emphasis is now placed on the application of proactive methods that seek to solve potential problems before accidents materialize or even better, prior to the implementation of hazardous road features. Chapter 5 reflects this evolution and discusses both proactive and reactive identification methods.

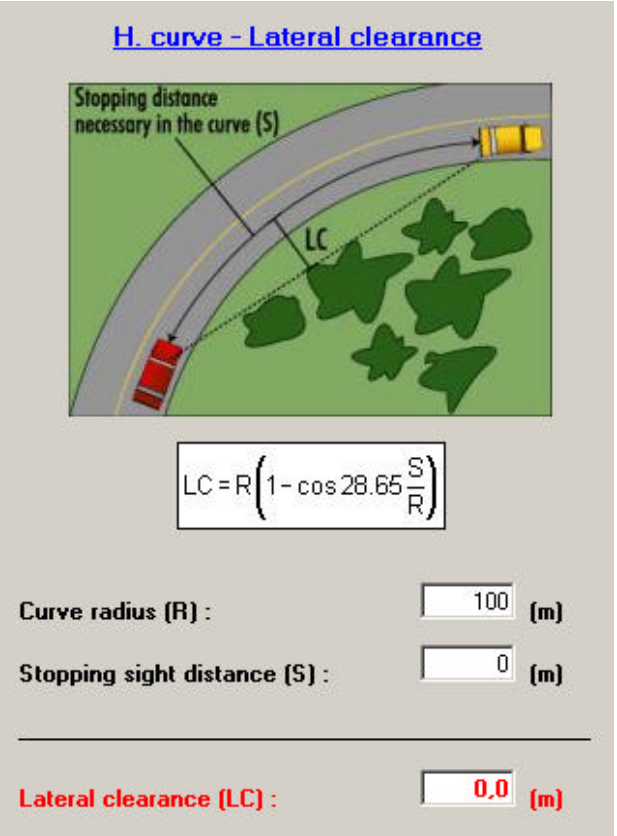
- ***Diagnosis*** (Chapter 6) – describes a process to assist in the determination of existing or potential safety deficiencies and in the finding of appropriate remedial measures. It recommends the use of all available types of information – principally accident history and site characteristics – to increase the accuracy of the diagnosis.

- ***Priority ranking*** (Chapter 7) – explains how to determine which projects should be implemented first, based on the comparison of their respective costs and benefits (accident savings and other savings).

- ***Evaluation*** (Chapter 8) – describes both accident-based and observation-based methods of assessment of the impact of actions that have been taken to improve road safety. By comparing anticipated benefits with real-life results, one can not only verify that the treated problem has been solved but also improve the efficiency of future actions.

Part 3 contains a number of technical sheets (T.S.) on various road features (e.g. horizontal alignment, vertical alignment and road surface conditions). These T.S. explain in simple terms how a specific road feature may contribute to create unsafe conditions and how it can be made safer.

Calculator – Example



Part 4 describes how to conduct various engineering studies whose results may be required when making a safety diagnosis (e.g. spot speed study or sight distance study).

Electronic version

Given the target readers' profile, efforts have been made to provide practical information in a user-friendly format. Accordingly, it was decided to produce a CD-ROM manual, which allowed the inclusion of several electronic calculators. These greatly facilitate the computation of engineering equations and statistical tests that are described in the manual.

Conclusion

The authors see this version of the manual as a first step towards the development of a comprehensive road safety reference that will progressively be expanded upon in following PIARC cycles. Additional technical sheets and engineering studies should then increase the engineering content of the manual and new parts should be developed to describe the contribution of the other components of the safety system.

Given the diversity and complexity of the existing road safety literature, C13 members strongly believe that there is a pressing need to develop such a practical reference. The dissemination of the best practices is seen as an essential pre-requisite in making faster strides towards safer roads. We are confident that this manual will contribute to this objective.

REPORT OF WORKING GROUP G: BOOKLET FOR HIGH LEVEL DECISION MAKERS: "*KEEP DEATH OFF YOUR ROADS*"

After the success of the 1999 PIARC (World Road Association) produced booklet on road maintenance: "Save your country's roads", PIARC, decided to make a similar booklet for politicians to get them acquainted with road safety problems and solutions.

As a result, at the end of 2001, Committee 13 was approached by GRSP to look into the possibility of producing an advocacy booklet on Road Safety for developing countries and countries in transition. After formation of PIARC Working Group F and agreement about terms of reference this booklet has been produced, based on a draft written by TRL, supported by DFID and very active working group members doing an intensive review. The design of the lay out and the printing has been done by the GRSP secretariat.

The English version of the booklet was launched and presented in June 2002 at the Intertraffic 2002 Asia - PIARC C13 joint seminar. PIARC C13 chairman Peter Elsenaar presented the first copies to the Thai Minister of Transport, GRSP Chairman Barry Sheerman and Colin Ellis representing DFID. In July 2002, copies were handed over to PIARC president Olivier Michaud and the new PIARC Secretary General Jean-François Corté. Later more copies were distributed and handed over to Ministers and DG's representing the target audience.

A French version has been published. Publications in other languages are encouraged, as long as the source is recognised and the message is maintained. Attempts are under way for translations in Spanish, Thai and Bangladesh languages.

As is clear from the above, the PIARC booklet "Keep death off your roads" targets high-level decision-makers. Its content is straightforward and can be read in 10 minutes, and invites them to act. Making a complex topic simple and short does however mean very careful selecting and editing. Members of PIARC C13 and C3 (Technology Exchanges and Development) have been involved in the review process. The chosen title and layout reflect the link to the earlier maintenance booklet.

The message is clear:

- World-wide, over 1 million people are killed and 50 million people are injured each year.
- Apart from the human suffering, accidents damage many aspects of your country's well being and cost your country a great deal of money, time and effort.
- Your roads are a vital part of your country's growth and development.
- But, with more traffic, more and more people will die and be injured in accidents unless action is taken.
- But waste and loss of life is not inevitable.
- Countries can reverse the trend, given the political will for well-directed and sustained effort.

- And much more can be done to protect your people without spending large sums of money.
- Many different bodies and agencies are needed in the fight against accidents.
- By working together and with even modest investment, you and your colleagues can make a real difference.

The booklet shows you:

- The size of the problem
- How to improve road safety
- Who should do what
- How to get value for money
- How to get advice

The briefing is for those with the drive, foresight and ability to act.

By sending this book in the coming months to its target audience - ministers, high level decision-makers in developing countries and countries in transition - PIARC and GRSP hope to promote road safety interventions and solutions in order to reduce the 1 million fatalities happening yearly in the world. The back of the cover summarises the scale of the problem as follows:

"On September 11, 2001 the twin towers of the World Trade Center were destroyed. Almost 3,000 people died, about the same number as those killed on the roads of the world in any one day."

At the moment of writing this report the booklet is available on the GRSP website: www.GRSProadsafety.org It is now also available on the PIARC website: www.piarc.org

This product is an excellent showcase of cooperation between international organizations.

CONCLUSIONS AND RECOMMENDATIONS

Based on this report and deliberations, Committee 13 advises PIARC to continue road safety activities - not only to continue the work taken up and to execute Durban conclusions, but also to build further on the network created. By bringing one message to decision makers, coordinating seminars and conferences in a better spread over regions, time and subjects, the effectiveness is raised of all parties involved.

Road safety characteristics change from country to country, not only as a matter of economy and motorization but also depending on culture and mobility means. Whereas in Africa 40 – 50% of the people killed in traffic are pedestrians, in some Asian countries over 50% of the traffic victims were using a bike or light motorbike. Law and enforcement activities are part of a total culture in which the task of policemen is not always in accordance with their skills, equipment and salary.

Taking into account these remarks, C13 Committee recommends:

1. International exchange on the implementation of ***Road Safety Audits (RSA***) should be continued. The organisation of a second International Road Safety Audit Forum should be encouraged. On such an occasion the Road Safety Review (RSR) should be highlighted. This inspection, evaluation or review of existing roads is often confused with RSA, which is connected with new projects. Techniques, evaluation, practical examples of RSR could undergo a similar process as RSA did in the past years. RSR is even of more importance to developing countries than RSA.

2. ***Design guidelines*** can continuously be improved by integrating human behaviour sciences. Not only this, but also a road categorisation, that can be recognised by the road user is needed. In successful safety concepts like the Swedish Vision Zero and the Dutch Sustainable Safety, these elements are a basis for such an approach. Recognisable, uniform road lay outs encourage drivers to adopt appropriate speeds and recognise their human characteristics.

3. Proposals are made in this report for ***evaluation methods of safety concepts***. The danger exists that this becomes a basic research project. Accessible safety databases are essential for this evaluation. It is recommended to use databases like CARE (EC) or IRTAD (OECD). The evaluation of road safety concepts in the EC project SUNFLOWER, which draws a comparison between **S**weden, the **U**nited Kingdom and the **N**etherlands, is a good example of such an evaluation on a smaller scale.

4. ***Behaviour and Persuasion*** are subjects in which the traditional PIARC community has limited expertise. Police, road safety foundations and unions have more practical experience in these subjects. By cooperation with such organisations the PIARC community can achieve knowledge and experience. It might encourage the road engineer to create a user manual for designs for instance for roundabouts, tunnels and road work signalling.

5. In reviews, the PIARC ***Road Safety Manual*** was rated a unique masterpiece. As only a first edition will be issued soon, updates on regular intervals should be organised, as well as completion. This attempt to provide a common global knowledge base on road safety might be a source of inspiration for national road safety manuals, like TRB is setting up nowadays.

6. The booklet "***Keep death off your roads***" is the second PIARC Booklet in this series; the first was devoted to the importance of road maintenance. Activities are under way to translate this booklet into Thai, Bangladesh, Spanish and other language. The C13 Committee promotes this idea as long as the message and source is well treated.

7. The ***cooperation with PIARC C3 and the Global Road Safety Partnership*** should be continued. Over 80% of the 1 million fatalities occur in developing countries and countries in transition. Strategies and techniques can be transferred from developed countries, which have the moral obligation to take an active role in this knowledge transfer. Nowadays the economic loss due to road crashes in developing countries is larger than the total investments in aid programs.

8. As road safety interventions need a multi-disciplinary approach, ***joint activities and programs on national and international level should take place***. Common advocacy is crucial to convince national and local authorities to act. Road users organisations and automobile clubs can assist in raising safety awareness together with road victim organisations, civil society and the private industry. A proper marketing of the road safety problem and its sometimes not popular solutions are needed.

9. As a large proportion of the crashes occur on urban, and local and other non-national road ***information and action plans should be initiated*** by local authorities, They need simple and reliable tools to execute this effort.

10. Committee 13 recommends that in the next PIARC Strategic Plan ***every Committee fosters and highlights a road safety technique*** or advice in its working area. Safety should be an integral part of all PIARC activities, and is not exclusively the responsibility of C13. Committee 13 can assist to integrate these activities and link safety with activities in other disciplines.

11. On the request of Committee C3, Committee 13 has organised two, and has been involved in about 10 other ***conferences in developing countries or countries in transition.*** The organisation of conferences in these countries is almost impossible if there is no adequate national organisation to liaison with. In future the role of a PIARC Committee might be concentrated on the architecture of the conference and marketing of the conference internationally to make the best use of available time. Common activities of one or more committees organising an event together has proven to be effective.

12. The Committee C13 ***thanks the PIARC Executive Committee and Secretariat General for its continuous support and encouragement to fulfill this program***.

13. It is recommended that Committee 13 acts as a good ***housekeeper for ongoing activities until a new committee has been formed*** and files can be transmitted.