DHV Environment and Transportation

Sustainable safe road design

A practical manual

A manual produced for the World Bank
and the Dutch Ministery of Transport,
Public Works and Water Management

September 2005

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FOREWORD

Every year more than a million people die in road crashes around the world, and about 70 percent of these deaths occur in developing countries. Pedestrians represent 65 percent of road crash deaths and 30 percent of them are children. In addition, a staggering 20 to 50 million people are injured or disabled each year in road crashes in developing countries, often pedestrians, motorcyclists, bicyclists and non-motorized vehicles occupants. This human tragedy is doubled by the catastrophic impact of loss of revenues and cost of medical care, as entire families can slip into deep poverty, wiping out the gains accumulated over years, and impacting, in turn, their communities. The emergencies created by road crashes also consume precious medical capacities in the health sector, and reduce the overall access to health care.

This silent epidemic is rapidly getting worse in developing countries. Research conducted by the World Bank [1] estimates that global road fatalities will increase by more than 65 percent between 2000 and 2020, unless intensified safety interventions are implemented. In Europe and Central Asia fatalities are forecast to increase by nearly 20% between 2000 and 2020,

These deaths and injuries are preventable as illustrated by the contrasting trends across regions. Road fatalities are forecast to decrease by nearly 30% in industrialized countries, defined as the G-7 countries, together with the Euro area countries and Korea, Hong Kong and Singapore. The Netherlands has been leading the way in this trend of improved performance. Its sustainable safety vision has been acknowledged as one of the most innovative and successful approaches to improving road safety in industrialized countries. The value of designing and implementing infrastructure to reduce the probability and severity of crashes has been proven, and measurable safety gains have been achieved.

The transfer of best practice knowledge must be tailored for widespread application. Uncertainty about the applicability of the sustainable safety vision in transitional and developing countries was addressed during the preparation of this Manual. Weak safety design capacity, poor institutional co-ordination and limited budgets presented substantial challenges to the adoption of the holistic approach applied in the Netherlands. The Manual reflects the realities of country environments encountered, and elements of the sustainable safety vision have been confirmed.

This Manual is the result of a strategic alliance between the Dutch program *Partners for Roads* and the World Bank to test the applicability of sustainable safety principles and concepts in road design in Central and Eastern Europe. It represents a first step in what will be a longer journey to implement safety as a leading and fundamental design criterion for road transport, just as it is for other transport modes. The quality of this Manual, and the gusto with which the ideas were received in the region, suggests that adoption of the sustainable safety vision could have a substantive and lasting impact on road safety in the region.

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World Bank

[1] Kopits, E. & M. Cropper, (2003) *Traffic Fatalities and Economic Growth*, Policy Research Working Paper 3035, Washington DC

1 INTRODUCTION

1.1 Manual for safe road design

This manual has been created during the project ***"Safe Road Design",*** funded by the World Bank and in cooperation with the Dutch Ministry of Transport, Public Works and Water Management as part of their 'Partners for Roads' programme. The consultancy services are provided by: DHV Environment and Transportation, The Netherlands.

The project is governed by contract no. 7129423, dated 7 May 2004. The date of the commencement of services was 26 May 2004.

"Sustainable Safe Road Design, a practical manual" is a manual to assist when developing national roads outside urban areas. The three core aims are:
1. to provide an overview of relevant safe road design practices;
2. to provide material for future training courses;
3. to guide experts in applying safer road design measures in different countries.

This manual is not a guideline on road design for one specific country. The manual is based on both the Dutch philosophy of sustainable safe roads based on the Dutch standards and guide lines and on the training sessions given in Bulgaria, Estonia, Latvia, Lithuania, Poland, Romania and Turkey in Autumn 2004 and Spring 2005.
Every location, every country and every culture is distinct in its own way and an appropriate solution needs to be found for each location. The information contained in this manual should always be adapted for the specific situation.
Not all weather and geographical conditions are treated separately from each other. It is important to develop country guidelines which consider the specific conditions encountered on the roads.

The manual is written:
1. to give designers guidance to find adequate solutions for a problem area;
2. to provide decision makers with proof of the possible benefits of a specific solution;
3. to use as a reference book;
4. to use as teaching material.

1.2 Road safety policy

The promotion of road safety should be priority for every road authority. Attention is generally focused on situations where a relatively large number of accidents and/or fatal accidents occur. Measures designed to tackle those accident concentrations should be based on thorough, objective analysis of the problems (determination of the origins). While accident analysis and investigations are very important this is a reactive approach to an existing situation. With sustainable road design the approach of road safety is pro-active: prevention is better than cure! An pro-active attitude by the road authority is essential to avoid situations that can result in accidents. This approach was stimulated in the Netherlands a few years ago under the banner of

'sustainable safe traffic'. In such a system road safety is the leading principle in the development of road infrastructure, such that:

- the chance of accidents due to the design is drastically reduced from the start;
- in sofar as accidents still happen, the circumstances are such that the chance of serious injury or fatal accidents is minimised.

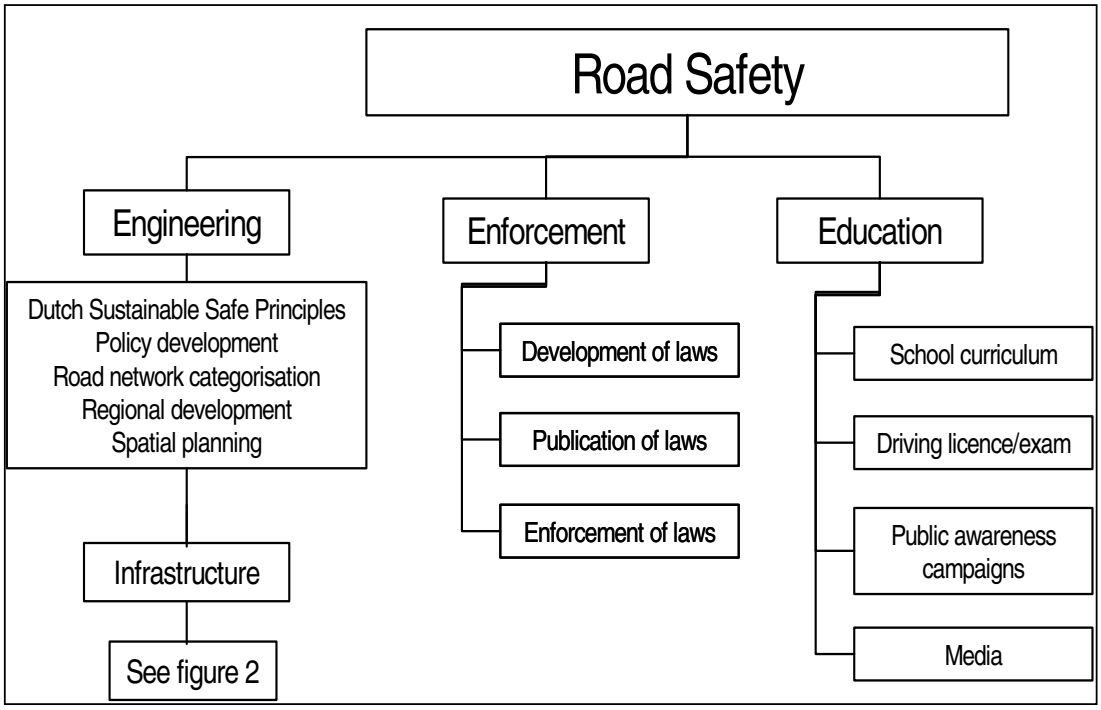

Figure 1: Road safety elements

The principles of sustainable safety are:

- Adjustments for the requirements of town and environmental planning;
- Adjustments for the requirements of safe road design;
- Adjustments for the requirements of mobility;
- Improved education and enforcement of road safety laws.

These four different principles are supplementary to each other and with mutual objectives to increase traffic safety. In any choice related to traffic and transport, safety has to be taken into consideration. Policies in the field of traffic safety have interfaces with various other tasks of public authorities (integrated approach).

1.3 Set up manual

The manual "Sustainable safe road design – a practical manual" contains information on the principles of sustainable road design, looking at the specific engineering implications. This

manual focuses on the engineering principles of sustainable road safety, and covers to a lesser degree the principles that education and enforcement play in sustainable safety. The manual focuses only on two-lane roads (single carriageway) outside built-up areas.

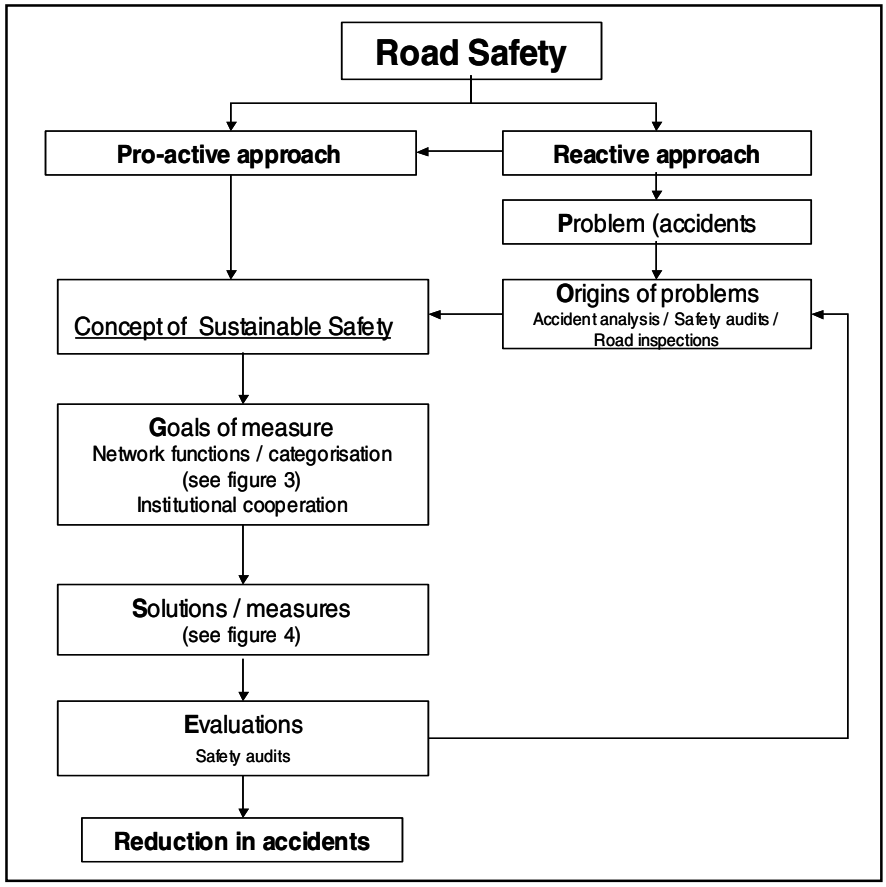

Figure 2: Pro-active and reactive approach to improve road safety through road design

This manual can be used on its own to examine the theory and practice of Safe Road Design. In combination with the manual "Take Over!" in which information about institutional cooperation is provided, a training programme for road designers can be developed.

Narrowing distributor road

In chapter 2 the methodology for analyzing a situation is introduced: POGSE (Problem-Origin-Goal-Solution-Evaluation, see figure 2). Chapter 3 is an introduction to sustainable road design- covering the topics of road function and categories. In Chapters 4 – 8

sustainable road design practice is covered – touching on the elements of engineering, such as cross sections, junctions, alignment, linear villages and pedestrian crossings to improve road safety. In Chapter 9 some practical examples from Lithuania, Latvia, Estonia, Poland, Romania, Bulgaria and Turkey are illustrated.

The process of 'black spot' analysis is carefully outlined in chapter 10 and illustrated with an example from the Netherlands. Chapter 11 outlines use of cost benefit analysis to determine the optimum solution. Education and enforcement, the other two E's important to implementing successful road safety are covered in Chapter 12.