

# How to make Two-Lane Rural Roads safer

Scientific Background and  
Guide for Practical Application

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## Scientific Background and Guide for Practical Application

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### **Authors:**

R. Lamm

*University of Karlsruhe (TH), Germany*

A. Beck

*University of Karlsruhe (TH), Germany*

T. Ruscher

*University of Karlsruhe (TH), Germany*

T. Mailaender

*Mailaender Ingenieur Consult GmbH, Karlsruhe, Germany*

### **Co-Authors:**

S. Cafiso

*University of Catania, Italy*

G. La Cava

*University of Catania, Italy*

**WIT**PRESS Southampton, Boston



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<http://www.witpress.com>

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## **Dedications**

### **Ruediger Lamm 1937-2005**

The Authors dedicate this book to the memory of Professor Ruediger Lamm, an excellent man, a great scientist and a leading figure at an international level in the field of Road Safety, who suddenly and unexpectedly passed away before publication.

### **Christa Lamm**

Before his death, Professor Ruediger Lamm dedicated this book to his wife Christa Lamm for four decades of selfless support.



## **Co-workers**

### **Co-workers:**

A. Beck

*beck-consult.de Berghausen, Germany*

R. Heger

*Dresden University of Technology, Germany*

B. Psarianos

*National Technical University of Athens, Greece*

### **Supported by:**

AKG Software Consulting GmbH

A. K. Guenther

*President, Ballrechten-Dottingen, Germany*

J. C. Hayward

*Robert Morris University, USA*

M. Eugen Rapp

*Bureau of Engineering, Max Eugen Rapp & Partners, Germany*

K. Wolhuter

*Council for Scientific and Industrial Research (CSIR), South Africa*



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## Preface

It is interesting to note that all analyzed highway geometric design guidelines include at the beginning in one way or another the following sentence: **“The Guidelines are the basis for the design of safe and functionally justified roads.”** If the guidelines guarantee the safety of the road, then “no” or “only a few” accidents should occur on that road. When accidents happen, drivers are always the ones who take the blame for the mishap. When drivers fail a number of times at certain locations, then it becomes obvious that the problem lies not with the drivers, but mainly with the geometry of the road itself. Since accidents are not uniformly distributed on the road network, high accident locations are a clear indication that, besides driver’s error, there exist other influencing parameters that are characterized by the road itself.

With respect to the development of guidelines and standards for highway geometric design in many countries, it can be noticed that from 1940 to 1960 especially driving-geometric and driving-dynamic models have been relevant, which were directed to constant design speeds, however, traffic safety was only indirectly – if at all –regarded.

Since the mid 1960s questions about the actual speed behavior were emphasized for the assessment of design parameters, however, traffic safety was again only indirectly considered. Nevertheless, many experts recognize the fact that abrupt changes in operating speeds lead to accidents, particularly on two-lane rural roads, and that these speed inconsistencies may be largely attributed to abrupt alignment changes. Thus, to help ensure design consistency between design elements and to coordinate design speed and operating speed became major research issues. So far, however, any evaluation of a road’s safety had been conducted more or less qualitatively. In this connection it was safe to say from a traffic safety point of view that no one could predict with great certainty, or prove by measure or number, where traffic accidents might occur or where accident black spots might develop.

Keeping this in mind, a practical procedure, which considers safety rules and criteria for the safety evaluation of new designs, redesigns, and Restoration, Rehabilitation, and Resurfacing (RRR) projects, became of major international concern. This book, entitled “How to Make Two-Lane Rural Roads Safer”, has been prepared in response to the expressed need.

The new book presents a through practical and scientific approach to designing highways for maximum safety. Based on original research plus scrupulously collected data amassed over more than two decades by the main author, this important book originates vital criteria for safe design and shows how best to achieve the lowest possible accident risk.

The book incorporates a methodology for evaluating planned or existing highway alignment designs with respect to their expected impact on traffic safety. The designer is able to evaluate alternative designs in terms of the relative danger they will impose on the traveling public. The operations engineer is able to prioritize highway improvement strategies based on the expected improvement to traffic accident patterns. Engineers are able to quantitatively predict the accident consequences of their proposed or existing alignments by using this process and employing these criteria.

Application of the described methodology will support the achievement of quantified measures of

- design consistency,
- operating speed consistency, and
- driving dynamic consistency.

All three criteria are evaluated in terms of three ranges, described as “good”, “fair (tolerable)”, and “poor”, with cut-off values between the ranges. It has been proved that the results of the safety criteria coincide with the actual accident situation prevailing on two-lane rural roads. By using the “good” ranges for the three safety criteria, sound alignments in plan and profile, which match the expected driving behavior of the motorists, can be achieved. These may significantly reduce accident risk and severity.

Finally, for a simplified general overview of the safety evaluation process, for example, for network investigations, the three safety criteria were combined in an overall safety module.

It is known that signs and markings can improve the safety record of a road section. However, the improvement is seldom substantial and certainly not to the level of transforming a “poor” design to a “good” design. On the other hand, the developed concept does improve safety and does not rely on signage to achieve this improvement.

The developed safety evaluation process has been accepted by the professional highway engineering community as illustrated by the fact that numerous publications and research reports deal with it and that several Road Agencies internationally have adopted or referenced it in their geometric design guidelines.

In general, the book is an invaluable source of information for educators, students, consultants, highway engineers, and scientists in the field of highway design and traffic safety engineering on new and existing (old) two-lane rural roads, which encompass in most countries about 90 per cent or more of the rural road network. The authors give essential information on:

- Design cases to avoid,
- Examples of good and poor solutions,
- Redesign of existing roads.

In addition, this valuable and necessary resource gives guidance in coordinating safety concerns with important economic, environmental, and aesthetic considerations.

The Authors,  
November 2007