

TOOLS FOR ROAD TUNNEL SAFETY MANAGEMENT – Experience and Development
 Rudolf Hörhan | Austria - Federal Ministry for Transport, Innovation and Technology
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INTRODUCTION

Foreseeable future requirements

- great demand for exchange of information and harmonisation as regards practical experience
 - with methods, management tools, standards and regulations
 - with practical implementation of safety measures
- feedback from tunnel operation has to be integrated in further developments
- development of fundamentals for sensible harmonisation at European and international level

➔ PIARC activities:
 establishing of working group 2 - Management of Road Tunnel Safety at the level of the Technical Committee on Road Tunnel Operation (C3.3)

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PIARC Technical Committee on Road Tunnel Operation (C3.3)
 Working Group 2 – Management of Road Tunnel Safety

Members of working group 2
 Rudolf Hörhan, Austria – Chairman
 Alain Jeanneret, Switzerland - Secretary

29 MEMBERS from:

Austria	Belgium	Czech Republic	Denmark	France	Germany
Greece	Italy	Japan	Netherlands	Portugal	Slovenia
Spain	Sweden	United Kingdom	USA	European Commis.

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Work Plan – Schedule

general aim: to produce publications on main topics
 time frame: approx. 2.5 years, 7 work sessions
 Reports: completed drafts available until January 2006
 approved reports available until end 2006

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PIARC Technical Committee on Road Tunnel Operation (C3.3)
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Work Plan – Topics

integrated approach of road tunnel safety

risk analysis

use of OECD / PIARC, QRA and DSM models

responsibilities in tunnel safety management

tools for tunnel safety management

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Work plan – objectives of working group 2

- give an overview of the safety approach to the design of road tunnels in various countries
- ensure an exchange of experience with different methods in different countries
- identify problems and find solutions
- give recommendations based on the results of the discussions in the Working Group
- identify need for further investigations

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FOCUS ON TOPIC 2 – RISK ANALYSIS

What is Risk Analysis?

- A big family of different approaches, methods and complex models combining various methodical components for specific tasks
- systematic analysis of sequences and interaction effects in potential accidents
- thereby identifying weak points in the system and recognising possible improvement measures
- risk analysis makes the quantification of risks feasible

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FOCUS ON TOPIC 2 – RISK ANALYSIS

What is the purpose of risk analysis?

- to check general consistency of safety planning
- to choose between alternatives
- to demonstrate safety in case of deviations from prescriptions
- to optimize safety planning in terms of cost-effectiveness
- a performance based approach for the assessment of safety standards

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FOCUS ON TOPIC 2 – RISK ANALYSIS

General Principles: Integrated approach – take the whole system into account

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FOCUS ON TOPIC 2 – RISK ANALYSIS

General Principles: Risk assessment procedure

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FOCUS ON TOPIC 2 – RISK ANALYSIS

Working Process

- Collection of experience in application of risk analysis in PIARC memberstates (questionnaires)
- Description of methods

Survey of methodology components

➔

Description of a limited number of practically applied methods including information on range and limits of application

➔

Documentation of a case study for each method described

- Deduce conclusions and recommendations

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FOCUS ON TOPIC 2 – RISK ANALYSIS

Methodologies – Survey of Components

Methodology	Intuitive approach	Standardized approach	Statistical	Factor analysis	Analytical	Spread and other models	Simulations
	General approach	Scenario-based approach	Risk Analysis				
	Intuitive approach	General Principles	Frequency	Consequences	FN matrix	Risk value	FN curve
Risk Evaluation	General approach	Scenario-based approach	Risk Evaluation				
	Intuitive approach	General Principles	Frequency	Consequences	FN matrix	Risk value	FN curve
	General approach	Scenario-based approach	Risk Treatment				
Risk Treatment	General approach	Scenario-based approach	Risk Treatment				
	Intuitive approach	General Principles	Frequency	Consequences	FN matrix	Risk value	FN curve
	General approach	Scenario-based approach	Risk Treatment				

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FOCUS ON TOPIC 2 – RISK ANALYSIS

Methodologies – example: quantitative system based approach

Input: Influencing factors
 Tunnel length Traffic volume Portion of heavy vehicles ...

Modelling of Consequences

Results
 Expected risk value (fatalities/year)

R

 Risk distribution (F-N-Curve)

Logical tree: initial event → accident scenarios

X

➔ RISK

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FOCUS ON TOPIC 2 – RISK ANALYSIS

Methodologies – example: qualitative or semiquantitative scenario based approach

Select relevant scenarios → Analyse development of scenarios → Investigate effects and consequences of scenarios → optimize design

scenario 1
 scenario 2
 scenario 3
 ...

eg. evacuation

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FOCUS ON TOPIC 2 – RISK ANALYSIS

Results – Report “Risk Analysis for Road Tunnels”

Contents of Report

- ✓ General Principles and Terminology
- ✓ Methodologies of Risk Analysis
- ✓ State of the Art of Risk Analysis in PIARC Member States
- ✓ Case Studies
- Conclusions and Recommendations

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FOCUS ON TOPIC 5 – TOOLS FOR TUNNEL SAFETY MANAGEMENT

Topic 5 focuses on 3 main issues:

- safety documentation
- collection and analysis of incident data
 - in order to systematically obtain findings from experiences
 - in order to improve the data base for risk analyses
- safety inspections of tunnels


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**FOCUS ON TOPIC 5 –
 TOOLS FOR TUNNEL SAFETY MANAGEMENT**

Objectives: Recommendations on

- contents and preparation of safety documentation
- method and process of data collection
- intended use of data (e.g. for risk analysis)
- processing of existing data
- what should be checked and how to do it
- periods of inspections



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**FOCUS ON TOPIC 5 –
 TOOLS FOR TUNNEL SAFETY MANAGEMENT**

Safety Documentation – structure of contents

Topics	design stage	commissioning stage	operation
Tunnel Description			
Traffic Situation	Recommendations on scope and accuracy of information required		
Transport of Dangerous Goods			
Safety Organization and Emergency Response			
Feedback of Experience			

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CONCLUSIONS (1)

- tunnel safety is an extremely complex topic and comprises much more than a simple listing of safety features of a tunnel
- therefore there is a need for a comprehensive set of tools for tunnel safety management
- the systematic analysis of interaction effects is essential for the optimization of tunnel design
- therefore risk analysis is an important complement to prescriptive provisions
- the method of risk analysis must be adequate to the specific problem investigated

EuroTAP 21



CONCLUSIONS (2)

- the dynamic development in the field of road tunnel safety leads to a great demand for information and harmonisation at European/international level
- the WG2 of PIARC is meant to serve as an important contribution to the international exchange of experience
- the main issues are risk analysis and tools for tunnel safety management

Thank you for your attention!
