



**XXIVth World
Road Congress
Mexico 2011**
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The new approach of Road Infrastructure Safety Management - Preconditions, Instruments and Examples -

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picture: presse.uni-wuppertal.de



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picture: www.answers.com



Example: EU - Road infrastructure safety management directive



Road infrastructure safety management



1

Road
safety
impact
assessment



2

Road
safety
audits



3

Network
safety
management

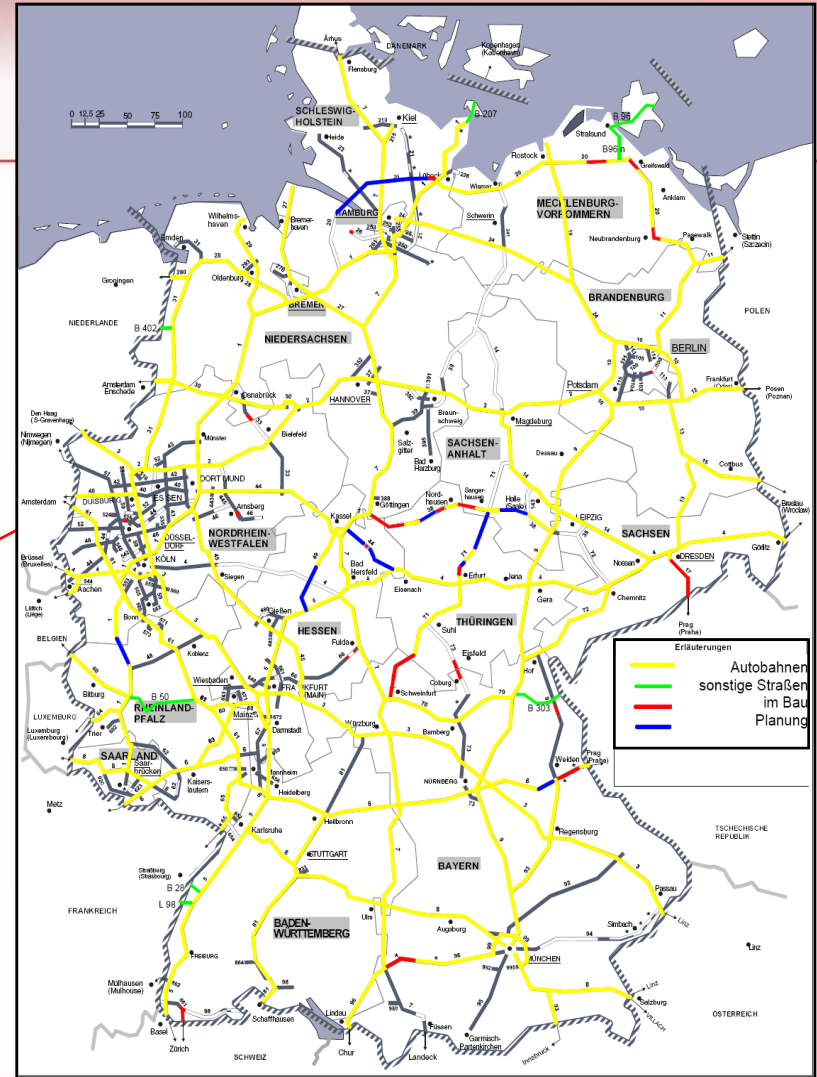


4

Road
safety
inspection



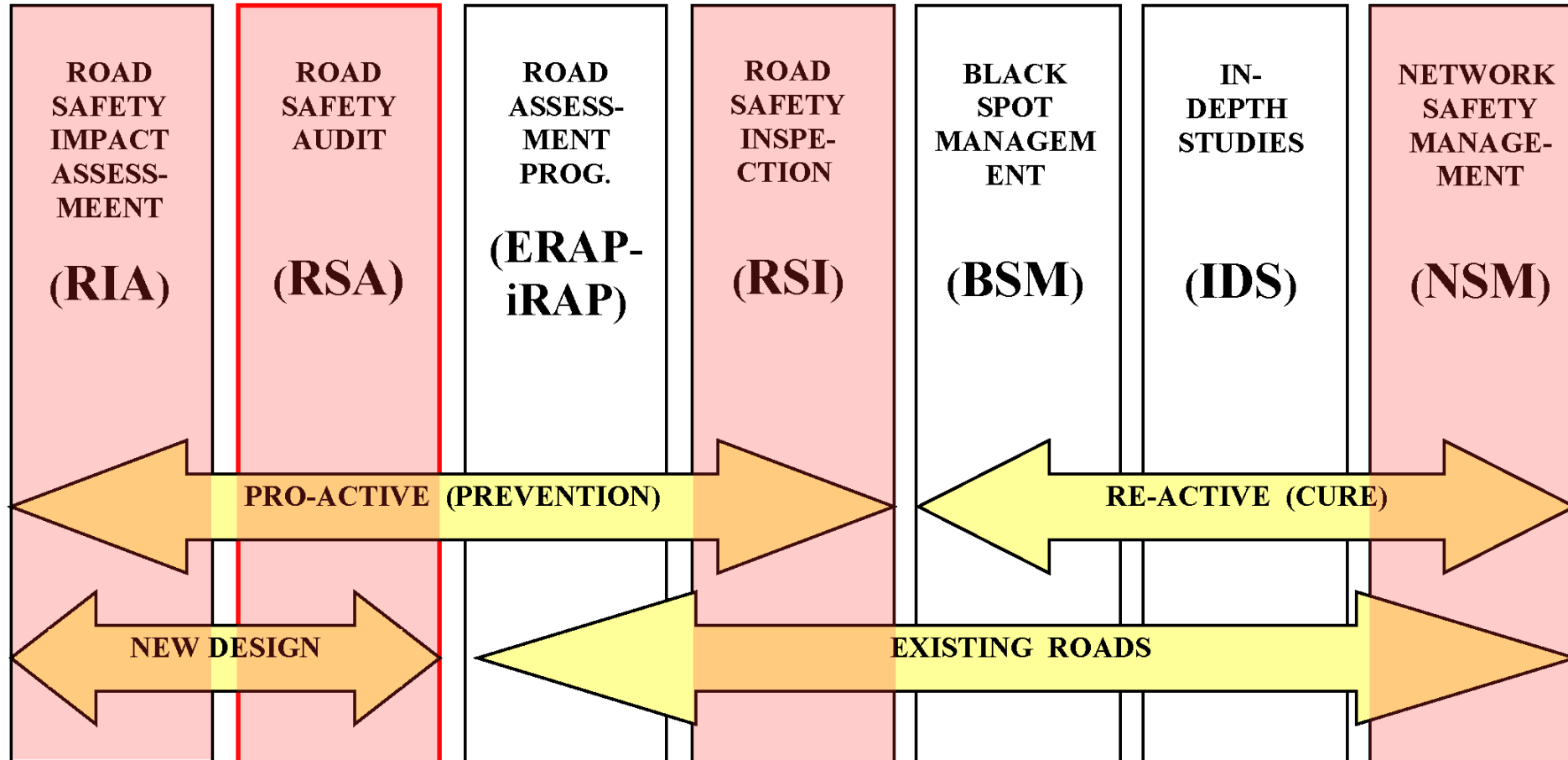
Application area of the directive: TEN-Road network



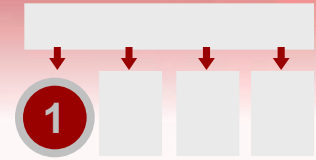
source: BMVBS, Ref. S10



Overview of international terms of safety management



Road safety impact assessment RIA



Aim of the procedure:

- A strategic comparative analysis of the **impact of a new road**, of **alternatives** or of **substantial modifications** to the existing network on the safety performance of the road network
- At the **initial planning stage** before the infrastructure project is approved
- The purpose is to demonstrate, on a strategic level, the implications on road safety of **different planning alternatives** of an infrastructure project



Road safety impact assessment RIA

Terminology:

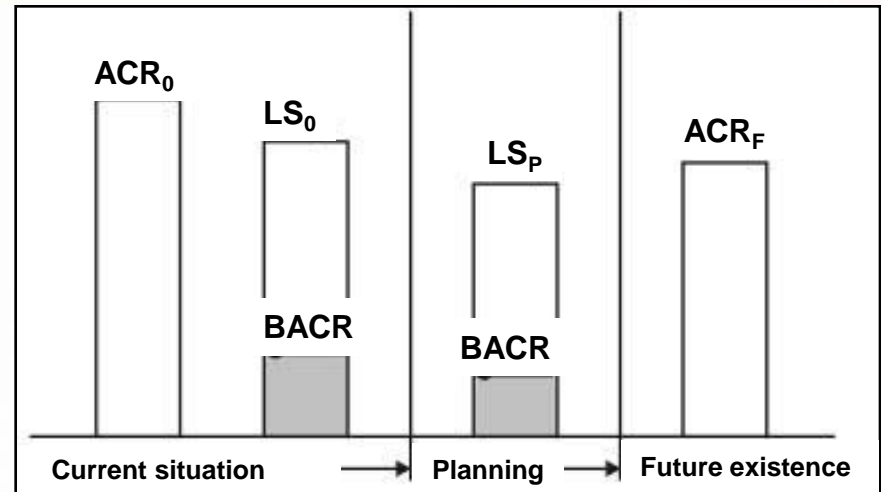
LS = **Level of Safety**

(virtual describing factor of road safety)

LS = BACR + surcharge

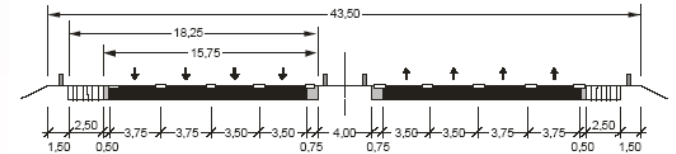
BACR = **Basic Accident Cost Rate** for assessment cases
(all design elements conforming to standards/guidelines)

surcharge = accident cost surcharges for deviations from
standards/guidelines



Road safety impact assessment RIA

Basic accident cost rate BACR



SCS 43,5

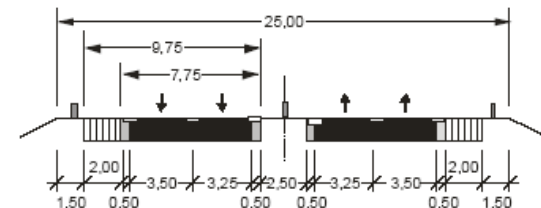
Standard Cross Section	Criteria of differentiation	BACR [EUR/(1000 veh* km)]
SCS 43,5	8 lanes	18 (v_{perm} free) 15 (v_{perm} 120 km/h)
SCS 36	6 lanes	17 (v_{perm} free) 14 (v_{perm} 120 km/h)
SCS 31,5	6 lanes	15 (v_{perm} 80 km/h) 17 (v_{perm} 100 km/h)
SCS 31	4 lanes	16 (v_{perm} free) 13 (v_{perm} 120 km/h)
SCS 28	4 lanes	13 (v_{perm} 100 km/h) 15 (v_{perm} 120 km/h)
SCS 25	4 lanes	14 (v_{perm} 80 km/h) 16 (v_{perm} 100 km/h)



Typical application area / design

Road safety impact assessment RIA

- Traffic volume equates to the application area
- Elements and dimensions of the cross section equate to the standard cross section
- Design elements in layout and profile equating to the standards
- proportions of consecutive radiuses are adjusted
- Cross falls are conform to the regular value
- Existing sight distances are greater than the necessary sight distances
- Roadside without unsafe features



SCS 26

source: HVS-Entwurf



Road safety impact assessment RIA

Surcharges for line deviations from constructions conforming to standards

Criteria	Deviations from constructions conforming to standards	ACR [EUR /(1000 veh * km)]					
		SCS 43,5	SCS 36	SCS 31,5	SCS 31	SCS 28	SCS 25
Traffic volume	ADT > 105,000 v/24h		2	2			
	ADT > 68,000 v/24h				2		
	ADT > 30,000 v/24h					2	
	ADT > 82,000 v/24h						2

Criteria	Deviations from constructions conforming to standards	ACR [EUR /(1000 veh * km)]					
		SCS 43,5	SCS 36	SCS 31,5	SCS 31	SCS 28	SCS 25
Cross section	Width of carriageway $15.00 \text{ m} \leq W < 15.75 \text{ m}$ (4 I)	2					
	Width of carriageway $W < 15.00 \text{ m}$ (4 I)	5					
	Width of carriageway $11.50 \text{ m} \leq W < 12.00 \text{ m}$ (3 I)		2				
	Width of carriageway $W < 11.50 \text{ m}$ (3 I)		5				

source: HVS-Entwurf



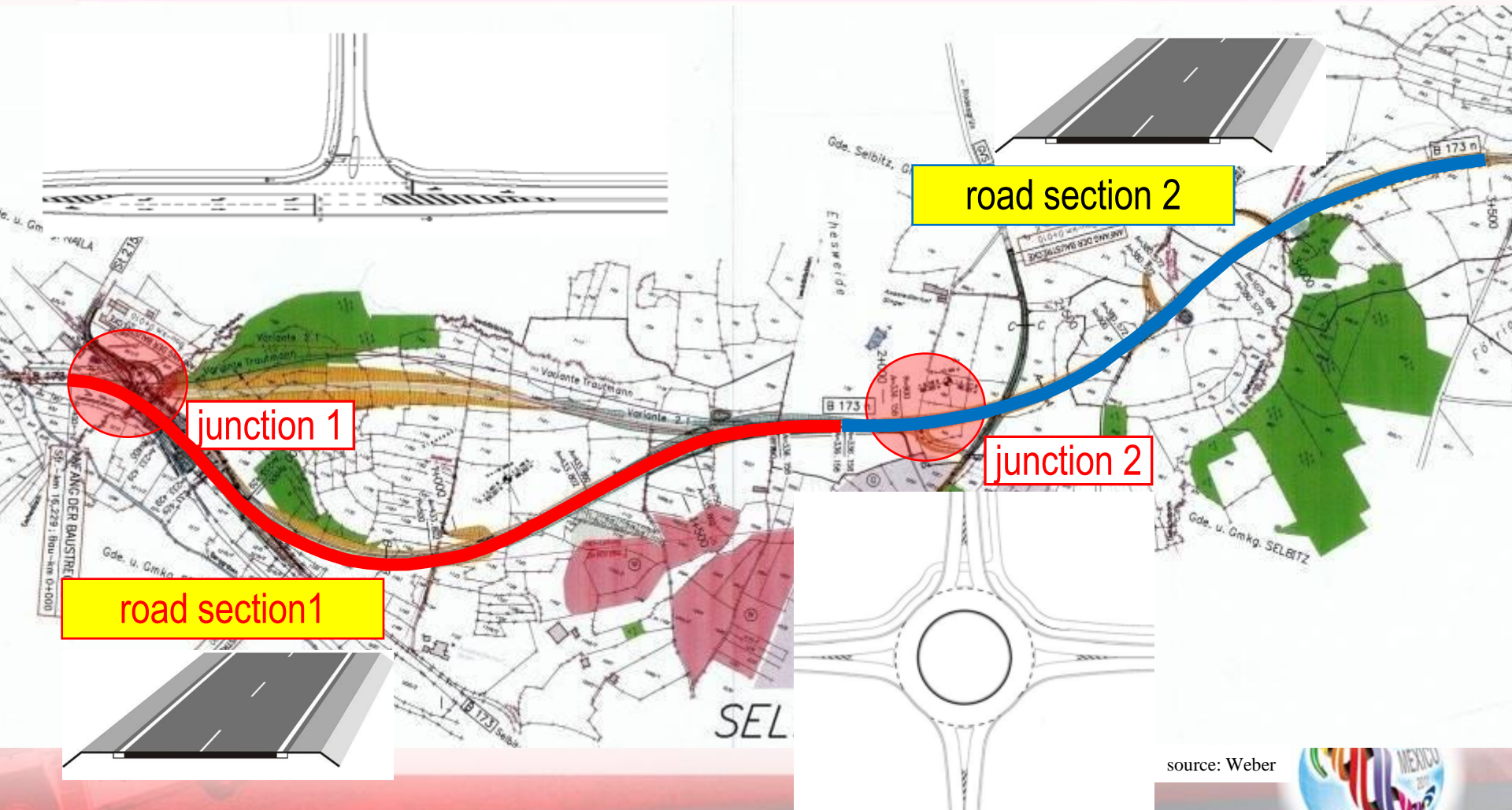
Road safety impact assessment RIA

Surcharges for local deviations from constructions conforming to standards

Criteria	Deviations from constructions conforming to directives	ACR [EUR /(1000 v)]						
		SCS 43,5	SCS 36	SCS 31,5	SCS 31	SCS 28	SCS 25	
Elements of layout	Radius below minimum radius	4	4	4	4	4	4	
	Consecutive radiuses are not adjusted $R1/R2 > 1.5$ with $R1 \leq 1,500$ m	Criteria	Deviations from constructions conforming to directives				ACR [EUR /(1000 v)]	
	Length of line L > 2,000 m		SCS 43,5	SCS 36				
	Falling below minimum length of line between curves which are bent in the same direction							
	Falling below minimum radius following a line							
Elements of profile	Longitudinal slope s > 4.0 %	Sight	Existing sight distance < required stopping sight distance	6	6			
source: HVS-Entwurf	Road space design	Cross slope of the line c < 2.5 %	1	1				
		Cross slope of the circular line c (R) too small	2	2				
		Diagonal slope d > 9.0 %	1	1				
		Zone of low drainage	6	6				
	Road side	Punctual dangerous spot without protection measures	3	3				
		Punctual dangerous spot with protection measures	1	1				
		Vertical dangerous spot without protection measures	10*length [km]	10*length [km]				
		Vertical dangerous spot with protection measures	2*length [km]	2*length [km]				

Project example – safety verification

Road safety impact assessment RIA



source: Weber



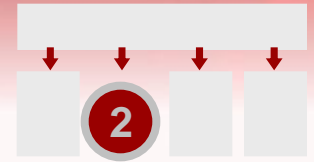
Road safety impact assessment RIA

Calculation of accident cost rates and safety check

		ACRsection [EUR / 1000 v * km]	ACRjunction [EUR / 1000 v * km]	LOS (safety)
Alternative 1	section 1	28 + Δ		B
	section 2	28 + Δ		C
	junction 1		12 + Δ	A
	junction 2		24 + Δ	B
Alternative 2	section 1	34+ Δ		D
	section 2	34+ Δ		D
	junction 1		10 + Δ	A
	junction 2		24 + Δ	B

source:
Weber





Aim of the procedure:

- an **independent detailed systematic and technical safety check** relating to the design characteristics of a road infrastructure **project**
- covering **all stages** from planning to early operation as to identify, in a detailed way, unsafe features of a road infrastructure project



Road safety audit RSA

Example of an audit report

SEETO RSA/RSI Pilots: RSA Report (draft) for Montenegro



Support for implementing measures for the South East Europe
Core Regional Transport Network Multi Annual Plan 2009-2012
EuropeAid/125783/C/SER/MULTI



WYG International



Road Safety Audit Report

Road M2

Section from km 1034+613 to km 1035+490

➤ PROBLEMS:

Function, design and operating elements

- (1) The road is located in a difficult topographical area. Fixed obstacles nearby the carriageway are unavoidable, sufficient passive safety installations are necessary.

Cross section

- (2) In some subsection the auditors have doubts that sufficient measures has been foreseen on cutting slopes to prevent falling material (e.g. falling rocks). Therefore the client should check with support of a geologist, if and where additional safety provisions like steel meshes are necessary.
- (3) Regarding the drainage of the road the RSA has identified problems at km 1035+190 (end of tunnel 29). At the right hand side the water could be not evacuated in a sufficient way because the interrupted open drainage gutter at the tunnel entrance.



Road safety audit RSA

Safety deficiency in a planning of an urban road: insufficient sight distances

Deficits

Line-of-sight obstruction by parking vehicles

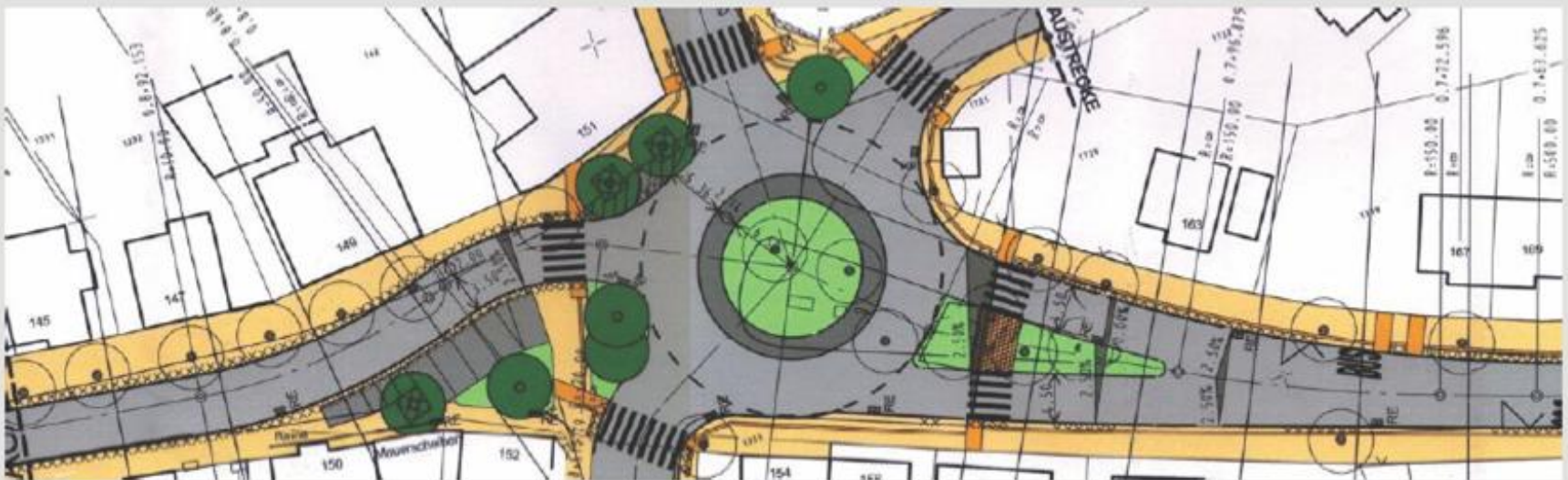
Group of deficits

Parking traffic

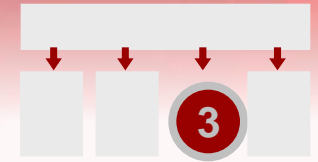
Subgroup of deficits

Bicycle/
Pedestrian

Layout:



Network safety management NSM

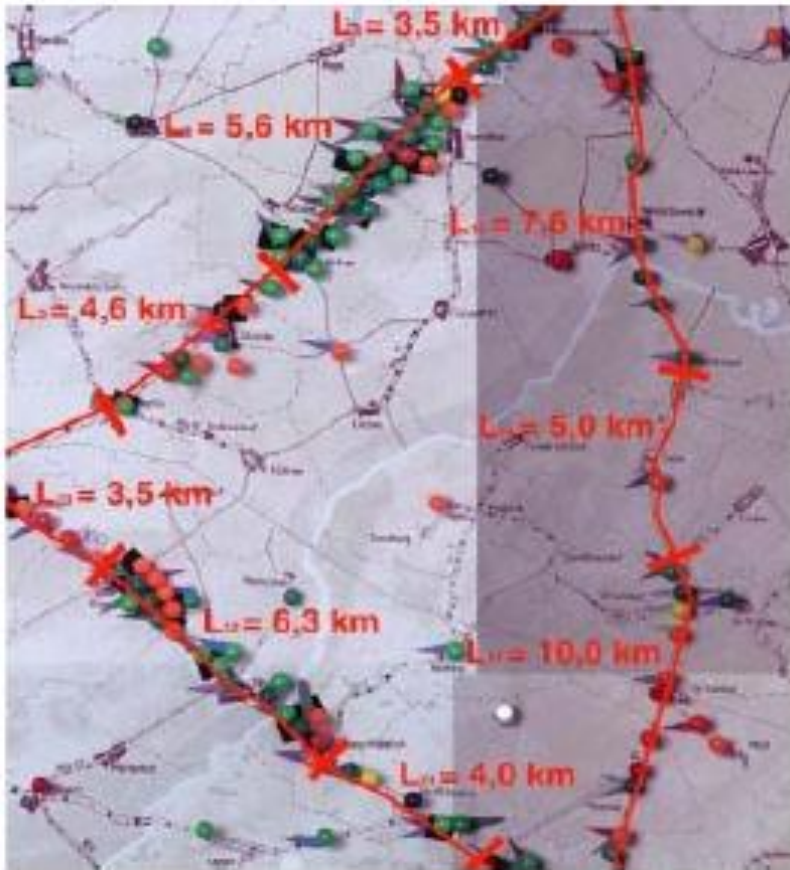


Aim of the procedure:

- a method to **identify, analyse and rank** sections of the **existing road network** upon which a large number of accidents in proportion to the traffic flow have occurred
- a method for identifying, analysing and classifying parts of the existing road network according to their **potential for safety development** and accident cost savings
- purpose is **to target investments** to the road sections with the highest accident concentration and/or the highest accident reduction potential.



Network safety management NSM

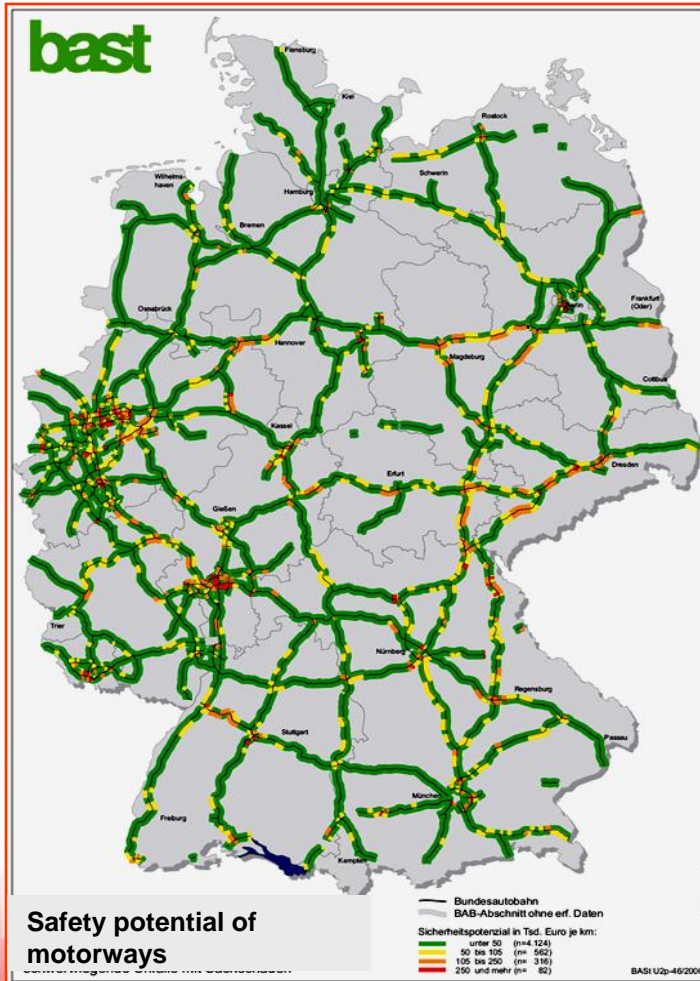


Example of sections with high accident occurrence

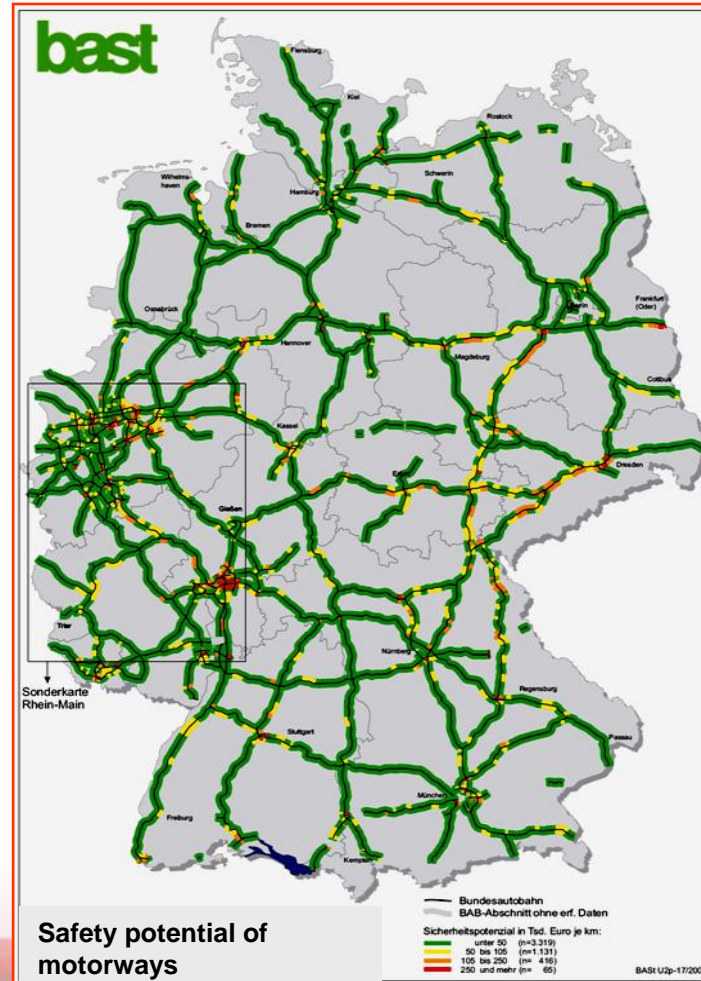


Network safety management NSM

2008



2010



source: Weber



Black Spot Management

Network safety management NSM

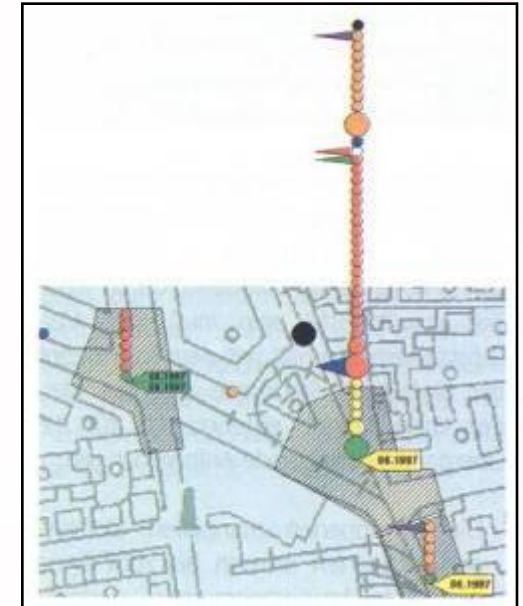
Type of black spot	Authoritative maps	Identification of peculiarities
Black spot patch BSP	1-YM; 3-YM(P); 3-YM(SP)	Limiting values
Black spot line BSL	3-YM(SP)	Visual density AD(SP); limiting values
Black spot area BSA	3-YM(P)	Accident density AD(SP)

Types of black spots, authoritative maps and criterias to identify peculiarities

Accident type plug in map	Limiting values Number of accidents	Period under observation [months]
1-year map	5 (similar)	12
3-Years map (P)	5	36
3-Years map (SP)	3	36

Limiting values for black spots BS („similar“: same typ of accident or circumstances)

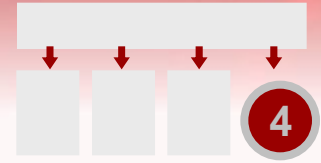
source: MAST



Accident type plug in map

1-YM



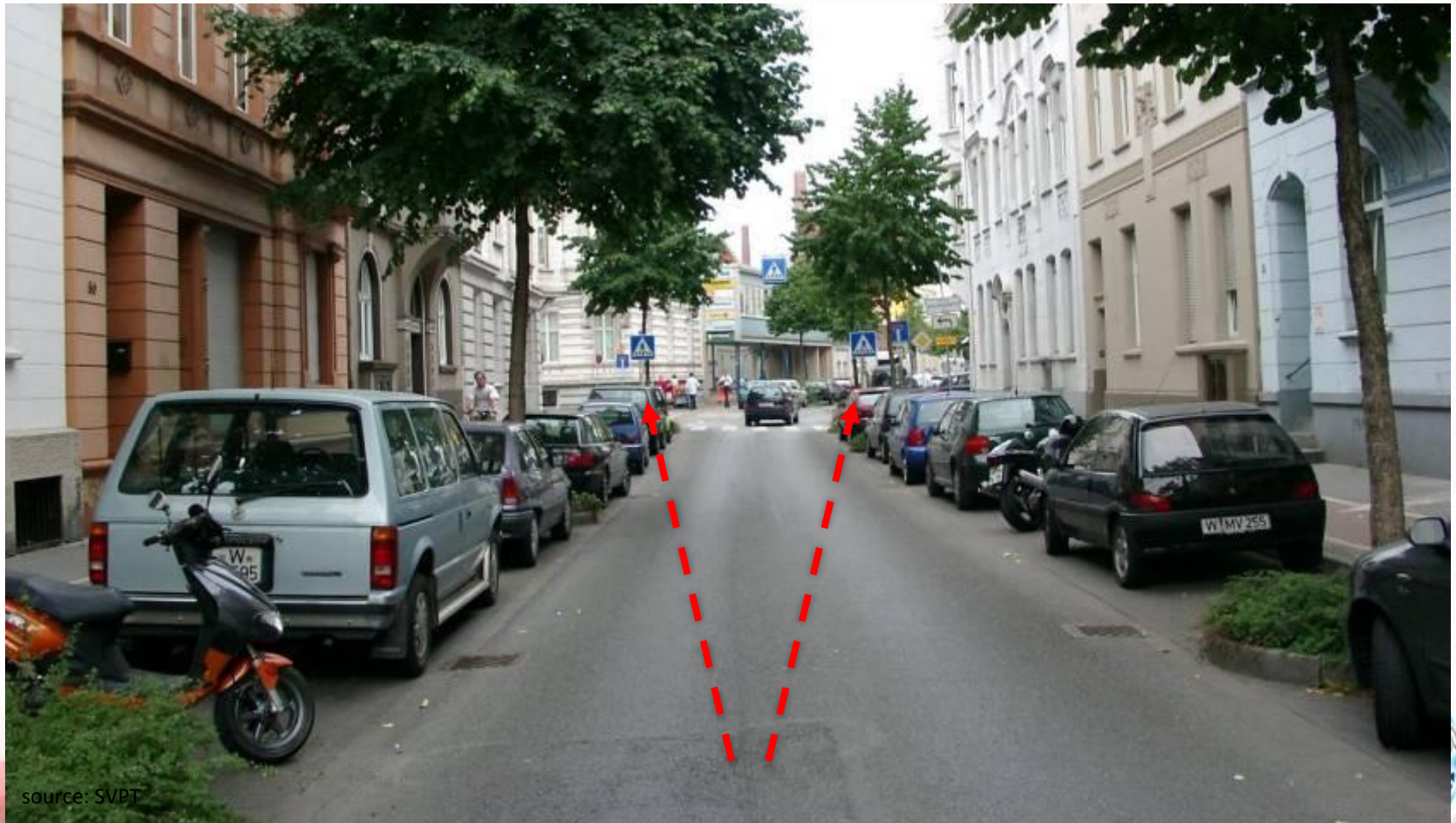


Aim of the procedure:

- ordinary **periodical verification** of the characteristics and **defects** that require maintenance work for reasons of safety as a preventive tool
- an additional part of regular road maintenance



Insufficient Sight Distances



source: SVPT

Conclusion / recommendations

- Implementation of safety management in planning level necessary
- Application of the complete method mix on all roads
- No „cherry-picking“ of selected methods
- Responsible handling with safety management is demanded
- Extensive training is essential
- Experiences have to be spread and discussed
- Engineers and decision makers have to be sensibilised
- just then it is possible to succeed in planning, building and maintaining „safe roads“



Thanks for your attention!

Juergen Gerlach

