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Adaptation of the Road Infrastructure to Climate Change

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BASt

ECTRI
European Conference of Transport Research Institutes

FERSI
Road Safety Research

Content

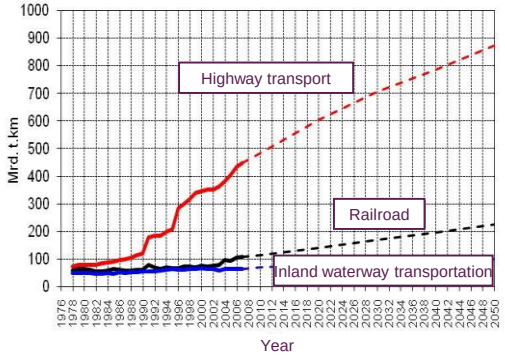
1. Motivation
2. Strategy
3. Projects

Content

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2. Strategy
3. Projects

Challenges

- Globalization
- Increase of goods transport
- Sustainability
- Technological change
- Demographic change
- Climate change













Impacts of Climate Change



Increase of rutting



Increase of "Blow up's"



Vulnerability of concrete bridges

Heat waves / dryness and extreme precipitation



Flooding due to low design of drainage systems



Flooding of tunnels



Accidents due to storms

Content

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German Adaptation Strategy to Climate Change (DAS), 2008

Aim:

- Creation of a national framework for action in order to prevent or minimize the adverse effects of climate change
- Identification of impacts and adaption needs, planning and implementation of measures

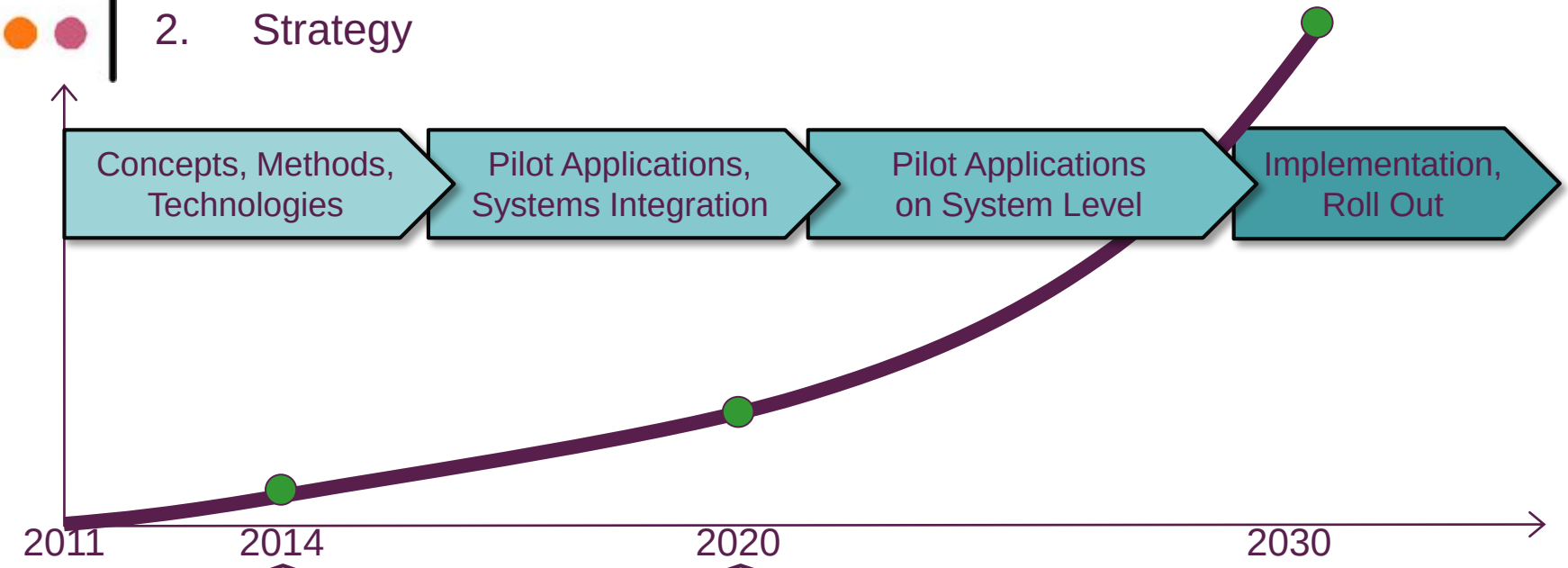
German Adaptation Strategy to Climate Change (DAS), 2008

- 14 sectors
- Sector road transport / road transport infrastructure
  - Adaptation of the dimensions of the drainage infrastructure to more extreme rainfall
  - Adaptation of pavements affected by heat through the use of modified materials

Action Plan to the German Adaptation Strategy to Climate Change, 2011

- Development of a set of indicators for the DAS
- Documentation of changes in each sector by using existing data
- The BASt was involved in the development of three indicators
  - Weather-related road accidents
  - Road condition
  - Use of de-icing salt on federal roads and highways

2. Strategy



Milestone 1

- Vulnerability analysis for elements of road infrastructure
- Development of adaptation technologies, including pilot projects
- Analysis of the impact of climate change on the road maintenance

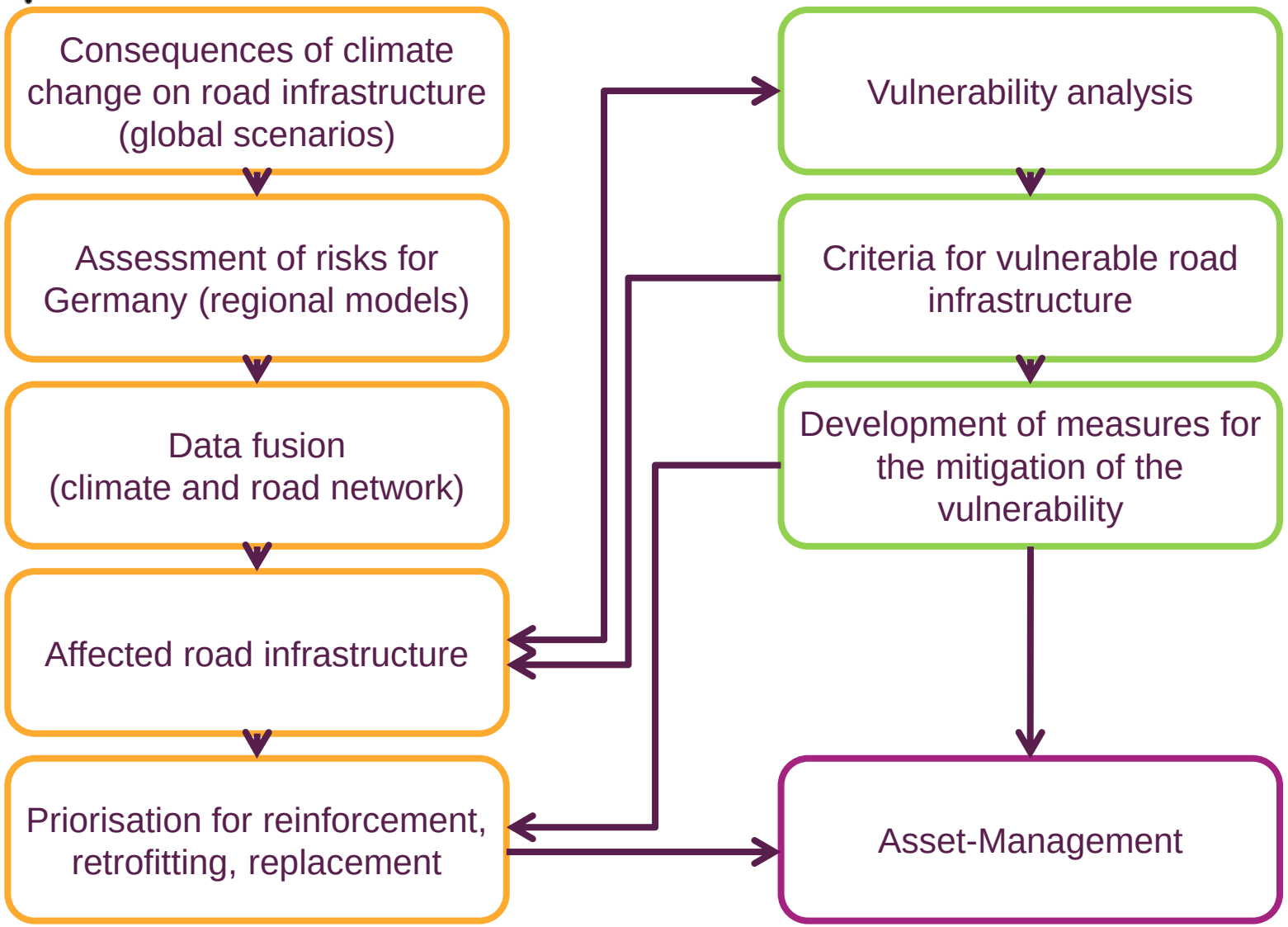
Milestone 2

- Adaptation strategy "climate change" is tested on two corridors
- Deduction of standards
- Implementation of adaptation methods in the road maintenance

Aim

- All main corridors are resilient to the effects of climate change
- Guidelines and standards are adapted

2. Strategy


Consequences of climate change on road infrastructure (global scenarios)
Assessment of risks for Germany (regional models)
Data fusion (climate and road network)
Affected road infrastructure
Priorisation for reinforcement, retrofitting, replacement
Vulnerability analysis
Criteria for vulnerable road infrastructure
Development of measures for the mitigation of the vulnerability
Asset-Management

Content

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3. Projects

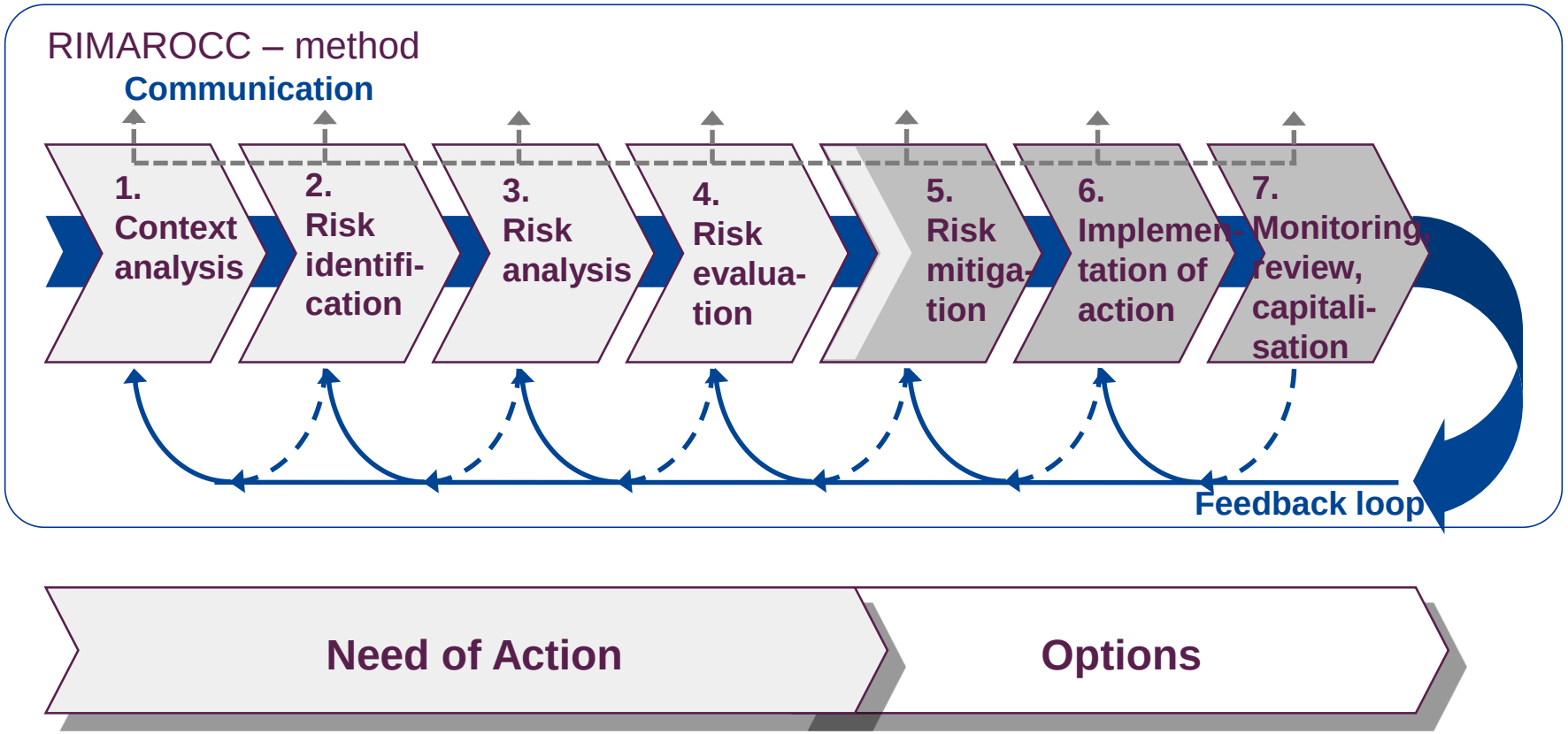
Projects	Status
Cross-linking of the AdSVIS projects	
AdSVIS server	
RIVA - Risk analysis of key goods and transit axes including seaports	
Comparison of meteorological parameters near federal roads and grid data of climatologic prediction models	
Development of climate impact models and design parameters for bridges and tunnels	
Vulnerability analysis of bridges and tunnels	
Analysis of measures to reduce the vulnerability of bridge and tunnel structures	
Development of a model for estimating landslide risk areas and development of a national hazard map	
Evaluation of the design of road drainage systems regarding climate change	
Inventory of road drainage systems in selected sections of the TEN-T	
Adaptation of pavement designs for asphalt and concrete constructions	
Standardized asphalt pavements due to changing temperature boundary conditions	
Asphalt pavements and extreme temperatures	
Impacts of weather extremes on concrete road pavements	
Impacts of climate change on road maintenance	

RIVA – Risk analysis of key goods and transit axes including seaports

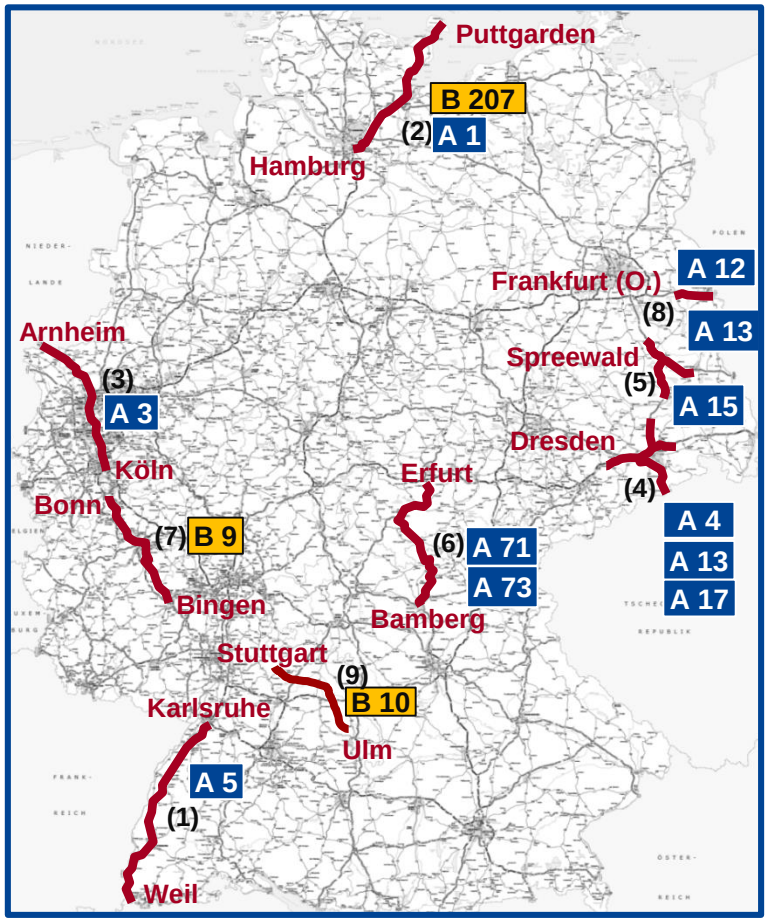
Objective:

- To present the risks arising from the projected climate changes for selected road sections of the German part of the TEN-T (Trans-European Transport Networks)
- Development of tools for the determination of the need for action

RIVA


RIMAROCC – method
Communication
1. Context analysis
2. Risk identifi-cation
3. Risk analysis
4. Risk evalua-tion
5. Risk mitiga-tion
6. Implemen-tation of action
7. Monitoring, review, capitali-sation
Feedback loop
Need of Action
Options

1. Context Analysis



- Selection of 9 roads
- Regional distribution, i.e. different climatic and geographic conditions
- Roads with high and low traffic
- Connection to seaports and neighboring countries
- Different types of construction
- Different conditions and age of the road sections

2. Risk Identification

Risk = function of [Threat, Vulnerability, Consequences]

Threat

Does a special weather event take place on the location of the possible risk element?

Weather event, (frequency, period, intensity)

Vulnerability

How vulnerable is the risk element to damages due to climate change?

Vulnerability
Resilience

Consequences

What relevance has the road section with the risk element from an economic point of view?

Traffic volume
Alternative routes

Example

Threat (Weather event)	**Vulnerability**	**Consequences**
Heat wave	Damage to road infrastructure	Disturbance of roads
	Damage to pavements, i.e. blow-ups of concrete pavements, rutting of asphalt pavements	Traffic jams / alternative routing / accidents
	Costs of repair, road safety, road maintenance	Higher fuel consumption, higher CO_2 emissions, delivery delays, consequential costs for the economy



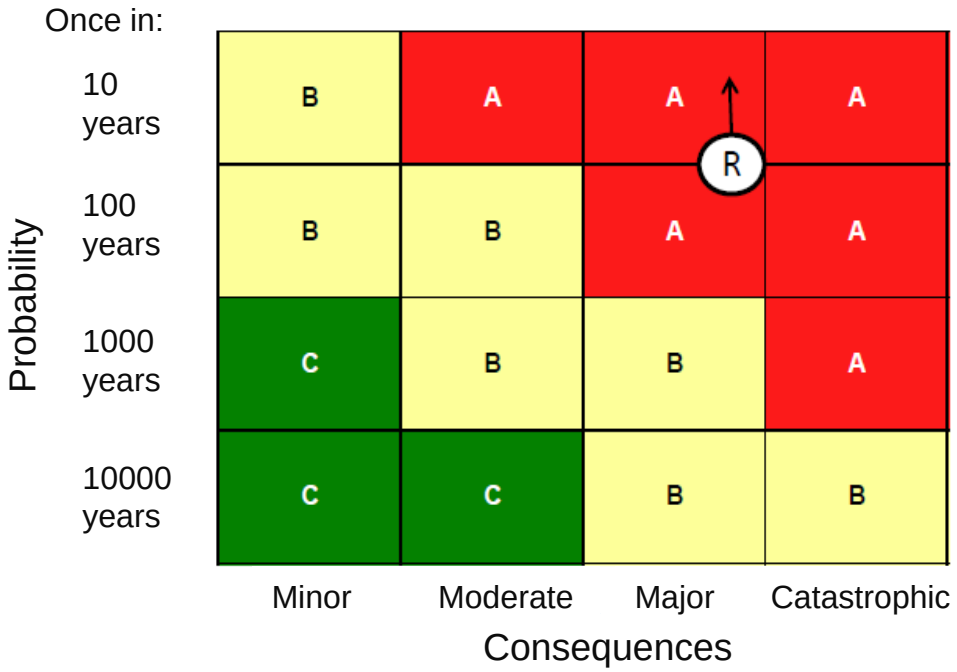


3. Risk analysis

- Presentation of the cause and effect relation
- Adjustment of evaluation procedures
- Examination of effects like:
  - Risk to persons
  - Damage to infrastructure and environment
  - Damage to reputation
  - Economic consequences

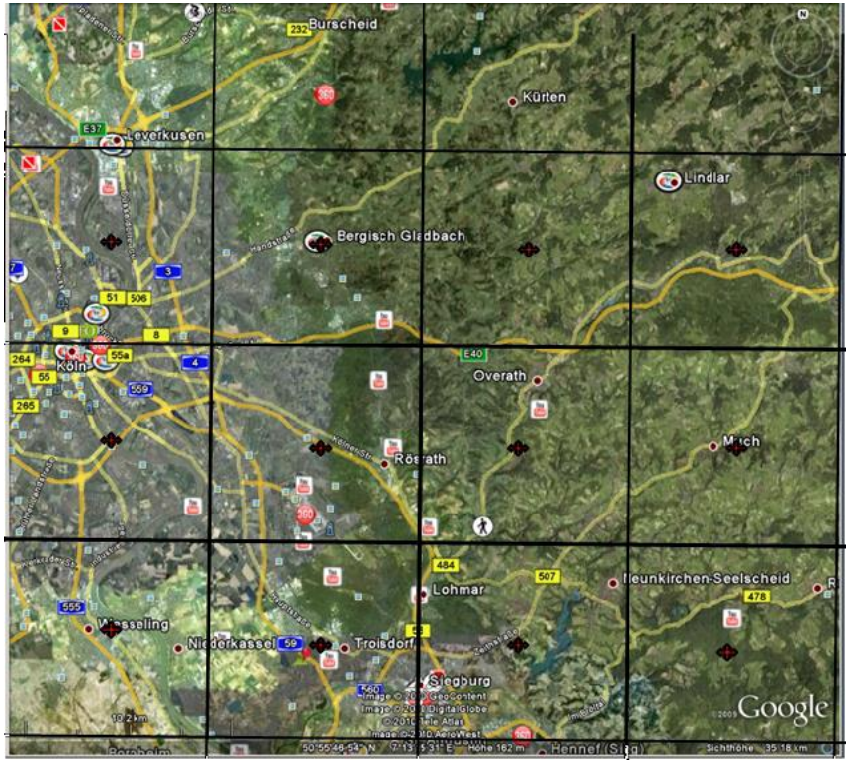
4. Risk evaluation

- Summarizing risk scenarios in a risk matrix
- Comparison of climate related risks and road infrastructure risks
- Evaluation of the risks



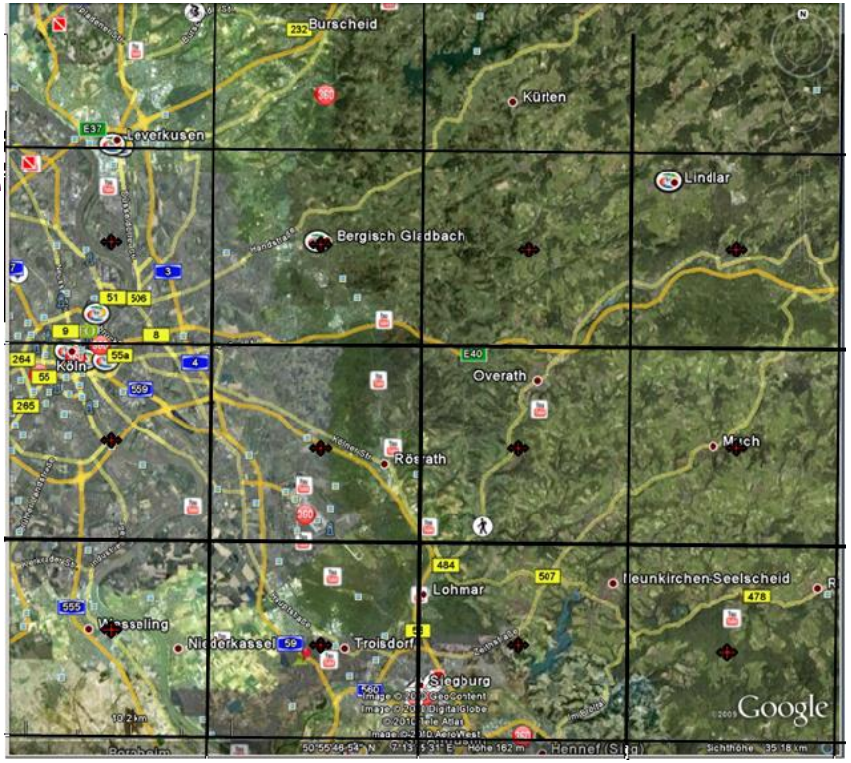
Comparison of meteorological parameters and grid data of climatologic prediction models

- Aim:
  - Estimation of the effects of climate change on road constructions
  - Development and implementation of adaptation measures



Comparison of meteorological parameters and grid data of climatologic prediction models

- Weather stations rarely located close to roads
- Climate projection provide data for a specific grid
- Creation of algorithms, which compare data of weather stations with weather data of roads
- Application to projected climate data



Other projects

- Design of road drainage systems
- Adaptation of pavement design for asphalt and concrete constructions, i.e. changing the asphalt type or the mineral aggregate
- Estimation of landslide risk areas and development of a hazard map
- Vulnerability analysis for bridges and tunnels

Thank you for your attention!