

line is supported with the ROADAPT database with over 500 adaptation measures for geotechnical and drainage assets, pavements and traffic management.

Case studies

Three case studies have been carried out for validation and demonstration purposes. These are the A24 in Portugal, the Rotterdam-Ruhr corridor and the Öresund region. The latter includes all ROADAPT outputs, where the others only focus on the QuickScan method. The case study report will become available together with the ROADAPT guidelines.

Course on climate change, effects for roads and adaptation options

Besides publication of the guidelines other dissemination activities will be conducted. One of them is a course that will be organized on September 22nd and 23rd 2014 in Delft, the Netherlands. Both practical and high level topics are introduced and explored with the participants. Objectives of the course are:

- to increase awareness of the necessity to take climate change into account
- to introduce a risk based approach that covers RIMA-ROCC and ROADAPT
- to train the participants in the use of the methodology, by making use of case studies.

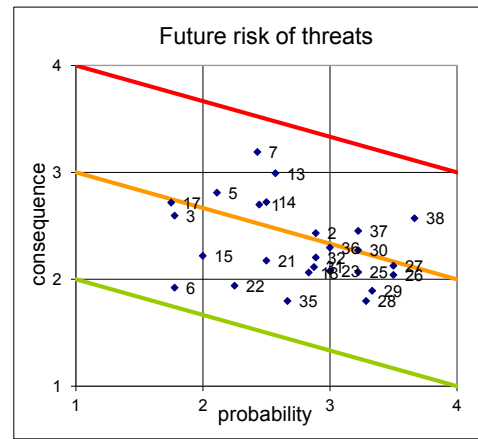
More information

The ROADAPT guidelines will be available in September 2014. For more information about the project or the ROADAPT course, you may contact Thomas.Bles@deltares.nl (coordinator ROADAPT project) or Kees.van.Muiswinkel@rws.nl (project manager CEDR). More information can also be found on the CEDR website www.cedr.fr.

The research being done within the ROADAPT project is carried out as part of the CEDR Transnational Road research Programme Call 2012. The funding for the research is provided by the national road administrations of the Netherlands, Denmark, Germany and Norway. The ROADAPT consortium consists of the following partners: Deltares (the Netherlands, coordinator), SGI (Sweden), Egis (France) and KNMI (the Netherlands).

CATEGORY OF ADAPTATION MEASURE	STAGES				
	PRO-ACTION	PREVENTION	PREPARATION	RESPONSE	RECOVERY
PLANNING				Extreme event management	
ROBUST CONSTRUCTION	Pro-active attitude	Prevention			
LEGISLATION					
RESILIENT CONSTRUCTION		Upgrade, retrofit, new construction			
MAINTENANCE AND MANAGEMENT		Preventive Maintenance and Replacement			Corrective Maintenance and Replacement
TRAFFIC MANAGEMENT	Traffic management				
CAPACITY BUILDING	Capacity building				
MONITORING	Monitoring and prediction				
RESEARCH	Research				

Policy matrix showing the building blocks of adaptation strategies



Risk Matrix and Risk Map as output of QuickScan

ROADAPT

- Roads for today, adapted for tomorrow



Introduction

Infrastructures are the backbone of our society. Citizens, companies and governments have come to rely on and expect uninterrupted availability of the road network. In the same time it is generally understood that the world's climate is changing and that this will have significant effects on the road infrastructure. Since road infrastructure is vital to society, climate change calls for timely adaptation.

However there are great uncertainties involved in both the projections of future climate as well as their effects on the road infrastructure and related socio-economic developments. In the meantime, there is a constant need for decisions and development of the road transport system.

The ROADAPT project is part of the CEDR Call 2012 'Road owners adapting to climate change'. The call states that one of the most important tasks of the road owners is the prioritization of measures in order to maximize availability within reasonable costs. This includes a risk based approach addressing cause, effect and consequence of weather related events to identify the top risks that require action with mitigating measures. In this respect the RIMA-ROCC framework (Risk Management for Roads in a Changing Climate) has been developed within ERA NET ROAD in 2011.



Objectives

ROADAPT aims at a further development of this framework into practical and useful methods for road owners and road operators. Output of the ROADAPT project is one ROADAPT-RIMAROCC integrating guideline containing different parts:

- Guidelines on the use of climate data for the current and future climate
- Guidelines on the application of a QuickScan on climate change risks for roads
- Guidelines on how to perform a detailed vulnerability assessment
- Guidelines on how to perform a socio economic impact assessment
- Guidelines on how to select an adaptation strategy

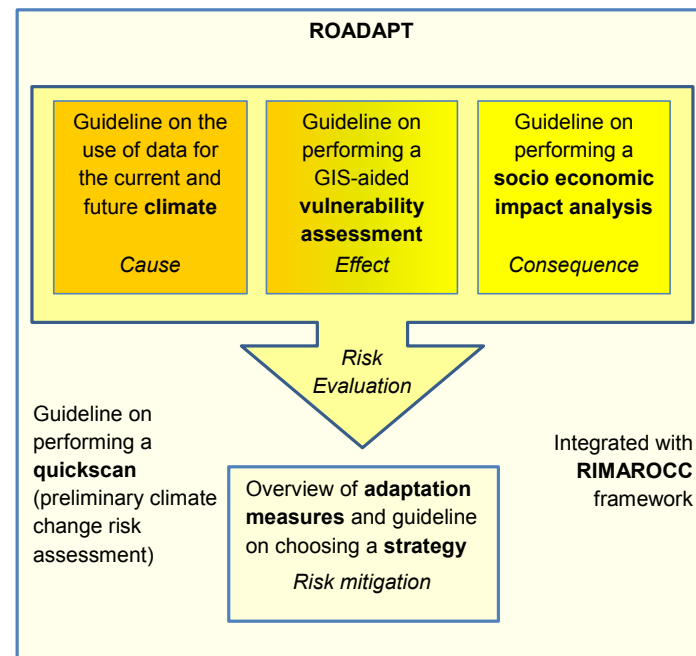
Output

Climate change

Part A provides background information and guidelines for tailored and consistent climate data and information. The guideline will support studies on the impact of the current and future climate for transnational road networks in Europe, suitable for National Road Authorities (NRA's). The document can be used by NRA's to judge the climate information that they receive from e.g. research institutes, consultancies, and to find answers to their questions. It can also be used by researchers and consultancies to select the most appropriate datasets and methods for a certain application. Also requirements related to climate data are given.

QuickScan

Part B provides a QuickScan method that preliminary estimates the major risks that can be associated with weather conditions both in the current climate and in the future. Another output of the QuickScan method is an action plan for adaptation. The identification and



preliminary assessment of top risks allows a road authority and/or road operator to consciously and effectively focus on specific areas in their network and/or on specific threats.

The output of the QuickScan is reached, by bringing all available knowledge, information and especially experiences of stakeholders together in three workshops. Implementation of the QuickScan method in the case studies revealed that the brainstorming process in the QuickScan method is a catalyst for team building. The approach develops awareness on climate change issues, and climate related risks in general. This helps developing adaptation strategies.



Vulnerability Assessment

Part C provides efficient tools for assessing vulnerabilities within the TEN-T road network. A new vulnerability assessment method, ROADAPT VA, has been developed.

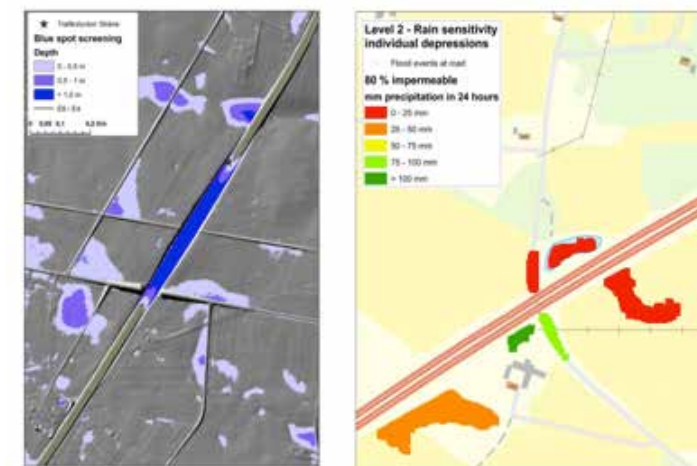
Vulnerability is assessed in a GIS environment using geographically distributed vulnerability factors describing the infrastructure and the area surrounding the road. The output is a GIS layer with areas with prerequisites for the analysed risk, and vulnerability scores. ROADAPT VA can be used for all climate-induced risks.

Socio Economic Impact Assessment

Part D of the ROADAPT guideline deals with the socio-economic impact assessment of road traffic event. It is based on three levels of analysis:

- to increase awareness of the necessity to take climate change into account
- to introduce a risk based approach that covers RIMAROCC and ROADAPT
- to train the participants in the use of the methodology, by making use of case studies.

For each of these 3 levels, the guideline describes

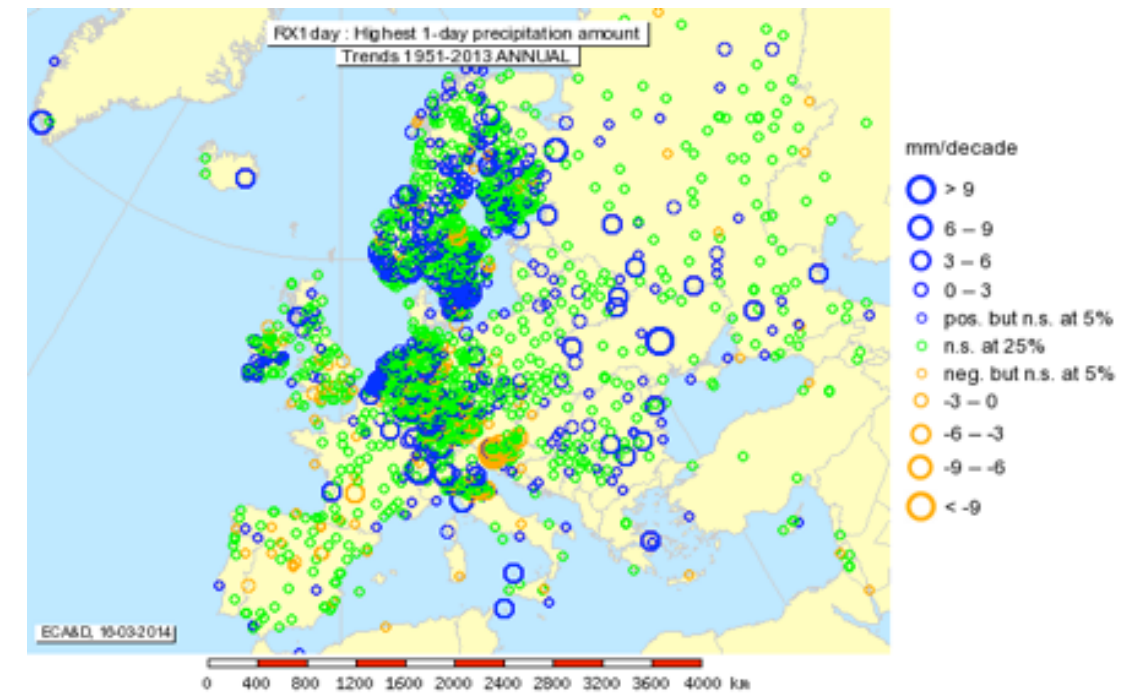


Vulnerability assessment of a road (blue spots)

methodologies that enable to evaluate the risk consequences of events linked to climate change, and in a broader manner, provides necessary information to identify the strategies to adapt to climate change.

Adaptation measures and strategies

Part E presents an overview of adaptation measures and



Trend in highest 1-day precipitation amount per year over the period 1951-2013 (ECA&D)

helps in selecting an adaptation strategy. The guideline provides practical support in RIMAROCC step 5: Risk Mitigation. The selection of adaptation strategies follows a 10 step approach that is applied to ten specific climate change related threats. Starting from the specific road owner's needs, the 10 step approach helps her/him to identify relevant damage mechanisms, design models, climate parameters for assessing the resilience of the asset in the current and future situation. Next, the approach identifies adaptation measures and strategies, assesses consequences of selecting measures and strategies, and identifies stakeholders to be involved. Knowledge gaps in climate change projections, adaptation technologies and essential construction and site specific data are identified. The time to market of innovative adaptation technologies is estimated to help in the development of technology roadmaps. The guide-



QuickScan workshop: case study A24 Portugal