

## Course on climate change, effects for roads and adaptation options

Besides publication of the guideline 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 being 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 covering RIMAROCC and ROADAPT
- to train the participants in using the methodology, by making use of case studies.

## More information

The ROADAPT guideline 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).

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).



# 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.

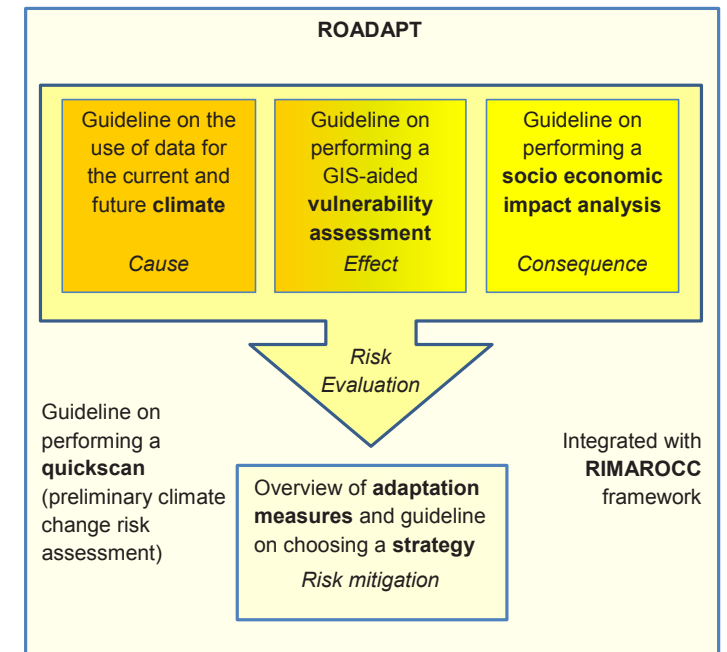
However there are great uncertainties involved in both the projections of future climate change plus their effects on the road infrastructure and related socio-economic developments. In the meantime, there is a constant need for decisions and development of the road transport system.

The ROADAPT project is part of the CEDR Call 2012 'Road owners adapting to climate change' in which is stated that one of the most important tasks of the road owners is the prioritization of measures in order to maximize availability with reasonable costs. This includes a risk based approach addressing causes, effects and consequences of weather related events to identify the top risk that need to be taken action on with mitigating measures. In this respect the RIMAROCC 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 (Figure 1):

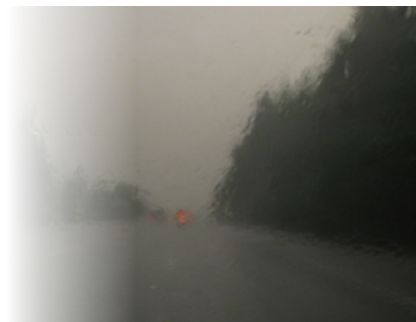
- Guideline on the use of climate change projections
- Guideline on the application of a QuickScan on climate change risks for roads
- Guideline on how to perform a detailed vulnerability assessment
- Guideline on how to perform a socio economic impact assessment
- Guideline on how to come to an adaptation strategy



## Output

### Climate change

Part A provides background information and guidelines for tailored and consistent climate data and information for 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. (impact) research institutes, consultancies, and to find answers to their questions. It can also be used by impact researchers and consultancies to select the most appropriate datasets and methods for a certain application. Also requirements related to climate data are included.





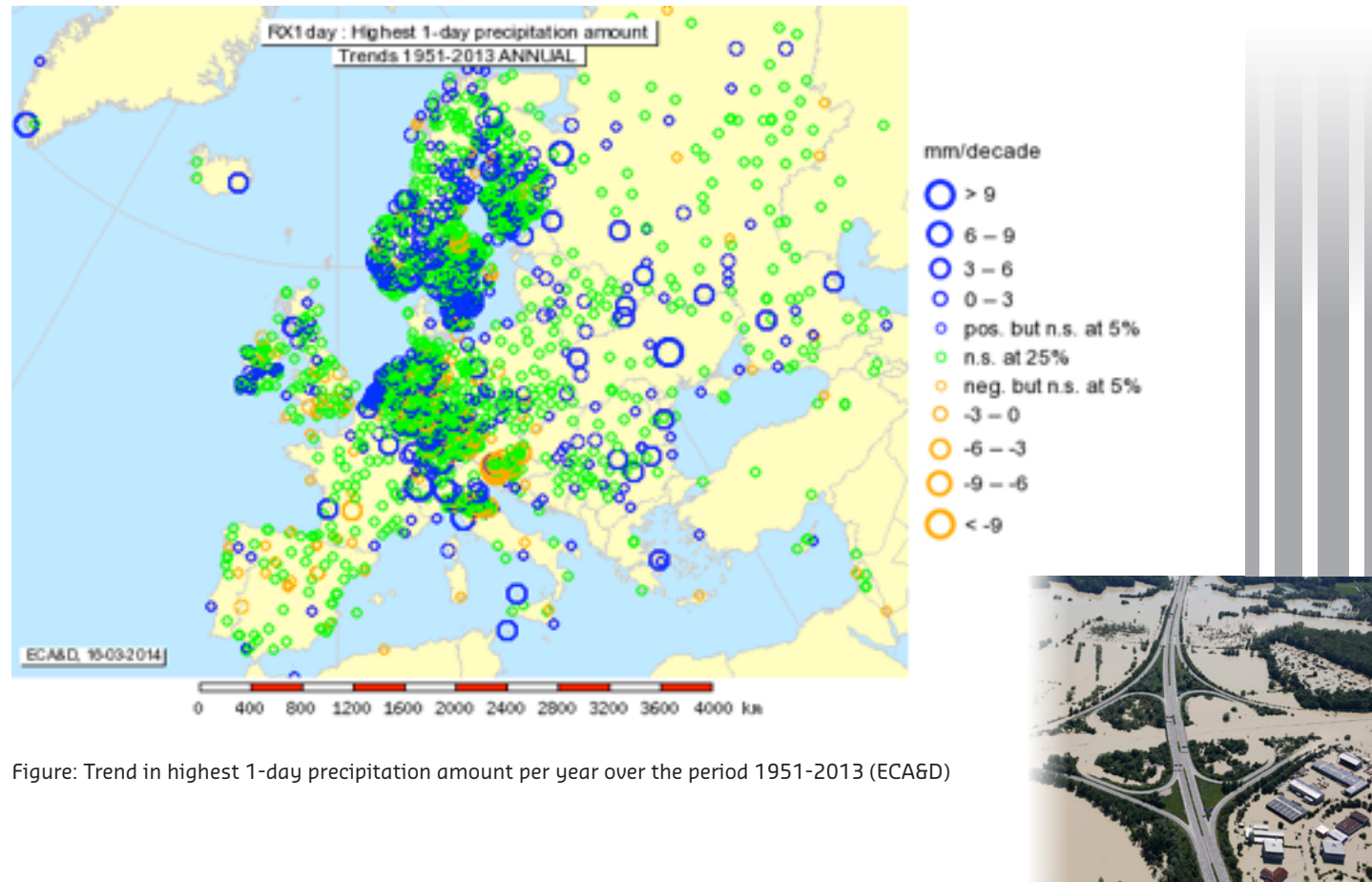


Figure: Trend in highest 1-day precipitation amount per year over the period 1951-2013 (ECA&D)

**QuickScan**

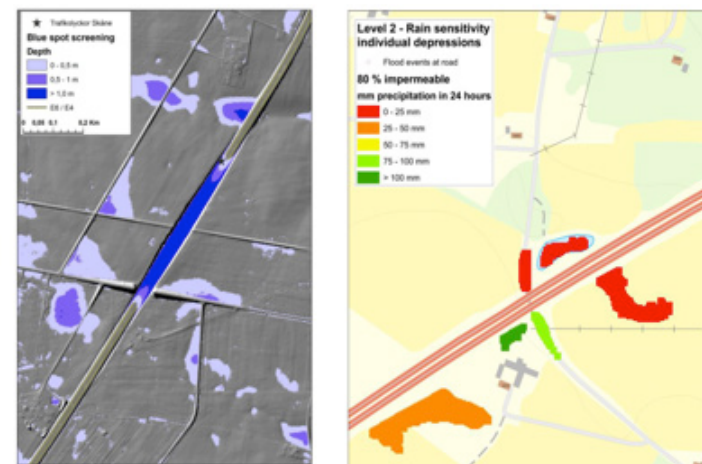
Part B provides a QuickScan method that preliminary estimates the major risks that can be associated with weather conditions both in the current climate and in the future, together with an action plan for adaptation. The identification and light-assessment of top risks allows a road authority and/or road operator to consciously and effectively focus on specific areas in their network and/ or on specific threats.

A founded first impression of climate (change) risks plus an action plan for adaptation is assessed in the QuickScan, by bringing all available knowledge, information and especially experiences of stakeholders together in three workshops. During implementation of the QuickScan method in the case studies it was learned that the brainstorming process in the QuickScan method showed to be important in terms of 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 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.



Vulnerability assessment of a road (blue spots)

**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:

- Network level: considering potential impact on traffic; delays, risk of accident, GHG emissions, etc.
- Local territory level: the territories that are served by the road network with impact on economic activity
- Economic system as a whole: at a wider scale the potential impact at corridor or inter-regional, national or cross-border level (including potentially very long distance re-routings on the TERN, passing through different countries)

For each of these 3 levels, the guideline describes 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 of the ROADAPT guideline presents an overview of adaptation measures and helps in selecting an adaptation strategy. This part of the guideline provides practical support in RIMAROCC step 5: Risk Mitigation. The selection of the 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 guideline 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 one includes all ROADAPT outputs, where the other only focus on the QuickScan method. The case study report will become available together with the ROADAPT guideline.



QuickScan workshop: case study A24 Portugal

		STAGES				
		PRO-ACTION	PREVENTION	PREPARATION	RESPONSE	RECOVERY
CATEGORY OF ADAPTATION MEASURE	PLANNING	Pro-active attitude			Extreme event management	
	ROBUST CONSTRUCTION		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