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Climate change risk assessments and adaptation for roads – results of the ROADAPT project

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Abstract

Infrastructure is the backbone of our society. Citizens, companies and governments have come to rely on and expect uninterrupted availability of the road network. Extreme weather is an important factor for the reliability of the road network. At the same time it is generally understood that the 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. Immediately, questions arise how to deal with the large uncertainties involved in the projections of future climate, how to assess their effects on the road infrastructure and related socio economic developments, and how to integrate adaptation into decision making. The ROADAPT project was commissioned under the CEDR Call 2012 'Road owners adapting to climate change'. It adopts a risk based approach using the RIMAROCC framework (Risk Management for Roads in a Changing Climate, developed under a previous ERA NET ROAD project). The approach addresses cause, effect and consequence of weather-related events to identify the top risks that require action with mitigating measures for climate change adaptation. Output of the ROADAPT project is a single ROADAPT-RIMAROCC integrating guideline.

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1. Introduction

Although there are considerable uncertainties involved in both the projections of future climate change and related socio economic developments and in estimations of the consequences of these changes in transportation requirements, there is a constant need for decisions and development of the road transport system. As stated in the CEDR 2012 Climate Change call for research: 'Road authorities need to evaluate the effect of Climate Change on the road network and take remedial action concerning design, construction and maintenance of the road network.'

The ROADAPT project is part of this CEDR Call. ROADAPT has an integral approach following the RIMAROCC (Risk Management for Roads in a Changing Climate) framework that was developed within the ERA NET ROAD climate change programme in 2010. ROADAPT aims at providing methodologies and tools enabling tailored and consistent climate data information, good communication between climate researchers and road authorities, a preliminary and fast quickscan for estimating the climate change related risks for roads, a vulnerability assessment, a socio economic impact analysis and an action plan for adaptation with specific input from possible adaptation techniques related to geotechnics and drainage, pavements and traffic management.

The outputs of the ROADAPT project are guidelines (available at www.cedr.fr) that address all these topics. In the main guideline an overview of all topics is provided. In five subsequent parts the specific topics are addressed in detail. These five parts are:

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

All the ROADAPT guidelines can be used individually, but should be seen as interdependent and fitting within the broader RIMAROCC framework. The guidelines are primarily written for National Road Authorities to gain insight into the steps to take for a climate change risk assessment on roads. However, the guidelines will be beneficial for a broad range of professionals, including road engineers (geotechnics, hydraulics, pavements, traffic management), asset managers, climate change adaptation professionals, innovation managers and project managers. Although the guidelines focus on roads, the topics and methodology are applicable for other infrastructure assets such as railways or electricity networks as well.

2. Climate change effects on roads

2.1. Extreme weather effects on roads

The ROADAPT guidelines deal with the way road authorities could adapt to the effects of climate change. It is the extreme weather that affects the road infrastructure and the level of service offered to their users, and climate change may result in changed frequencies of extreme weather. Already from the time that the first roads were constructed, the weather influences the performance of the road infrastructure. Therefore, it is important to have an overview of how the weather can threaten road infrastructure and/or road users. Within the ROADAPT guidelines such an overview has been developed as a starting point for all risk and vulnerability studies to the effects of extreme weather on roads. The following items from the overview can be used in studies for both today's and future situations.

- At first the threats are described. They are grouped into 12 main threats and subdivided into 40 sub-threats. The threats can either originate outside the road asset (for example in the case of a flooding or landslide) but can also originate within the road asset (for example wind damage to lightning fixtures or a decrease in driving ability due