

ICARUS - Improving the uptake of Climate change Adaptation in the decision making processes of Road Authorities

Incorporating climate change and resilience concepts in decision making is a balancing act between ambitions, the newest approaches and technologies vs pragmatic and proven practices, information needs vs data availability, expected service levels and investments. The most crucial question might be *how to build and implement the business case for resilience via adaptation*, balancing the service levels that the road network needs to achieve with the costs and benefits for enhancing resilience.

This balancing act is the story of ICARUS, which refers to the Greek mythology with the legend of Icarus, the son of the master craftsman Daedalus. Daedalus constructed wings, made of feathers and wax, for his son to escape from Crete and gave him the instruction not to fly too high or the sun would melt the wax, nor to fly too low or the sea would clog his wings. It is a metaphor for the key challenges that National Road Authorities (NRAs) face during the integration of climate change into their decision-making processes, which explains the use of Icarus' name as the acronym of the project. By working towards a too high service level (i.e. flying too high), measures will probably prove to be too costly compared to the benefits and will not be implemented. By focussing mostly on the cost of measures (i.e. flying too low), the measures won't be very effective in increasing the resilience of the road network and reaching the required service level. A better understanding and assessment of the balance between service levels, cost and benefits of measures is key for implementation of climate change resilience.

Many European NRAs have recognized for a long time that climate change will have a significant effect on their assets and operations, as well as on the services that the road network provides for society. Consequently, significant progress has been achieved by research conducted in the past decade. Conducting a resilience assessment has become relatively common practice and the forthcoming development of adaptation strategies has also been undertaken in many cases. However, the step to full implementation in all processes and on all organizational levels of the NRAs poses a significant challenge. Within ICARUS, the previous research and lessons learnt from various case studies will be used as a starting point and enriched to ensure successful implementation into the NRAs processes. Current barriers and gaps will be identified for technical execution of resilience assessments and suggestions will be made how to overcome these. Implementation will be ensured via development of training material and guidelines.

The ICARUS project will produce results that progress the current State of the Art and will be of immediate benefit to NRAs:

- An overview of the baseline for climate change resilience assessments, resilience evaluation and the use of cost benefit assessments for climate change adaptation;
- A report on the use of impact chains for understanding of direct and indirect impacts;
- Guidelines on how to define and use minimum viable service levels for evaluating resilience and adaptation options based on quantification and valuation of associated costs and wider benefits and considering a whole life perspective;
- Guidelines providing an overview and characterization of measures, aimed towards implementation in the various NRAs processes;
- Demonstration report showing how adaptation measures can be evaluated;
- Report with success factors on implementing Nature Based Solutions;

- Resource training pack for different target audiences to ensure implementation of output.

The ICARUS consortium consists of Deltares (Netherlands), Tecnia (Spain), Ramboll (Denmark and Finland), Maple consulting (UK) and Research Driven Solutions (Ireland). The consortium has been involved extensively in previous research, as well as in projects for the NRAs to materialize the research.