CEDR Transnational Road Research Programme Call 2015

Overview of DeTECToR

Sarah Reeves, TRL

Final conference 19/04/18

Presentation outline

1. Project objectives and scope
2. Approach taken
3. Deliverables
4. Summary

Project overview

DeTECToR - Decision support tools for embedding climate change thinking on roads

Project partners

TRL

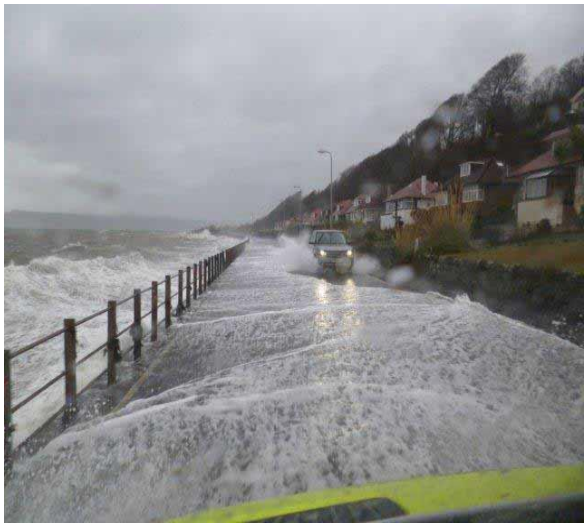
Alfen Consult — Für eine zuverlässige und wirtschaftliche Infrastruktur

Climate & Environment Consulting Potsdam GmbH

AIT Austrian Institute of Technology

Instytut Badawczy Dróg i Mostów
Road and Bridge Research Institute

Key climate change challenges



A. Making the business case for climate change adaptation
   - Should I invest in adaptation action?
   - What are the costs if I don't?
   - What is the most cost-effective adaptation strategy?

B. Embedding climate change in procurement processes and operations
   - How do I reduce my carbon footprint?
   - How can I influence my supply chain?
   - What are the pros and cons of different procurement approaches?

Objectives

- To produce two sets of tools and guidance to help NRAs address these challenges:

A. A risk assessment and CBA tool & a guidance document on including climate change in economic appraisal

B. An online collaboration platform for procurement & a guidance document on embedding climate change into operations and procurement processes

Methodology

Information gathering and review

- Literature review
- NRA survey and workshop

Development of tools and guidance

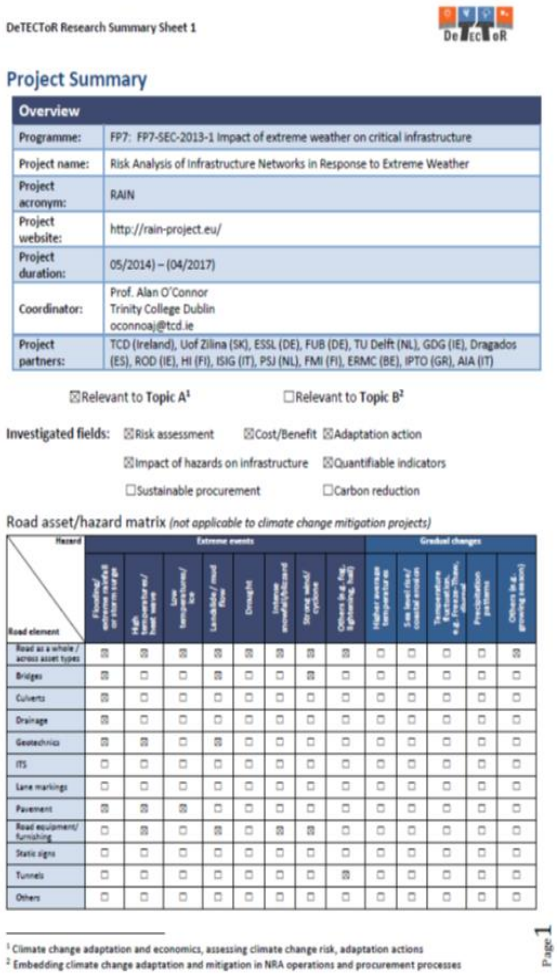
- Risk and cost-benefit tool & guidance document
- Procurement collaboration platform & guidance document

Pilot studies

- Trial tools with NRAs
- Finalise tools

Literature review

- Review of relevant research to identify good practice and useful information /approaches:
  - (a) to inform the development of the tools and guidance
  - (b) to produce a summary of existing research for NRAs
- Literature review covered CEDR & EC projects, national projects, reports, guidance etc.
- 4-page summary sheets produced for 39 key projects providing information including how NRAs could implement the findings



DeTECToR Research Summary Sheet 1

Project Summary

Overview	
Programme:	FP7: FP7-SEC-2013-1 Impact of extreme weather on critical infrastructure
Project name:	Risk Analysis of Infrastructure Networks in Response to Extreme Weather
Project acronym:	RAIN
Project website:	http://rain-project.eu/
Project duration:	05/2014) – (04/2017)
Coordinator:	Prof. Alan O'Connor Trinity College Dublin oconnoa@tcd.ie
Project partners:	TCD (Ireland), Uof Zilina (SK), ESSL (DE), FUB (DE), TU Delft (NL), GDG (IE), Dragados (ES), ROD (IE), HI (FI), ISIG (IT), PSJ (NL), FMI (FI), ERMC (BE), IPTO (GR), AIA (IT)

☒Relevant to Topic A[1] ☐Relevant to Topic B[2]

Investigated fields: ☒Risk assessment ☒Cost/Benefit ☒Adaptation action ☒Impact of hazards on infrastructure ☒Quantifiable indicators ☐Sustainable procurement ☐Carbon reduction

Road asset/hazard matrix *(not applicable to climate change mitigation projects)*

Hazard / Road element	Extreme events							Gradual changes				
Road as a whole / across asset types	☒	☒	☒	☒	☒	☒	☒	☐	☐	☐	☐	☐
Bridges	☒	☐	☐	☒	☐	☐	☒	☐	☐	☐	☐	☐
Culverts	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Drainage	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Geotechnics	☒	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐
ITS	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lane markings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pavement	☒	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Road equipment/ furnishing	☐	☒	☐	☒	☐	☒	☒	☐	☐	☐	☐	☐
Static signs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tunnels	☐	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐
Others	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

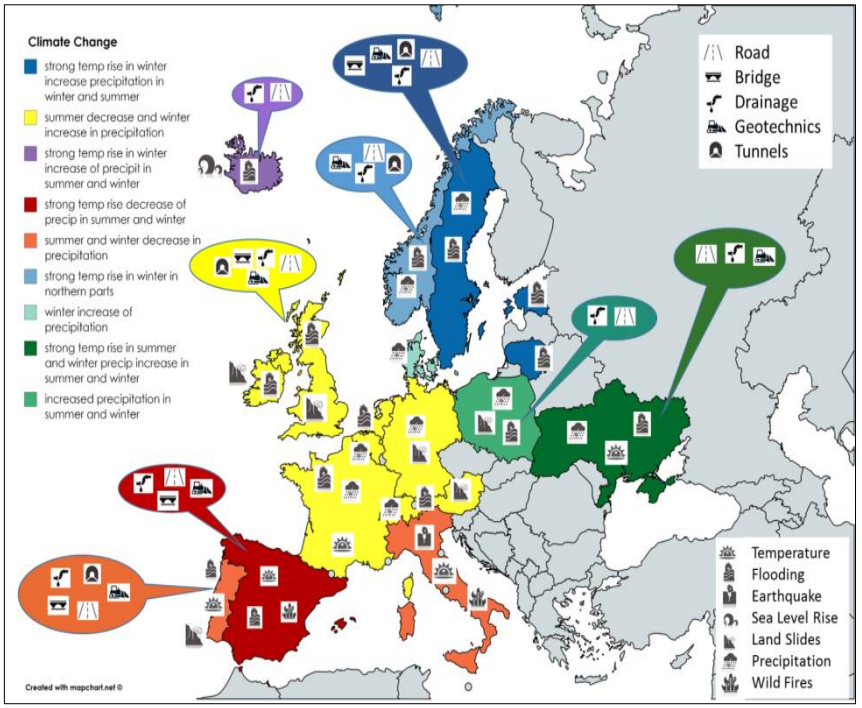
[1] Climate change adaptation and economics, assessing climate change risk, adaptation actions
[2] Embedding climate change adaptation and mitigation in NRA operations and procurement processes

Page 1

Survey and workshop

44 responses, 24 countries

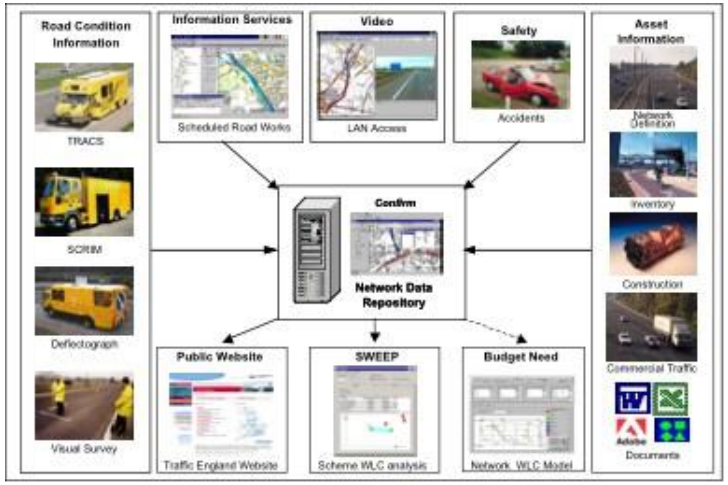
- Online survey to collect information on NRA priorities and activities
- Example results
  - 76% don't include CC impacts in economic appraisal
  - 34% include requirements related to carbon reduction in project specifications
- Workshop April 2017
  - Presentation of findings from review and survey
  - Plans for the tools
  - Discuss requirements of the software tools



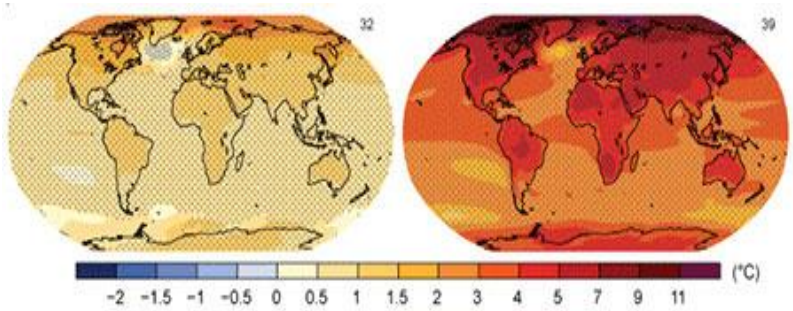
NRA priorities

- *drainage, pavements and geotechnics*
- *flooding*

The risk assessment and CBA tool



Asset Data



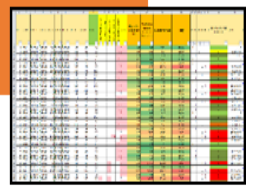
Climate Data

Vulnerability Configuration

Cost-Benefit Calculation Configuration

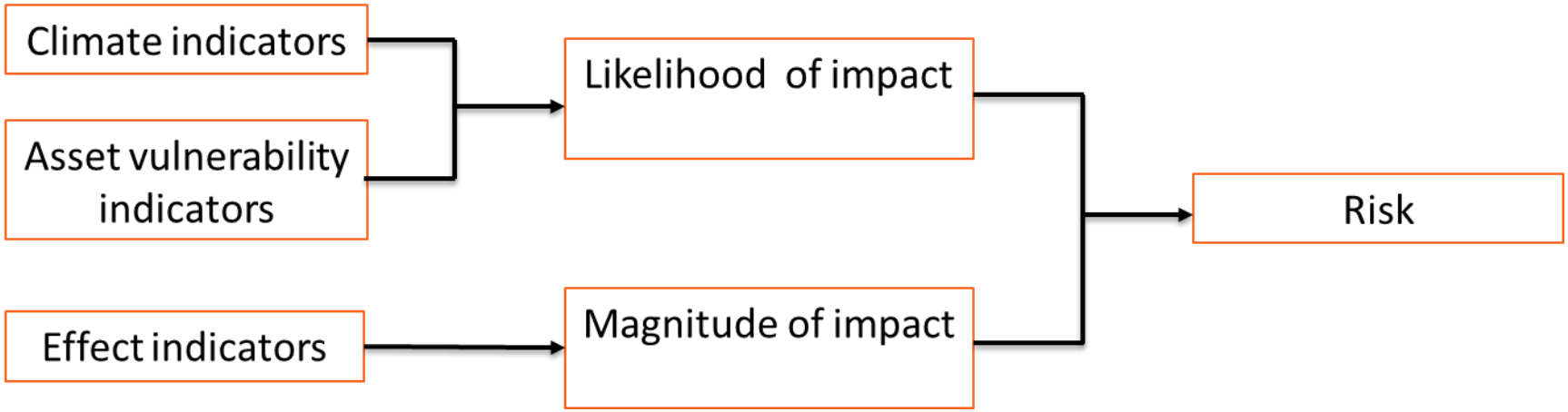
Risk Assessment Module

Cost-Benefit Calculation Module

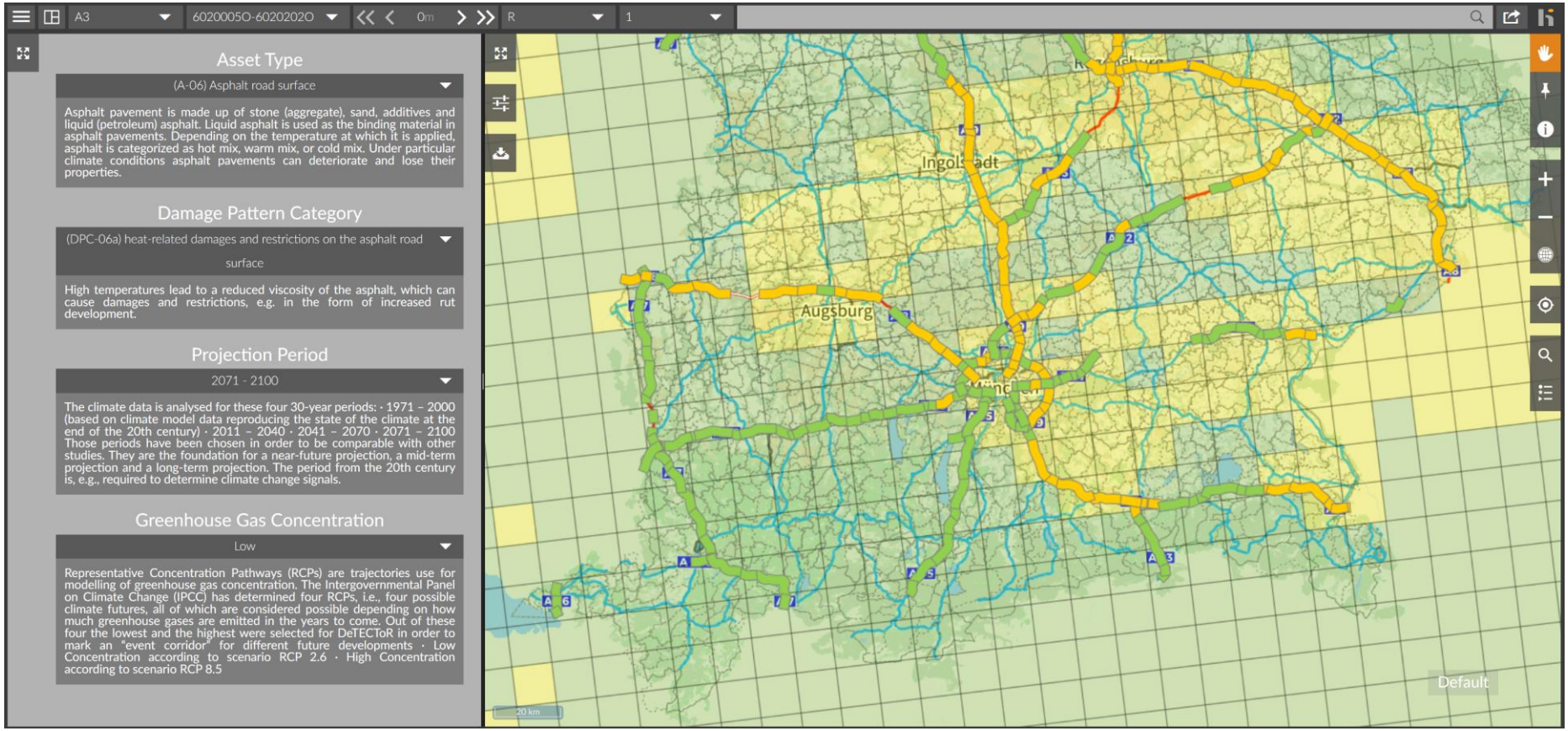


Risk module approach

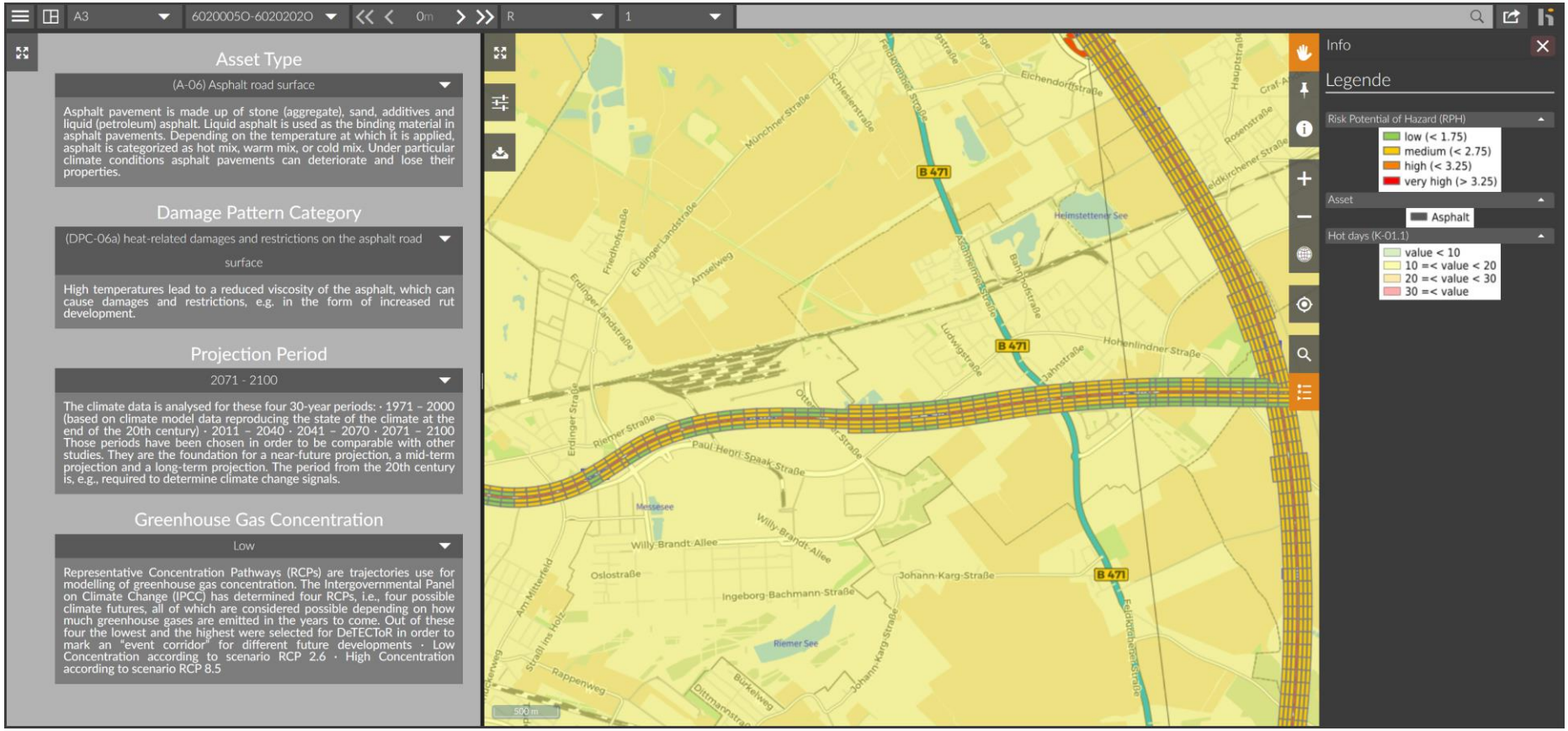
- Indicator method based on RIVA
- Factors influencing the likelihood and magnitude of impact are identified
- Relevant indicators and thresholds are defined
- Scores assigned from 1 to 4 based on the uploaded data
- Results are combined to produce a score for likelihood and impact - these are used to produce an overall score for risk



Risk module


A3
6020005O-6020202O
0m
R
1
Asset Type
(A-06) Asphalt road surface
Asphalt pavement is made up of stone (aggregate), sand, additives and liquid (petroleum) asphalt. Liquid asphalt is used as the binding material in asphalt pavements. Depending on the temperature at which it is applied, asphalt is categorized as hot mix, warm mix, or cold mix. Under particular climate conditions asphalt pavements can deteriorate and lose their properties.
Damage Pattern Category
(DPC-06a) heat-related damages and restrictions on the asphalt road surface
High temperatures lead to a reduced viscosity of the asphalt, which can cause damages and restrictions, e.g. in the form of increased rut development.
Projection Period
2071 - 2100
The climate data is analysed for these four 30-year periods: · 1971 – 2000 (based on climate model data reproducing the state of the climate at the end of the 20th century) · 2011 – 2040 · 2041 – 2070 · 2071 – 2100 Those periods have been chosen in order to be comparable with other studies. They are the foundation for a near-future projection, a mid-term projection and a long-term projection. The period from the 20th century is, e.g., required to determine climate change signals.
Greenhouse Gas Concentration
Low
Representative Concentration Pathways (RCPs) are trajectories use for modelling of greenhouse gas concentration. The Intergovernmental Panel on Climate Change (IPCC) has determined four RCPs, i.e., four possible climate futures, all of which are considered possible depending on how much greenhouse gases are emitted in the years to come. Out of these four the lowest and the highest were selected for DeTECToR in order to mark an "event corridor" for different future developments · Low Concentration according to scenario RCP 2.6 · High Concentration according to scenario RCP 8.5
Augsburg
Default
20 km

Risk levels and information



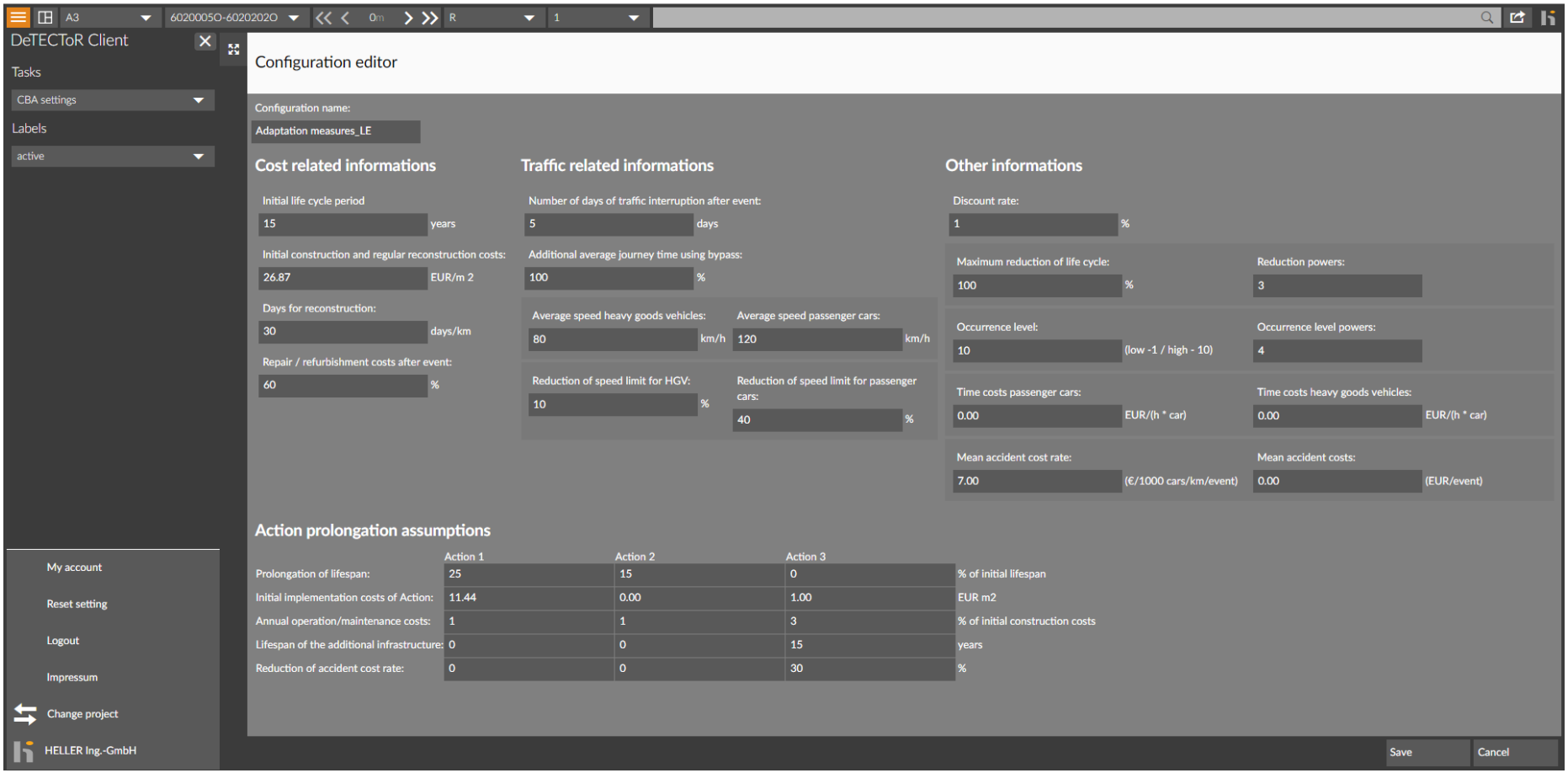
CBA module approach

- Calculates costs over appraisal period
  - Direct costs such as repair after weather damage
  - Indirect costs – delay, accidents
- Likelihood from risk module used to estimate probability of an event occurring each year
- Likelihood changes over time due to
  - Changes in climate indicators (use of different projection periods)
  - Changes in asset vulnerability – condition lifecycle plus reduction due to climate change
- Based on cost and information input by user and details of the asset, e.g. traffic flow, number of lanes
- Cost is calculated per year and combined

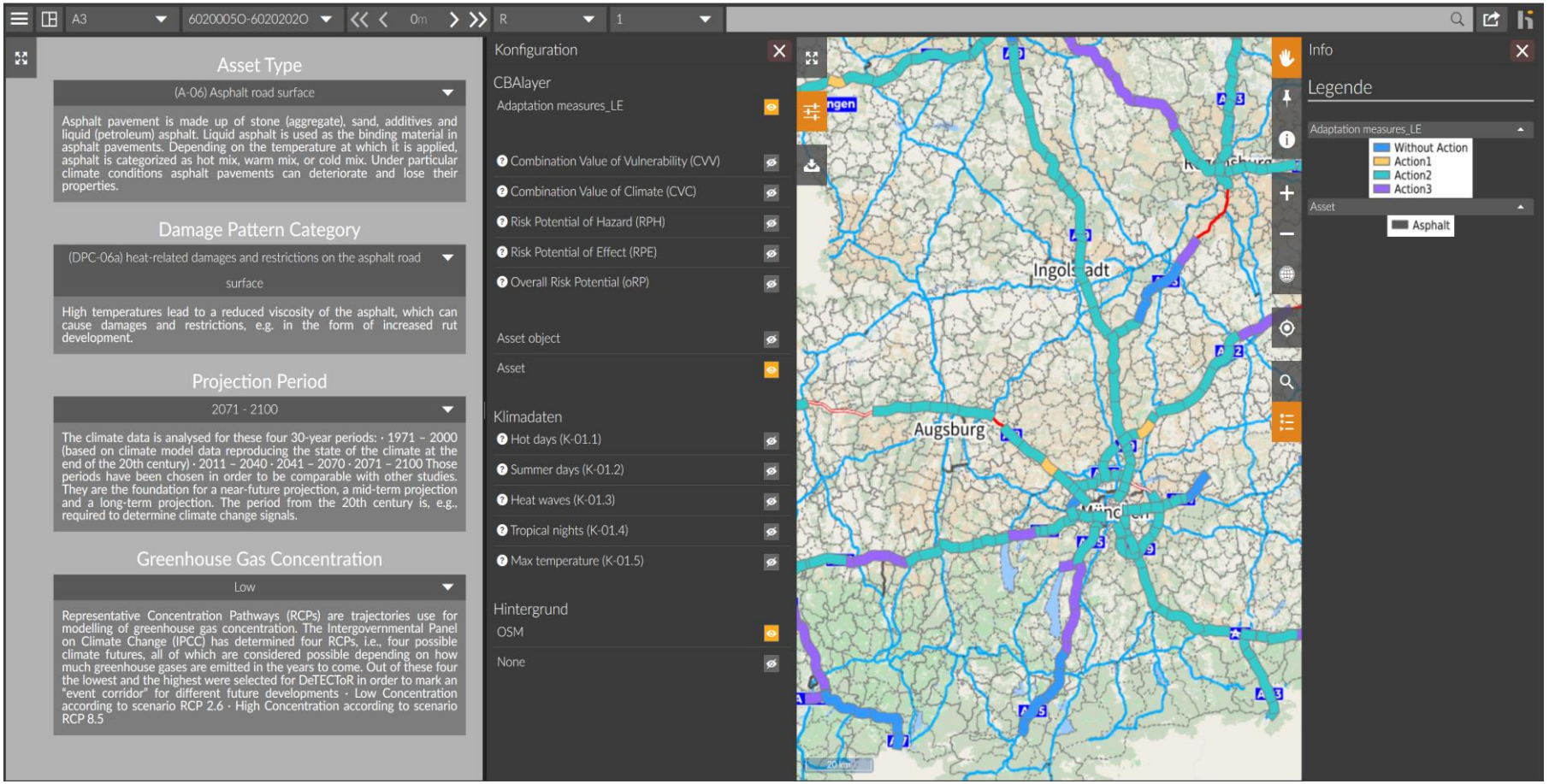
Adaptation options

- Three types of adaptation action can be defined
- Costs are recalculated with modified scoring for likelihood and/or consequence
- For example increasing the surfacing thickness could decrease vulnerability or improving traffic management could reduce consequences
- Enables comparison of options to identify the most cost effective over the appraisal period

CBA inputs


DeTECToR Client
Tasks
CBA settings
Labels
active
Configuration editor
Configuration name:
Adaptation measures_LE
Cost related informations
Initial life cycle period
15
years
Initial construction and regular reconstruction costs:
26.87
EUR/m 2
Days for reconstruction:
30
days/km
Repair / refurbishment costs after event:
60
%
Traffic related informations
Number of days of traffic interruption after event:
5
days
Additional average journey time using bypass:
100
%
Average speed heavy goods vehicles:
80
km/h
Average speed passenger cars:
120
km/h
Reduction of speed limit for HGV:
10
%
Reduction of speed limit for passenger cars:
40
%
Other informations
Discount rate:
1
%
Maximum reduction of life cycle:
100
%
Reduction powers:
3
Occurrence level:
10
(low -1 / high - 10)
Occurrence level powers:
4
Time costs passenger cars:
0.00
EUR/(h * car)
Time costs heavy goods vehicles:
0.00
EUR/(h * car)
Mean accident cost rate:
7.00
(€/1000 cars/km/event)
Mean accident costs:
0.00
(EUR/event)
Action prolongation assumptions
Action 1
Action 2
Action 3
Prolongation of lifespan: 25 15 0 % of initial lifespan
Initial implementation costs of Action: 11.44 0.00 1.00 EUR m2
Annual operation/maintenance costs: 1 1 3 % of initial construction costs
Lifespan of the additional infrastructure: 0 0 15 years
Reduction of accident cost rate: 0 0 30 %
My account
Reset setting
Logout
Impressum
Change project
HELLER Ing.-GmbH
Save
Cancel

CBA outputs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Konfiguration
CBAlayer
Adaptation measures_LE
Combination Value of Vulnerability (CVV)
Combination Value of Climate (CVC)
Risk Potential of Hazard (RPH)
Risk Potential of Effect (RPE)
Overall Risk Potential (oRP)
Asset object
Asset
Klimadaten
Hot days (K-01.1)
Summer days (K-01.2)
Heat waves (K-01.3)
Tropical nights (K-01.4)
Max temperature (K-01.5)
Hintergrund
OSM
None
Augsburg
Info
Legende
Adaptation measures_LE
Without Action
Action1
Action2
Action3
Asset
Asphalt

Procurement tool

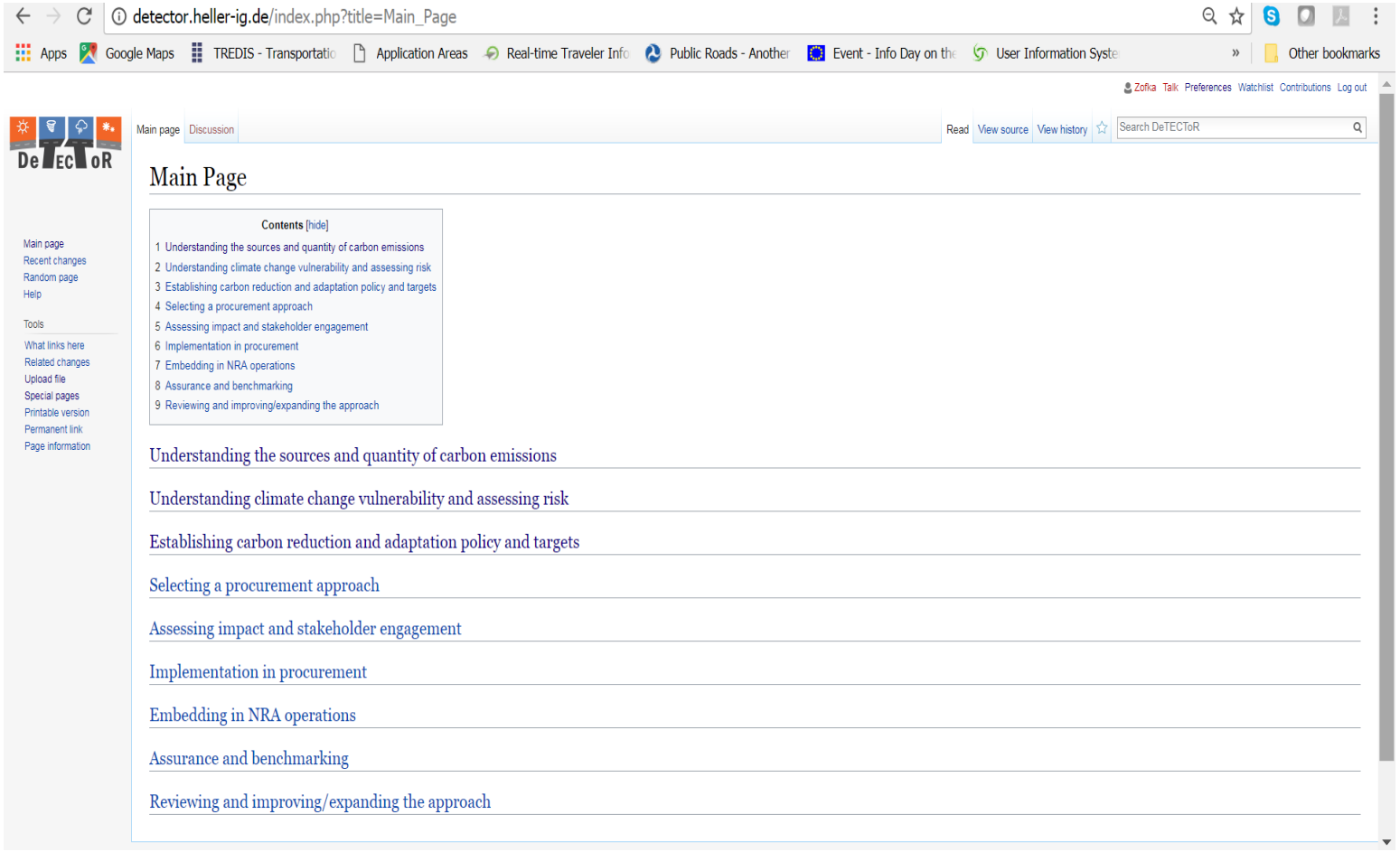
- Online collaboration platform
  - Wiki functionality
  - Initially populated by DeTECToR
  - Built on by NRAs post-project
- Contains information to help NRAs embed climate change mitigation and adaptation in operations and procurement processes
- Searchable
- Links to other resources
- Familiar format for browsing and adding information

WIKIPEDIA
The Free Encyclopedia

Tool contents

- Guidance areas/steps
  - Understanding the sources and quantity of carbon emissions
  - Understanding climate change vulnerability and assessing risk
  - Establishing carbon reduction and adaptation policy and targets
  - Selecting a procurement approach
  - Assessing impact and stakeholder engagement
  - Implementation in procurement
  - Embedding in NRA operations
  - Assurance and benchmarking
  - Reviewing and improving/expanding the approach
- Repository of research project summary sheets (searchable pdf)

Contents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Apps
Google Maps
TREDIS - Transportatio
Application Areas
Real-time Traveler Info
Public Roads - Another
Event - Info Day on the
User Information Syste
Other bookmarks
Zofka Talk Preferences Watchlist Contributions Log out
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Discussion
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View source
View history
Search DeTECToR
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Contents [hide]
1 Understanding the sources and quantity of carbon emissions
2 Understanding climate change vulnerability and assessing risk
3 Establishing carbon reduction and adaptation policy and targets
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7 Embedding in NRA operations
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9 Reviewing and improving/expanding the approach
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Random page
Help
Tools
What links here
Related changes
Upload file
Special pages
Printable version
Permanent link
Page information
Understanding the sources and quantity of carbon emissions
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Content

detector.heller-ig.de/index.php?title=Understanding_the_sources_and_quantity_of_carbon_emissions

Apps | Google Maps | TREDIS - Transportatio | Application Areas | Real-time Traveler Info | Public Roads - Another | Event - Info Day on the | User Information Syste | Other bookmarks

Zofka Talk Preferences Watchlist Contributions Log out

Page Discussion | Read Edit View history More | Search DeTECToR

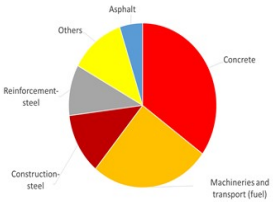
Main page
Recent changes
Random page
Help

Tools
What links here
Related changes
Upload file
Special pages
Printable version
Permanent link
Page information

Understanding the sources and quantity of carbon emissions

Road transportation is responsible for 26% of total energy consumption which relates to about 24% of all CO2 emissions (the main greenhouse gas) in the EU, with passenger cars being responsible for more than half of these emissions (European Commission, 2010). Despite manufacturers reducing CO2 emissions, increasing numbers of vehicles of the road means that emissions have been continuously growing by about 2% per year. Therefore, to fulfil the EU obligations with target 20-20-10 and tackle climate change, CO2 emissions from vehicles need to be reduced (European Commission, 2011). According to research done by the Swedish Road Administration, the majority of GHG emissions from infrastructure is generated by concrete, machineries and trucks (fuel), steel and asphalt

(Figure below).



Environmental goals that fall into the NRAs responsibilities also include actions which contribute to carbon emission reductions. These include: • Managing traffic so there is less idling time for vehicles • Objective to reduce GHG emissions from domestic transport (emission targets) • Enforcing use of low carbon intense construction materials for roads (also including technical requirements in for green procurement). • Enforcing and encouraging low carbon intense maintenance techniques.

Description of Tools and Methodologies: Recent projects such as CEREAL, LICCER and MIRAVEC provide different approaches summarized in summary sheets below. Also currently available CO2 calculation tools include Sweden's Klimatkalkyl and Highway's England carbon accounting tool, Dutch CO2 Performance Ladder and EU SULTAN Tool.

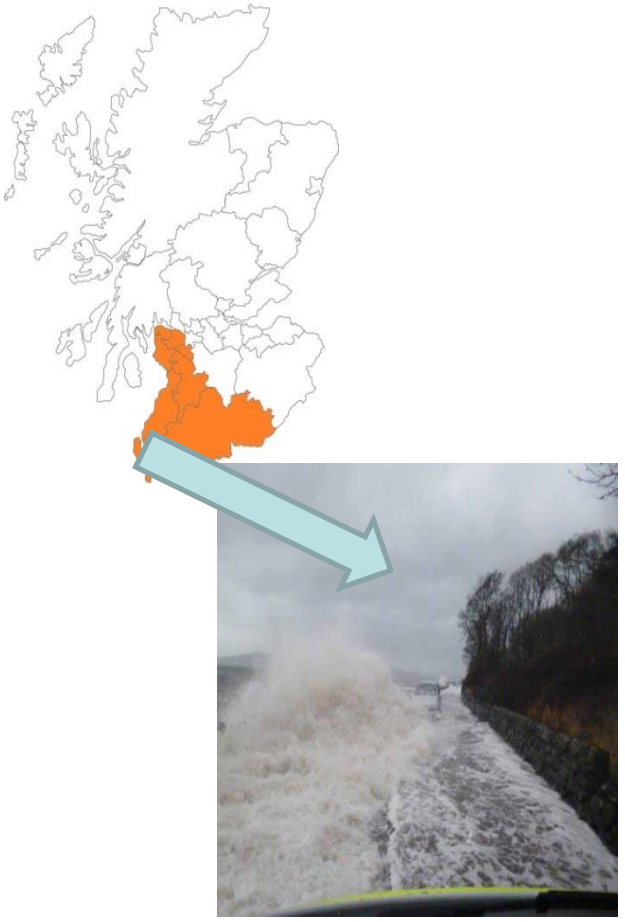
CEREAL (CO2 Emission REduction IN roAd Lifecycles) The project aimed at enhancing Europe wide carbon footprinting of road construction and pavement maintenance. A tool was developed for the prediction of CO2 emissions in the construction and maintenance phase of roads called Carbon Road Map. Default data is available in the tool or report and part of the database is fed by LICCER. A benefit of this model structure is that it can be tailored to the local situation.

LICCER (Life Cycle Considerations in EIA of Road infrastructure) The project developed a model including a framework and guidelines. This was based on existing tools and methodologies for Life Cycle Assessment (LCA) and GHG emissions of road infrastructure that can be used within an EIA process in the early stage of transport planning. The LICCER model includes site-dependent aspects of the planning such as the choice of a plain road, bridge or tunnel. The life-cycle model focuses on energy use and contribution to climate change. The LICCER model calculates the annual cumulative energy (consumption and greenhouse gas emissions) of the involved road corridor alternatives using default values. The model enables NRAs and other stakeholders to compare different road corridor alternatives in the decision-making process. The model is based on LCA methodology following the ISO 14040 standard. It was applied for verification in two case studies in Sweden and Norway.

MIRAVEC (Modelling Infrastructure Influence on RoAd Vehicle Energy Consumption) The project developed a spreadsheet tool based on simplified fuel consumption models that allowed the comparison of the effects of different infrastructure-related measures on fuel consumption and CO2 emissions. The model requires data about the most widely available pavement and road layout parameters, and uses information about traffic flow and vehicles as background information. While the tool can be applied even with limited data, the strong influence of these background data found in the analysis may supersede the infrastructure effects in some cases. The MIRAVEC tool estimates the average vehicle speed from the road geometry, the level of rutting, ride quality, the level of traffic and the split of heavy to light vehicles. In addition, a simple method for estimating the effect of idle time due to traffic congestion has been developed and implemented. It further enables users to estimate vehicle fuel consumption associated with a specific route and to explore the effects of various changes to the road infrastructure on the fuel consumption. This spreadsheet tool has been used to assess the potential benefits to be gained from making improvements to the infrastructure (i.e. the capacity for NRAs to provide energy reducing road infrastructure) by considering different scenarios and using statistical data available from national road networks.

Pilot studies

- Pilot studies in conjunction with selected NRAs to:
  - Test the functionality & usability of tools
  - Provide worked examples for guidance documents
- Risk assessment and CBA tool
  - Austria, Germany and Scotland
  - Asset data from NRAs uploaded
- Procurement tool
  - Norway, Sweden and the Netherlands
  - Information from interviews uploaded

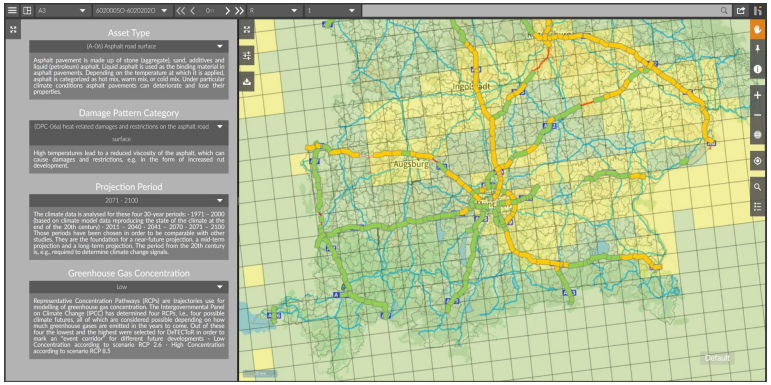


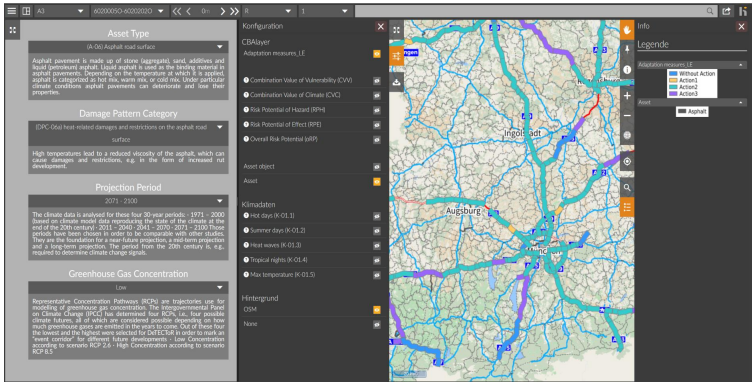
Guidance documents

- Each tool has accompanying guidance documents
- Economic guidance document
  - Section A – guidance on including climate change in economic appraisal
  - Section B – handbook for the DeTECToR CBA tool
- Procurement guidance document
  - Section A – guidance on including climate change in operations and procurement processes
  - Section B – handbook for DeTECToR procurement tool

Summary

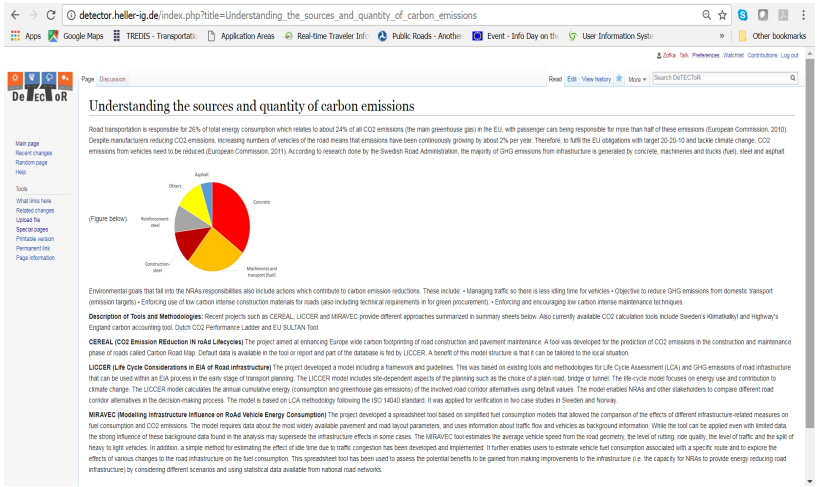
- Risk assessment and CBA tool
  - Provides an indication of risk to different types of climate hazard and how this is likely to change in the future
  - Network level assessment enables high risk road sections or assets to be identified
  - Enables the costs of different adaptation strategies to be compared
  - Uses asset data from NRAs and climate projection data
  - A flexible framework that can be tailored and developed by NRA to suit their network and priorities

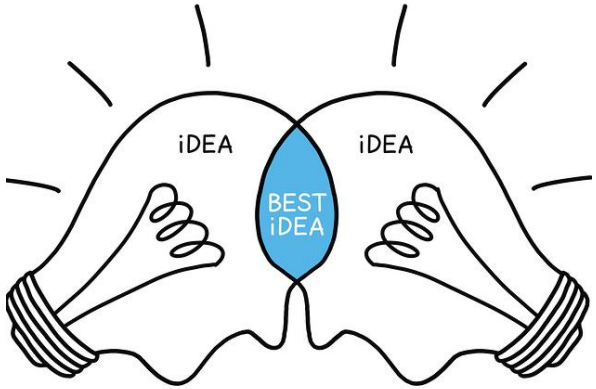




Summary

- Online collaboration platform for low carbon procurement
  - Provides information and case studies on different approaches to including climate change in procurement and operations
  - Wiki functionality allows NRAs to add and update content
  - Includes examples from the three pilot study countries
  - Repository of research project summary sheets





Thank you for listening

Any questions?

DeTECToR - Decision support tools for embedding climate change thinking on roads

http://detector.trl.co.uk/