
Climate Change Adaptation at European Railway Infrastructure Companies

Results of the UIC ARISCC project

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adaptation for international transport networks, UNECE

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GHG emissions and railways

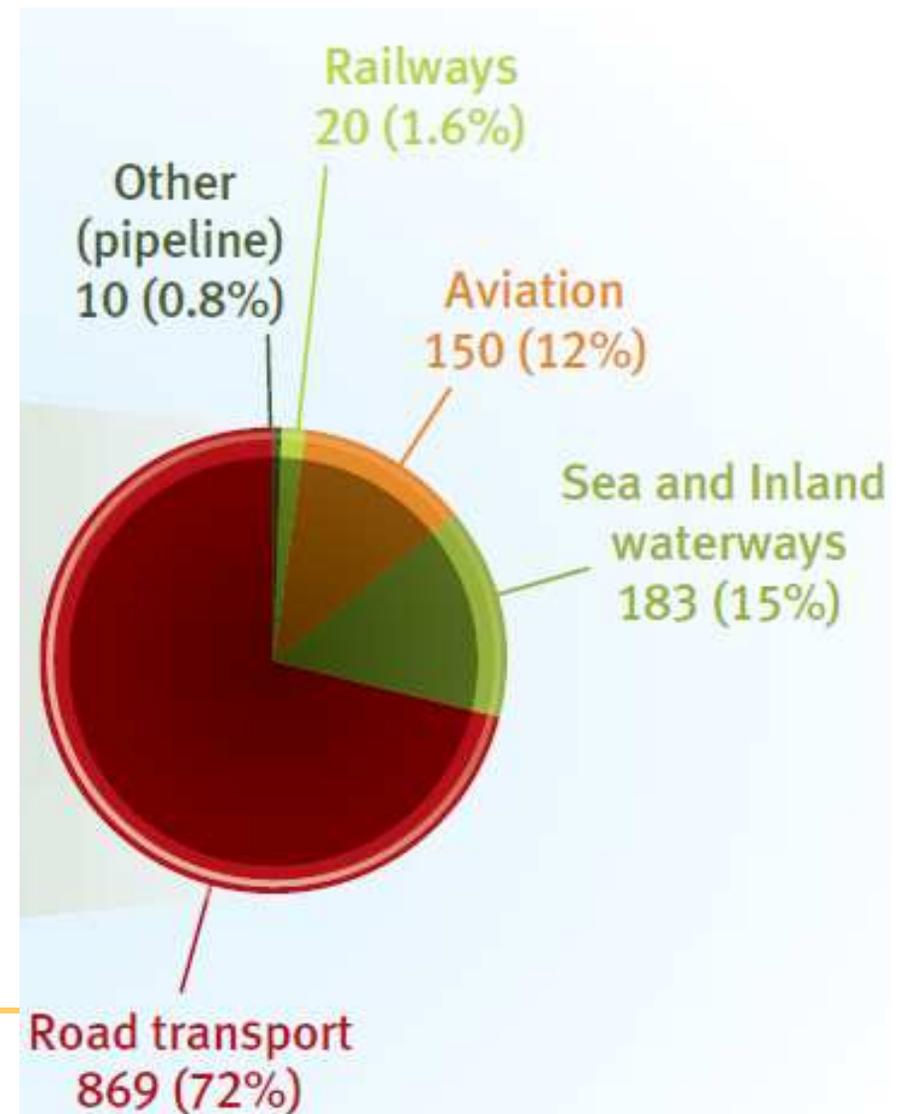
Railways as a „GHG efficient“ transport mode

- Status 2007, EU & EFTA, UIC
 - 1.6% CO₂ emissions of all transport
 - 6% of all pass., 10.3% of all freight
- Development 1990-2007
 - -27% in total CO₂ emissions
 - -11% (pass.) and -35% (freight) in specific CO₂ emissions

(UIC 2009, EU Comm. 2007)

- Outlook 2007-2030
 - -50% in specific CO₂ emissions

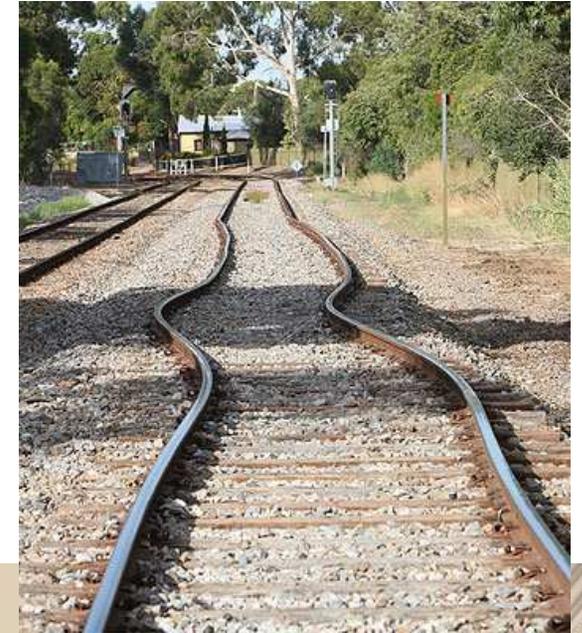
(UIC/CER Sustainability Strategy 2030)



*in million tons CO₂
UIC 2009, EU Comm. 2007*

Impacts of extreme weather events

Railway infrastructure is being affected by natural hazards and extreme weather events today...



.. and manages these events!



Picture sources: ÖBB, SBB, Daily Telegraph

Climate change adaptation – Starting point & drivers

- European railway infrastructure companies “feel”
 - that CC consequences are advancing rapidly &
 - the need to develop and implement appropriate strategies for CC adaptation and to exchange knowledge
 - Recent legislative/regulative demands (examples)
 - EU: White Paper on adapting to climate change
 - UK: Climate Change Act 2008: governmental power to require ‘bodies with functions of a public nature’ and ‘statutory undertakers’ to perform climate change risk assessment
 - Germany: Federal Railway Authority (EBA) included CC questions into environmental impact assessment (UVP) for new and renewed lines/tracks
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Railway infrastructure – Specificities

- Long life time of railway infrastructure and long investment and payback times
- Investment, upgrade and maintenance decisions have consequences for decades on routes and infrastructure subsystems
- Railway infrastructure as a critical infrastructure which has to provide transport services under all conditions



Expected impacts from climate change

Railways expect impacts of climate change and related weather events on their infrastructure and operation from changing weather patterns, return periods & intensity:

Factor	Effect	Impact on Railways/Assets
Temperature		
High temperatures and heat waves	overheating	infrastructure & rolling stock equipment
Sudden temperature changes	tension	track buckling
Intense sunlight	overheating	track buckling, slope fires, signaling problems
Precipitation		
Intense rainfall	soil erosion, land slides, flooding	damage to embankments, earthwork
Extended rain periods	slower drainage, soil erosion	other infrastructure assets, operation
Flooding: coastal, surface water, fluvial	landslides	drainage systems, tunnels, bridges
Drought	desiccation	earthworks desiccation
Wind		
Storm/gale (inland)	higher wind forces	damage to installations, catenary
	uprooting of trees	restrictions/disruption of train operation
Coastal storms & sea level raise	Coastal flooding	embankments, earthwork, operation
Lightning strikes & thunderstorms	Overvoltage	catenary and signaling
Vegetation	Faster plant growth, new plants	vegetation management

UIC ARISCC Project – A Europe-wide Collaboration

ARISCC project – Adaptation of Railway Infrastructure to Climate Change

- Funded by UIC International Union of Railways
- Project manager: DB Environment Centre
- Consultant: IZT Institute for Futures Studies and Technology Assessment, Berlin

Under changing climate conditions, railways have to answer the following questions:

- What are the potential impacts of climate change on your business?
 - What and where are your vulnerabilities?
 - What are the associated risks for safety & performance?
 - What adaptation measures and actions do you implement or have to implement?
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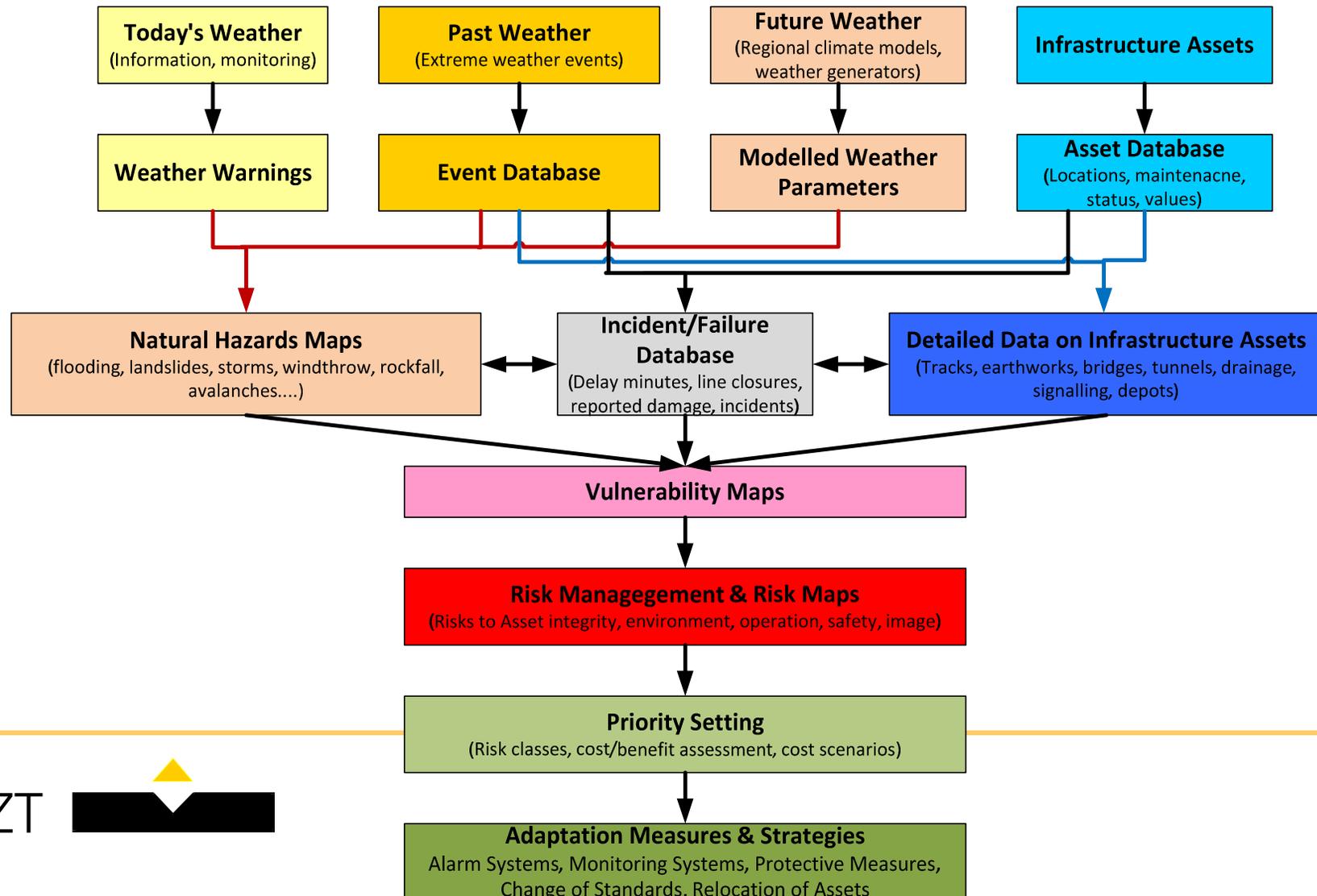
Adaptation measures – Approaches & Strategies

- **Today's consequences from extreme weather events and natural hazards as starting point**
 - **Compilation of impacts on infrastructure and operation**
 - **Asset management: knowing your company's infrastructure subsystems and structures (current status and location)**
- **Many measures and modules suitable and needed to cope with today's challenges!**
- **Information collection and assessment: patterns, tendencies, weak points and event spots, priorities etc.**
- **CC adaptation as a future oriented “brick” of an integrated natural hazards management!**
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Integrated Natural Hazards Management

Core question: which information are needed to cope with today's and future's challenges and impacts?



Insights from European Railway Infrastructure Companies

- **Some forerunner companies**
- **Raising awareness across all companies**
- **Different systems and tools in use to deal with today's natural hazards and extreme weather events**
 - **Please visit the website www.ariscc.org for a full collection of good practise examples**
- **Climate change seen as additional load to today's weather patterns**
- **Adaptation with and within existing tools and approaches**
- **Going back to „good standards of maintenance“**
- **Knowing your company's assets and their conditions**
- **Adaptation is less research but much more actions**



The way ahead..

- ARISCC Final Conference (beginning of 2012)
 - **We are happy if you attend..**
- ARISCC 2 ?
 - **Your collaboration is highly appreciated..**
- Spread of knowledge
 - **EU new member states ?**
- Adaptation of railways in more vulnerable regions
 - **South Africa (RSA)**
- ...



Thank you for your attention!

www.ariscc.org

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Mobility
Networks
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ProRail, InfraBel, SNCF/RFF,
Trafikverket, Liikennevirast



Commissioned by: The logo for UIC (Union Internationale des Chemins de Fer), featuring the letters 'UIC' in blue and green with a stylized red and blue swoosh.

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Climate Change Adaptation – An „Easy“ Example

Copenhagen-Ringsted line (DK, 2008)

- **Renewal of line for higher capacity**
- **Assessment of climate change induced additional loads: line robustness in the next 100 years**
- **Result: 20% more water from heavy rainfalls until 2100**
- **Solution: Building a drainage system with higher capacity than required by today's standards (+ 30%)**



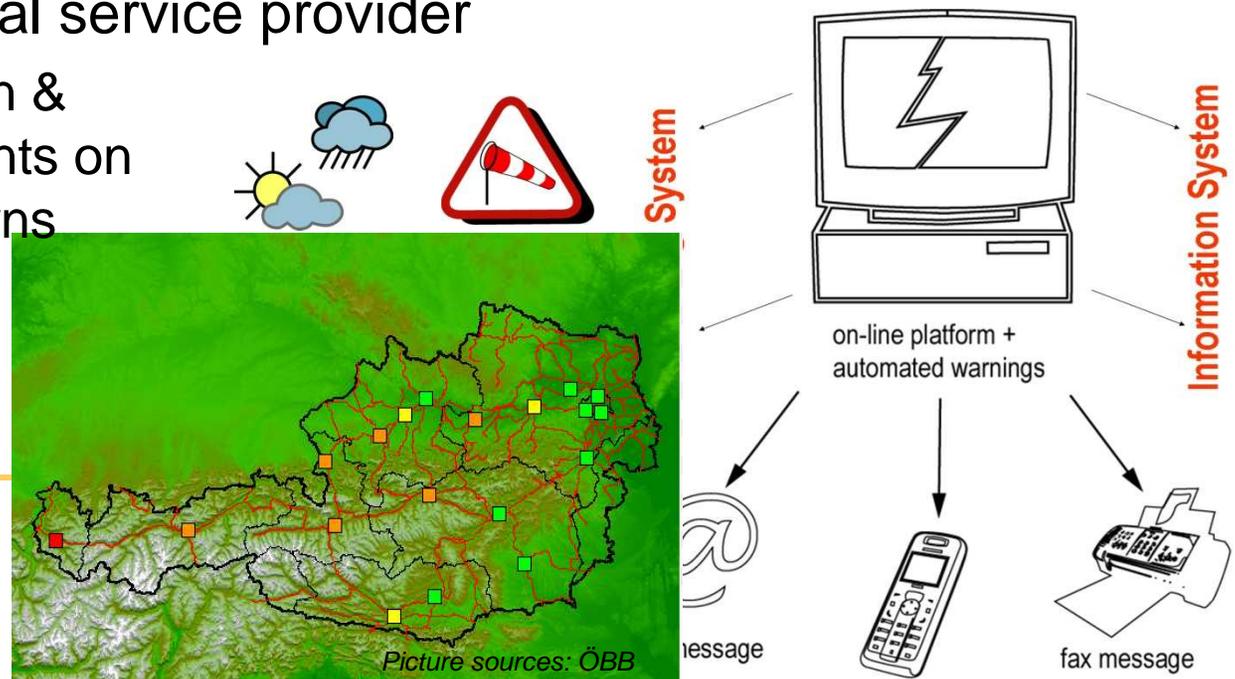
Foto: klimatilpasning.dk

Today's impacts: systems in use – Weather monitoring

INFRA.wetter, ÖBB Infrastruktur

- Online real-time weather monitoring and weather warning
 - Precipitation/rain, thunderstorms, snow, (high water/floods)
- Overlay with GIS data of railway network/ infrastructure
- Automatic warnings before/ during extreme weather
- Additional, railway-own meteorological stations
- External meteorological service provider

Adaptation: data collection & assessment of past events on changing weather patterns & return periods + future weather from regional climate models → adapt warning levels and thresholds



Today's impacts: systems in use – Event maps & data

Example of event maps from SBB Infrastruktur

- Compilation and overlay of natural hazard events and resulting impacts on railway operation and infrastructure
- Identification of weak spots and accumulations of events
- Prioritisation and introduction/ update of protective measures and processes (e.g. monitoring)

Adaptation: assessment of natural hazards impacts and intensity under changing climate conditions
→ upgrade of infrastructure/ protective measures, intensified monitoring

