# Workshop: Intersections Between Resilience and Risk

Transport and Critical Infrastructures – Risk and resilience for railways in a changing climate

By Simon Hodgkinson (University of Birmingham)

## What does Resilience mean to you?

**Resilience** is defined as the ability of a rail organisation to provide services effectively and sustainably as the climate changes. This includes elements of

- **Robustness** - the ability to resist disruption
- **Redundancy** - the ability to use backup facilities to provide service during disruption
- **Recovery** - the ability to rapidly return to service after disruption

## Key Resilience Research Challenges

- Dealing with uncertainty in future projections (i.e. climate, infrastructure, socioeconomic)
- Raising awareness of climate risks/resilience
- Providing organisations with the knowledge/tools to pro-actively adapt
- Considering the railway as part of a wider socio-technical system
- Comprehensive risk assessments = hazard * vulnerability * consequence
- Prioritisation of resilience interventions and efficient resource allocation

## Your Current Research Focus

- Developing a framework for railway adaptation to climate change internationally
- Developing an infrastructure criticality assessment methodology (single points of failure) – decision support
- Evaluating metrics of system failure consequence
- Exploring infrastructure interdependencies and cascade failure risk

## What would “good” look like?

A transport system in which the world’s railways have acquired the **flexibility** to **intelligently** adjust to climate change, thereby providing their economies and societies with **reliable** and **cost-efficient** transportation services.

Risk and resilience assessment should **not involve a ‘special project’** or new undertaking for rail organisations but instead be **integrated with business as usual**.

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## Perceived Barriers?

- Lack of awareness or willingness to respond to climate change
- Lack of capacity or expertise within an organisation
- Absence of executive level leadership
- Business Case – planning horizons and foresight?
- Silo-thinking & lack of cooperation (departments/organisations)
- Issues with metrics and "perverse incentives"
- Failure to recognise system "externalities"

## What are the consequences - Risks?

- No adaptation or maladaptation
- Only reacting to extreme events – fail to prepare, prepare to fail…
- Performance degradation – system failure
- Reputational damage to rail industry
- Expertise & knowledge in disparate parts of an organisation
- Inefficient resource allocation
- Failure to recognise full spectrum of "systemic" vulnerabilities

## Envisaged Breakthroughs Required

- Promotion of climate change risks in wider risk registers
- Changes to asset investment criteria – whole-life costs/benefits
- Detailed mapping of infrastructure interdependencies and identification of "failure pathways"
- Multi-modal and multi-infrastructure risk assessments
- Resource allocation based on localised performance risk

## Who needs to do what?

- Government and transport ministry leadership for adaptation
- Champions of adaptation within rail organisations
- Response and recovery plans – restore assets, maintain service
- Adapt infrastructure and operations - railway system adaptation
- Communication channels with stakeholders
- Local-scale risk assessments for local level interventions
- Collaboration on cross-network risks - interdependent infrastructures

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# Risk and resilience for railways in a changing climate
## KEY PROJECTS

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Tomorrow's Railway and Climate Change Adaptation

RSSB

MOWE-IT
MANAGEMENT OF **WEATHER** EVENTS IN THE **TRANSPORT** SYSTEM

NERC
SCIENCE OF THE ENVIRONMENT

Environmental Risks to Infrastructure Innovation Programme (ERIIP) - *Weather-induced single point of failure assessment methodology for railways*

RAILADAPT

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# Birmingham Centre for Railway Research and Education

- Climate change and weather impacts
- Railway Control & Operations simulation
- Data integration and cybersecurity
- Condition monitoring & sensing
- Power systems & energy use
- Aerodynamics
- Benchmarking
- Computational modelling
- Geotechnical engineering & asset management

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