Adaptation research and system approaches in the UK

UIC Sustainability Conference
Venice October 2012
John Dora
Nick Stern (now Lord Stern, former Chief Economist at the World Bank)

‘Economics of Climate Change’ Review, 2006

“The scientific evidence is now overwhelming: climate change presents very serious global risks, and it demands an urgent global response…What we do [in mitigation] now can have only a limited effect on the climate over the next 40 or 50 years. On the other hand what we do in the next 10 or 20 years can have a profound effect on the climate in the second half of this century and in the next…”

“From all of [the report’s] perspectives, the evidence gathered by the Review leads to a simple conclusion: The benefits of strong, early [adaptation] action on climate change outweigh the costs…”

This led to the UK Government’s Climate Change Act 2008, requiring:

- A 5 yearly Climate Change Risk Assessments - first published 2012
- A National Adaptation Plan (a ‘work in progress’) 
- Organisations to report on their adaptation to climate change
Climate change impacts

Summer temperatures

Sea level rise...

Global average temperature 1850-2009
2000s warmest decade
Rail CCA studies – T925 TRaCCA

- TRaCCA study initiated 2009

  (Tomorrow’s Railway and Climate Change Adaptation (funded by RSSB, with NR contribution in kind including staff project management and data retrieval time))

- T925 aimed to provide tools and knowledge to improve the reliability for the railway network – solutions not problems

- UK Met Office Hadley Centre expertise

- Medium ‘Carbon Emissions’ scenario taken

- A prioritisation and scoping exercise to meet statutory reporting deadlines and aligned to CP5 work
  - covering 2020s, 2030s, 2040s

- Detailed climate impact analyses on the selected priorities
What we’ve learned – Headlines

- A marked difference in climate north/south is likely
- An increase in the number of days required to monitor track buckling and an increase in the frequency of speed restrictions as a result
- Cold winters will become increasingly rare
- Track buckle risks increase
  - Following today’s processes means reduced System Reliability
  - Major floods become 6x more frequent by 2080s
- Uncertain as to how wind, humidity, weather variability will change
- Adaptation activity can foster wider benefits
- A Whole Life, Whole System approach can bring more benefits, more efficient delivery

Heat related non-work days – 2040s
What we’ve learned – Headlines

- **A reduction in productivity for maintenance workers**, due to heat stress
- A small projected increase in **sag of overhead line equipment**
- An increase of **passenger heat stress**
- **Increased river and localised flooding** leading to scour and flooding of bridges, embankment scour, culvert washout, depot flooding and track and lineside equipment failure
- **Sea level rises and storm surge increases** requiring improved railway flood defences
- Electronics are susceptible to rapid change in Temperature (Humidity?)
- Data, Science need geared to Resilience Building
Future Skewed Distribution: evidence that by 2040s higher temperatures will be more common but absolute might still be similar to now
Climate change and adaptation modelling is an enabler for prioritised, targeted investment.

Asset lifecycle important, System-wide approach important.
- Adapt at equipment renewal stage = a low cost high impact strategy.
- Investment in adaptation can improve current railway resilience and system reliability.

Forecasting system example: RSSB *T643 Impacts of climate change on coastal rail infrastructure*.
- Led to 36 hour sea state forecasts.

Differentiated standards can reduce costs.
Authorised June 2012

Budget: £2.0M for Foundation projects for 2 years within a 5 Year Timeline

Size of problem in excess of £4.6Bn over 30 years

Whole Industry, whole System Approach

11 Work Packages

The work is sponsored by RSSB’s Research Programme
Foundation Deliverables include:

- A Knowledge review and gap assessment
- An Overseas analogy study
- Assessing GIS-based evaluations of vulnerability
- System and sub-system modelling/vulnerability tool feasibility studies
- A Change management programme
- An evaluation of metrics
- A study into the economics of the benefits of adaptation
- A review of priorities
Further Deliverables – 3 to 5 years time

- An holistic rail system vulnerability tool
  - A tool to support information on climate vulnerability and adaptation/resilience actions at entire railway system level

- Sub-system vulnerability tools
  - A tool to support information on climate vulnerability and adaptation/resilience actions for railway sub-systems e.g. rolling stock

- Decision support tools for local/policy managers
  - A set of DSTs to help local managers select appropriate local adaptation/resilience actions
To consider..

**Resilience** against a legacy of 180 years of railway infrastructure assets:

- Bridges, Embankments, Tunnels, Coastal, Drainage etc
- Interactions with assets having different life-cycles and technology eg: ‘short[er] life’ assets:
  - Power, Signalling, Telecoms, Track
- Existing ‘System of Systems?’
  - What about the ‘interfaces’? Who owns these? How many?
It's not just Transport in isolation!

WHO OWNS THE INTERFACES?
COMPATIBILITY?

Interdependencies and Interfaces

Demand

Energy

Transport

Waste

Water

ICT

Critical Communications

Demand Management

Energy Supply

Demand

Demand

Demand

Demand

Demand
Use of GIS Platforms to aid System Modelling

Flooding analyses have ‘shown the way’
  - River and surface flood maps

Will prove concept of making use of digital elevation mapping, urban heat island mapping technology and weather forecasting for:
  - Heat and equipment
  - Wind
  - Humidity

Technology and Engineering exists – it needs harnessed

Economic and Financial Models need Innovation!
Conclusions

- GB Rail has undertaken research into climate change impacts up to 2050
- Positive benefits identified in System Resilience
- Improvements are needed in data and science and out to 2100
- Wider research programme funded (T1009) to build on T925 TRaCCA
  - 2 years’ Foundation projects in a 5 year programme
  - Much research external to Rail in progress and will be utilised
- Thinking long-term:
  - A Whole Life, Whole Systems Approach
  - Legacy Assets Important
- Engineering Solutions are at heart of Adaptation - *Economists need to catch up*...!
THANK YOU
Links

RSSB Research:  www.rssb.co.uk ; http://www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/Research/T643_rb_final.pdf

TRaCCA:  www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/Research/T925_rpt_phase3.pdf


UK Government Adaptation Reports:  www.defra.gov.uk/environment/climate/adapting

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