CLIMATE CHANGE ADAPTATION
Assessing Vulnerabilities

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Presentation

- Network Rail
- Adaptation Drivers
- Funding
- TRaCCA Phase 1 Prioritisation
- Output
- Current Position
- Learning
- Conclusions

Network Rail Portfolio

31,000 km track	¾ Earth's Circumference
12,000 km electrified railway	2/3 Overhead line – 1/3 third rail
43,000 bridges	Largest single bridge owner in UK
700 tunnels	200 miles of railway in tunnel
23,000 culverts	250 miles of subterranean water courses
300 coastal and estuarine defences	150 miles of coastal railway
2500 stations	Large property portfolio
25,000 km of major earthworks	Twice the length of UK's entire motorway and trunk road network
Operating interface	24 Passenger Train companies

"Maintain, enhance and renew the existing network" (ORR) …. regulatory framework and timescales

Context

- Network Rail is a not for dividend company that owns and operates Britain's rail infrastructure.
- Its mission is to provide a safe, reliable and efficient railway fit for the 21st century
- Network Rail operates under a Network Licence which sets out the conditions under which it must operate
- One specific obligation for Network Rail is to have asset management policies and criteria to maintain, renew, replace, enhance and develop the assets

Adaptation Drivers

- Weather and reliability
  - Annual Report 2010 www.networkrail.co.uk/epdf/default.aspx/annual-report-and-accounts-2010
    - Winter 2009/10 cost NR £40M
  - 2007 floods cost NR £36M
  - Major floods occur every year, somewhere
- Government requirement www.defra.gov.uk/climate/legislation
  - Climate Change Act 2008
  - Reporting Power

Sourcing Funds

Tomorrow's **R**ailway and **C**limate **C**hange **A**daptation project (TRaCCA)

- Three phases:
  1. Establish priorities
  2. Develop and test models
  3. Establish climate change impacts for whole GB system
- Industry-wide issue
- Government role - TSAG authority
- RSSB funds
- Network Rail contracted to deliver TRaCCA

Phase 1 Priorities

Where to start?

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Whom to ask?

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Where to start?

Whom to ask?

How to categorise?

Phase 1 Priorities

Where to start?

Whom to ask?

How to categorise?

Grouping by Assets and Systems?

Experts' workshops?

Risk Assessment

Seven workshops:

Track

Civils and Buildings

Signalling, Power, Communications

Operations and Train Companies

Maintenance

Renewals

Systems

Risk Assessment

Seven workshops:

Track

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Systems

Experts from Network Rail, RSSB and ATOC invited

Outputs expected – Key Risks to Safety and Performance

Workshop format

1. Met Office presentation – 1½ hours
    - Set out key Assumptions:
        - 2020s – 2040s
        - 2009/10 traffic and asset policies
    - To inform the experts about:
        - Climate Science
        - UKCP09 Projections
        - Likely changes in UK climate
        - Implications for weather

Workshop format

2. General discussion
    - Relevance to Rail
    - Impacts on asset or system
3. Detailed discussion
    - Potential risks identified and listed
    - Categorised
        - H – M – L for Safety, Performance,
        - Climate change increasing or decreasing the risks
        - Data availability

Workshop outputs

4. Results collated into one spreadsheet from all Workshops

Climate Impact Group	Risk[1]	Safety Impact	Performance impact	Impact from Climate Change?
Heat	Air conditioning failure in carriages	Low	Medium	High
Heat	Track buckling	High	High	High
Heat	Speed restrictions due to buckle risk	Low	High	High
Heat	Use of heat watchmen for buckle risk	Medium	High	High
Heat	Floating electrical earth caused by a low water level	High	High	High
Heat	Reduced window of opportunity for work – renewal and maintenance - due to heat restrictions on track	Low	Medium	High
Heat	Reduction in track quality due to less maintenance	Low	Medium	High
Heat	Staff working conditions in hot weather	High	High	High
Heat	Earthworks desiccation	Low	Medium	High
Heat	Effect of heat on swing bridges	Low	Low	High
Heat	Contact wire sagging at terminal stations	Low	High	High
Heat	Solar gain affecting lineside equipment: Signalling, Power, Telecoms	Med	High	High
Heat	Reduced transformer life	Low	Low	High
Increased rainfall	Increased flooding generally	Low	High	High
Increased rainfall	Flooding at stations	Low	Medium	High
Increased rainfall	Flooding at depots	Low	Medium	High
Increased rainfall	Flooding affecting plant and equipment rooms	High	High	High
Increased rainfall	Flooding caused by poor drainage and high water levels	Low	High	High
Increased rainfall	Flooding at bridges – scour/ pressure/ obstruction damage	high	High	High
Increased	Flooding in tunnels	Low	Medium	High

Outputs' analysis

5. Then ranked according to Safety, Performance and Climate impacts:

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Outputs' verifications

6. Need for Verification of the results:

   - Results circulated among the workshop attendees and other senior engineers
   - Verified that our vulnerability identification process was robust

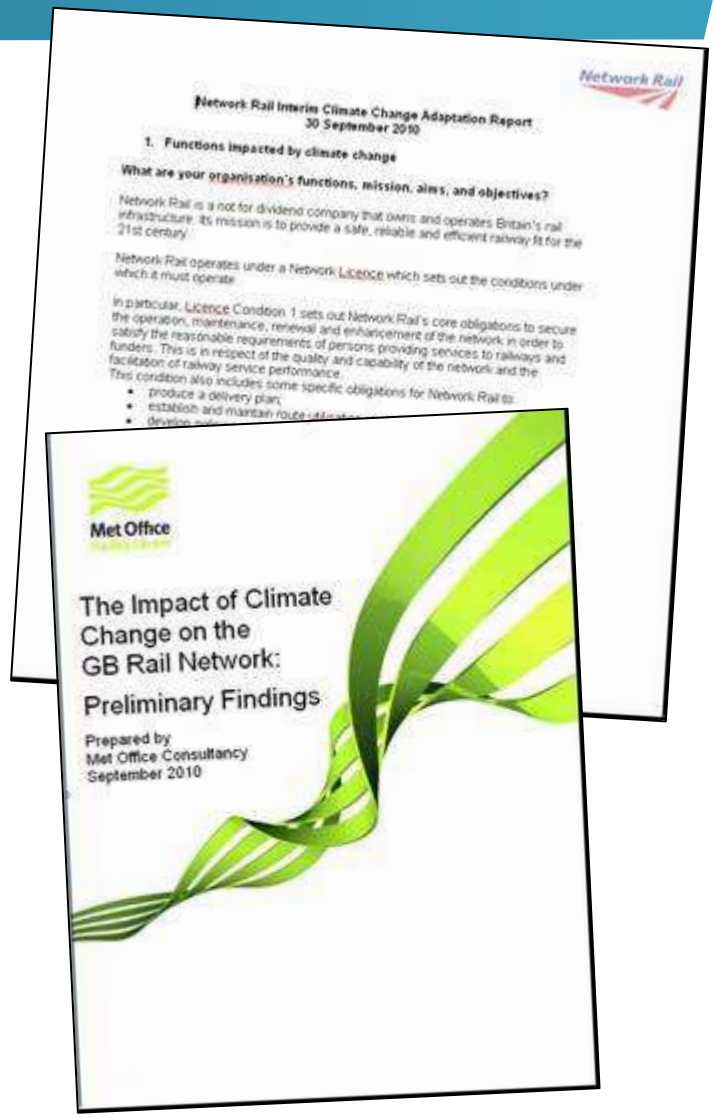
This resulted in some additions and deletions…and agreement that processes as well as vulnerabilities were as important

Vulnerability Output

Cluster	Vulnerability topic for further analyses
Track	Management of track buckle risk
Track	Reduced window of opportunity to carry out maintenance/ renewals work due to heat
People	Passenger health from train failure in extreme temperatures, including heat and cold
People	Impact on freight from train failure in extreme temperatures, including heat and cold
People	Staff working conditions, eg: use of heat watchmen
Power/ Signalling/ Telecomms	Sag in overhead line systems
Power/ Signalling/ Telecomms	Heat affecting lineside equipment; specifically signalling and telecoms equipment
Fluvial flood	Track and lineside equipment Failure
Groundwater flood	Track and lineside equipment Failure
Pluvial flood	Track and lineside equipment Failure
Fluvial flood	Scour and water effects at bridges
Fluvial flood	Scour at embankments due to high river levels and culvert washout
Fluvial flood	Safety of workforce carrying out inspections during an extreme flood event
Pluvial flood	Landslips
Fluvial flood	Accessibility of fleet and of maintenance depots
Vegetation	Change in type, poor adhesion, and track-circuit non-activation
Vegetation	Falling trees causing obstructions
Coastal and estuarine defences	Wave overtopping and flooding at defended coastal and estuarine railways

Current position

- Able to model only at low resolution
- Correlation and modelling of impacts not always possible
- ‘Delay Minutes’ used, as well as thresholds from Standards
- High-level overview delivered to Government
- Preliminary findings from Met Office
- Detailed outputs due February 2011 for whole network



Learning points

- Database consistency across ‘silos’
  - Example: Drainage requires *consistent asset* register but is managed in more than one department
- Delays measured nationally for some years
  - Line closures not!
- Prime purpose of databases is not *weather management*
- Little in way of weather/ asset behaviour correlation

Conclusions

- Much work is in progress
- Much data has been sourced
- Science is good in some areas
- Modelling can use scenarios as well as asset/ performance data
- Challenges include use of data gathered for other purposes
- We're learning that we can plan for when decisions are needed
- System resilience *now* is important!

……..there's a lot yet to do

See http://www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/Research/T925_rpt_phase1.pdf