

*Climate Change Adaptation and  
Transport – UK and Rail*

*John Dora*

*UNECE Expert Group November 2011*

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# *The talk...*

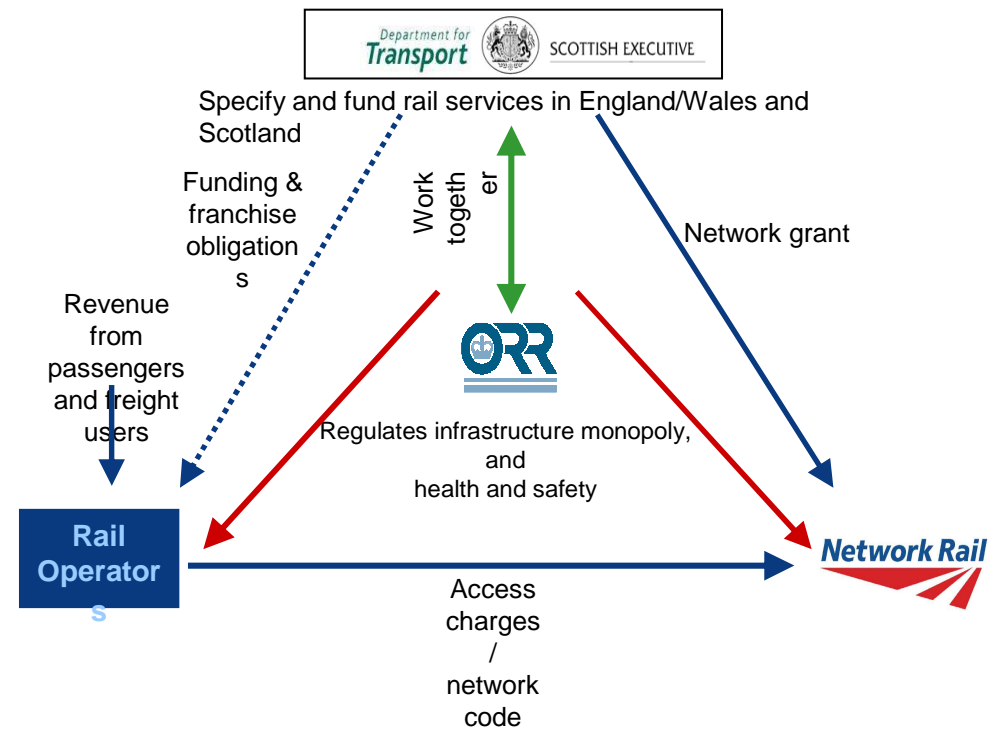
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- Network Rail in UK context
- UK Government context
- Rail context
- CCA NR engagement
- Rail CCA studies – TRaCCA
- Going forward

*Hyperlinks are shown at the end of the presentation*

# Network Rail in the UK

- Network Rail in UK
    - GB Rail Infrastructure owner
    - Regulated
    - 5-year Control Periods
    - 30-year Technical Strategy
- Currently working towards CP5 (2014 -2019)



# *Infrastructure portfolio*

**31,000 km track**

$\frac{3}{4}$  Earth's Circumference

**12,000 km electrified railway**

$\frac{2}{3}$  Overhead line –  $\frac{1}{3}$  third rail

**38,000 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

*“Maintain, enhance and renew the existing network” (GB Rail Regulator)*

## *Government context*

- Nick Stern 'Economics of Climate Change' report, 2006
- Climate Change Act 2008 requires:
  - 5 yearly *Climate Change Risk Assessments*
  - National Adaptation Plan (both 'work in progress')
- Act has a Power to require organisations to report on Adaptation
- Power invoked on Network Rail early 2010
  - Over 90 organisations reporting

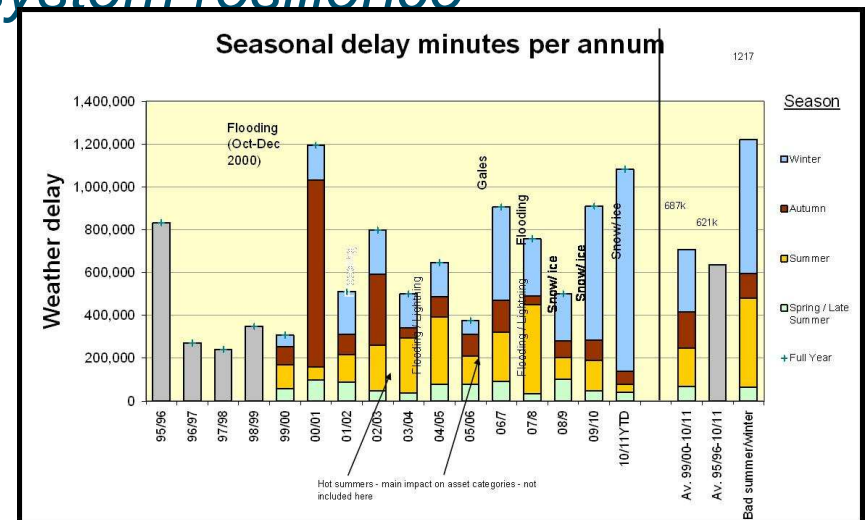
# Rail context

- Past studies by GB Rail (RSSB, NR), and the Environment Agency show ‘business as usual’ is not an option
- Flooding costs £50M pa – this could be £500M by 2040s
- The rail industry appetite for:
  - a safe, affordable and highly reliable railway with increased capacity – better *system resilience*

– Now and into long term

- TRaCCA\* study initiated

\*Tomorrow’s Railway and Climate Change Adaptation



# *CCA – NR engagement*

## **Government**

- Adaptation Report
- Climate Change Risk Assessment
- National Adaptation Plan
- UKCIP and Environment Agency

## **Network Rail**

- Weather resilience, Climate resilience
- Reorganisation – Systems

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# *CCA engagement*

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## **Industry**

- CP5 - Business Plan for Rail includes CCA provision
- Rail Research and Adaptation Network
  - R&D Projects' synergies, incl. FP7
- TRaCCA

## **International activity**

- CER
- UIC
- UNFCCC

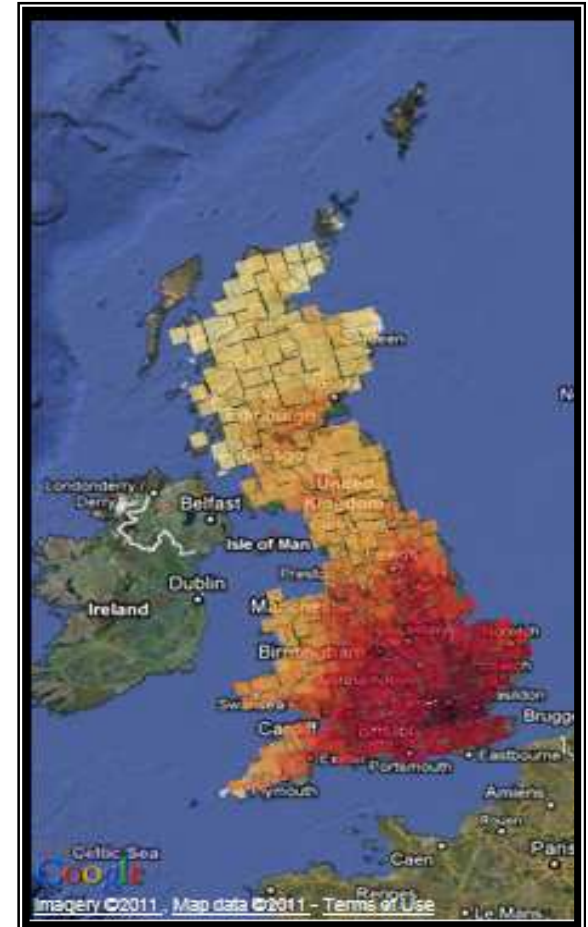


## *Rail CCA studies - TRaCCA*

- TRaCCA aimed to provide tools and knowledge to improve the reliability for the railway network – **solutions not problems**
- Phase 1 sanctioned by Rail Research Leadership group (TSAG) in November 2009:
  - UK Met Office Hadley Centre expertise
  - a prioritisation and scoping exercise to meet statutory reporting deadlines and aligned to CP5 work
  - covering 2020s, 2030s, 2040s
- Continued funding agreed May 2010 for Phases 2 and 3 for:
  - detailed climate impact analyses on the selected priorities

## What we've learned – some Headlines

- A marked difference in climate north/south is likely
- Cold winters will become increasingly rare
- Track buckle risks increase
  - Today's processes mean reduced System Reliability
- NR budget for c500,000 minutes for weather-related delays pa = £37M
- Adaptation has wider benefits



Heat related non-work days – 2040s

## *Learning points*

- TRaCCA is a *unique amalgam* of MO Hadley Centre Science with Rail expertise
- Infrastructure life-cycle important – what will be affected?
- Timing for Adaptation Action - £70M identified for CP5....
- Heightened level of awareness in Rail regarding weather resilience now, and adaptation investment for longer term resilience
- Much interest wider than Rail
- Research is key
- Technical solutions approach is good – think ‘how do we fix this’

## *Some 'Positives'*

- Investment in adaptation measures can improve railway *system* resilience and *system* reliability
  - Investment can be prioritised - phased at Asset Renewal
- Differentiated standards can reduce costs
- Climate change and adaptation modelling can help to prioritise and target investment to the right place
  - Engineering solutions, Forecasting tools

(Example: RSSB study *T643 Impact of climate change on coastal rail infrastructure*)

## *Some limitations*

- Engagement at outset was patchy
- TRaCCA worked to timescales set by Government - this limited the scope
- The available data were not ideally suited to modelling:
  - Delay minutes developed for *delay attribution*
  - Rolling stock, human factors – no data
- There are limits to what current science can predict:
  - cf: wind, humidity, urban heat island

# Visualisation tool

TRaCCA4Rail - Windows Internet Explorer

http://www.metoffice.gov.uk/premium/discoverclimate/tracca4rail/?PlanetDirectoryPro=AQIC5wM2LY45fCxenz6gTYswcTq4vuxX7NW\_-nYoE9ONps,\*AAJT5QACMDMAAIMxAAIw

File Edit View Favorites Tools Help

★ Favorites TRaCCA4Rail

## The impact of climate change on the GB rail network

TRaCCA4Rail

Opacity: 0.7

Range of Model Outcomes Time: 2040

Min Mean Max: future 2040s max

Super User My Account Logout

- Home
- Track buckling
- Track maintenance
- Overhead line sag
- Heat stress
- Passenger and freight risk from extreme weather
- Fluvial flooding
- Pluvial flooding
- Trees on the lineside
- Help

Zoom and pan using the map tools at the top left of the left-hand map. The right-hand map will update automatically. For more help, see the "Help" menu.

Map data ©2011, Map data ©2011 - Terms of Use

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No. of heat-related 'non-work' days

Legend: 0, 200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000, 2200

### Track maintenance » Heat-related "non-work" days

The maps show the modelled number of heat-related "non-work" days (days when the daily maximum temperature of 21°C or above was reached, each time a daily maximum temperature of 25°C was met or exceeded, the prior three days were also counted as "non-work" days, even if daily maximum temperatures did not exceed 21°C on those days).

Time periods are as follows:

- Baseline period: thirty-year period from 1971-2000
- 2020s: thirty-year period from 2010-2039
- 2030s: thirty-year period from 2030-2049
- 2040s: thirty-year period from 2030-2059

These results are based on climate change projected by the Met Office's Regional Climate Model, driven by the UKCP09 medium emissions scenario.

The maps show that in the baseline period, the number of heat-related "non-work" days is greatest in the South and East of Great Britain which is consistent with the warmest conditions that are currently experienced across these regions. In the future, the occurrence of such events is projected to increase across most of the country, and to remain most frequent across southeastern areas.

<http://www.metoffice.gov.uk/premium/discoverclimate/tracca4rail/>

Internet 75%

start Presentations TRaCCA Workshop ... TRaCCA TSLG Sept... Sent Items - Micros... RE: Weather Data ... TRaCCA4Rail - Win... EN 14:41

## *Interest in TRaCCA*

### **Government**

- DfT, Transport Scotland, Defra, SEPA
- Infrastructure UK

### **Academia**

- Oxford University (ITRC)
- Birmingham University (Futurenet)

### **Infrastructure Owners**

- TfL, National Grid, EA

### **International**

- UIC
- OeBB, DB, SNCF
- United Nations

### **Network Rail:**

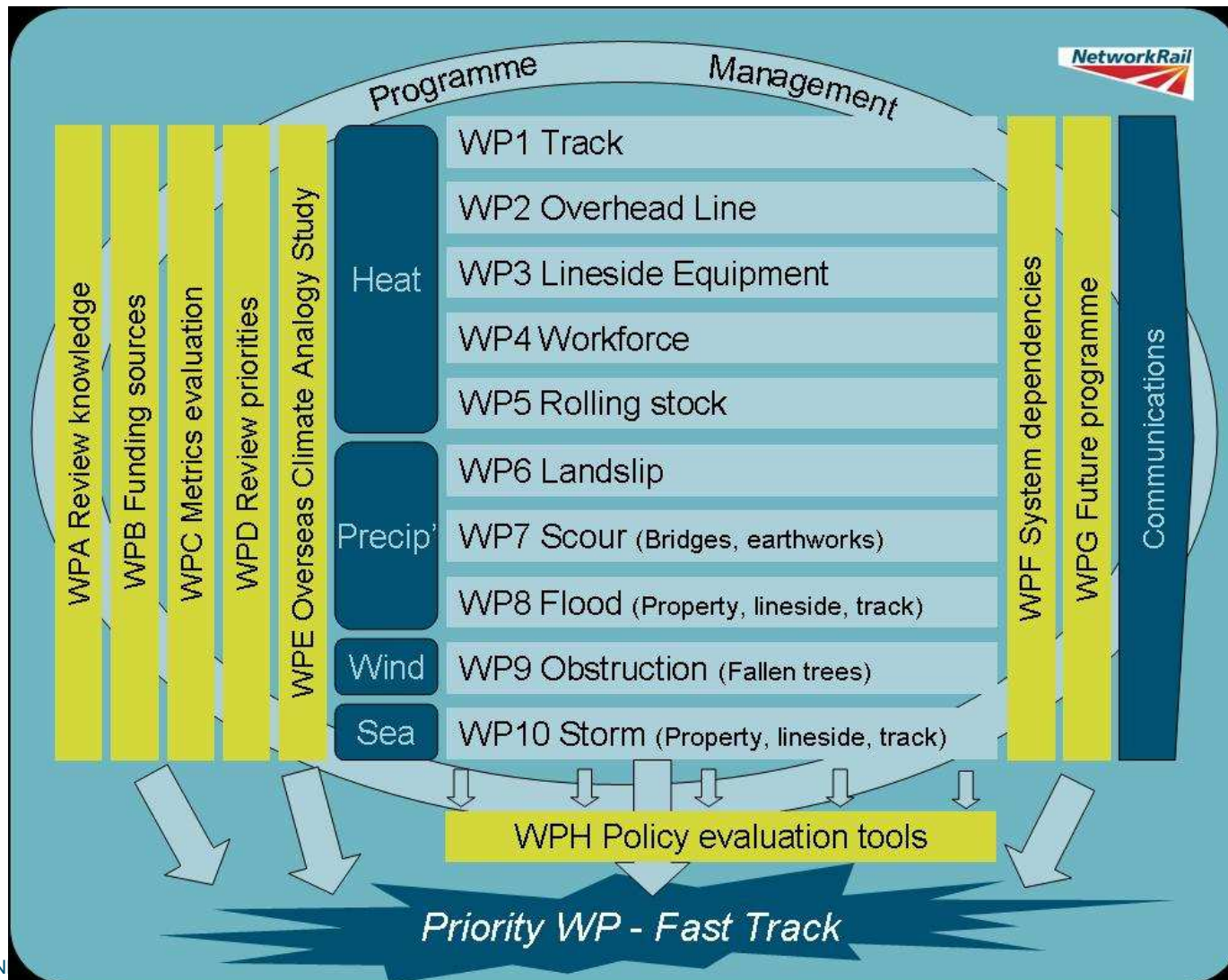
- IIP/ SBP CP5 Strategy
- Systems Engineering
- Systems Analysts
- Reliability Team

## *Going forward...*

- TRaCCA was a defined *project* and has led the way
- Many benefits in being more ambitious:
  - Broader scope (in terms of participation, activities and time, with a *systems approach*)
  - Build on external R&D and Science
  - Improvement the data/ invent new metrics
  - ‘Fast-track’ packages to bring early benefits (especially in ‘local weather management’)
  - Bring other countries’ experiences **now** to help show the **future for the UK** and vice-versa



# Current proposal



Estimated Cost to Rail: £5M

Timeline: 5 Years

Expect UK Research to match funding – £10M possible

# Links

Network Rail: [www.networkrail.co.uk](http://www.networkrail.co.uk)

Rail Industry CP5 Plan: [www.networkrail.co.uk/iip.aspx](http://www.networkrail.co.uk/iip.aspx) <C:\Documents and Settings\Jdora\Local Settings\Temp\wz4c20\Buckled track.jpg>

RSSB Research: [www.rssb.co.uk/RESEARCH/Pages/main.aspx](http://www.rssb.co.uk/RESEARCH/Pages/main.aspx);  
[www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/Research/T643\\_rb\\_final.pdf](http://www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/Research/T643_rb_final.pdf)

TRaCCA: [www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/Research/T925\\_rb\\_final.pdf](http://www.rssb.co.uk/SiteCollectionDocuments/pdf/reports/Research/T925_rb_final.pdf)

Adaptation and Resilience Research [www.ukcip-arcc.org.uk/](http://www.ukcip-arcc.org.uk/); [www.arcc-futurenet.org](http://www.arcc-futurenet.org);  
[www.itrc.org.uk](http://www.itrc.org.uk)

UK Government Adaptation Reports: [www.defra.gov.uk/environment/climate/adapting](http://www.defra.gov.uk/environment/climate/adapting)

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# Problems??



# Some solutions!

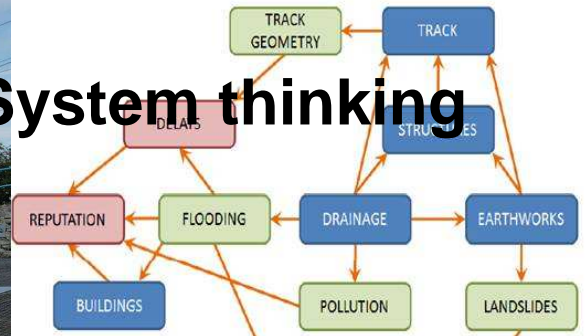


New Drainage

29/10/2010



Remediated Bank



System thinking



Targetted weather forecasts



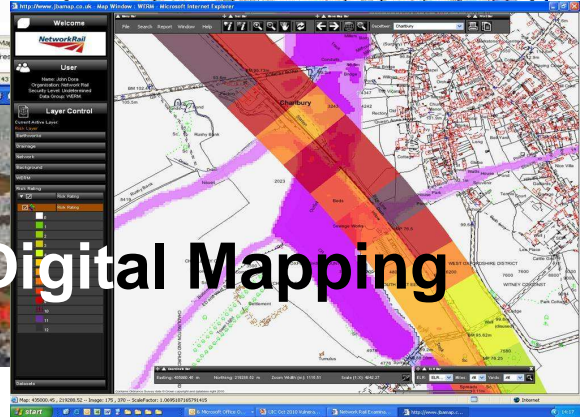
Flood monitoring



Emergency kit



Reconstructed hillside



Digital Mapping

*Last slide.*

**THANK YOU**