

'2012 - a year of dramatic contrast'

UK Met Office

iSmart February 2014

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...and not just 2012!!

Met Office 2012 Summary ²

- The UK annual rainfall total was 1335 mm (116% of average), the second highest in the series from 1910, narrowly beaten by 2000 (1337 mm). England had its wettest year in the series. 2012 was the third wettest year in the England and Wales series from 1766, behind 1872 and 1768. Many locations from the south-west to the north-east received over 135%, with northern Scotland and the west of Northern Ireland the drier exceptions. **The year began with ongoing concerns over long-term drought** heightened by a relatively dry January to March, but the situation was then transformed by the **wettest April and June in the England and Wales series from 1766**, while **summer (June, July, August) was the wettest since 1912**. Rainfall totals for autumn and December remained well above average, and a succession of **rain events in late November and late December contributed to extensive disruption from flooding**.

- 99% average sunshine!



Introduction to Network Rail

Iconic Victorian Structures

- 💧 Forth Bridge- complete 1890
- 💧 St Pancras Station – opened 1868
- 💧 Kings Cross Station – opened 1852
- 💧 Potters Bar Tunnel & Earthworks – 1850 seen during widening works



Images courtesy NR and others

Network Rail Infrastructure

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 slope Km of major earthworks

Twice the length of UK's entire motorway and trunk road network

7,000 Km Drainage incl. 155,000 Catchpits

Recent Drainage Stats

"Maintain, enhance and renew the existing network" (Office of Rail Regulation)

Network Rail Infrastructure

- 💧 25,000 slope Km of major earthworks
- 💧 7,000 Km Drainage
- 💧 155,000 Catchpits
- 💧 Long life assets
..and they'll be there a long time too..
- 💧 Consider History....

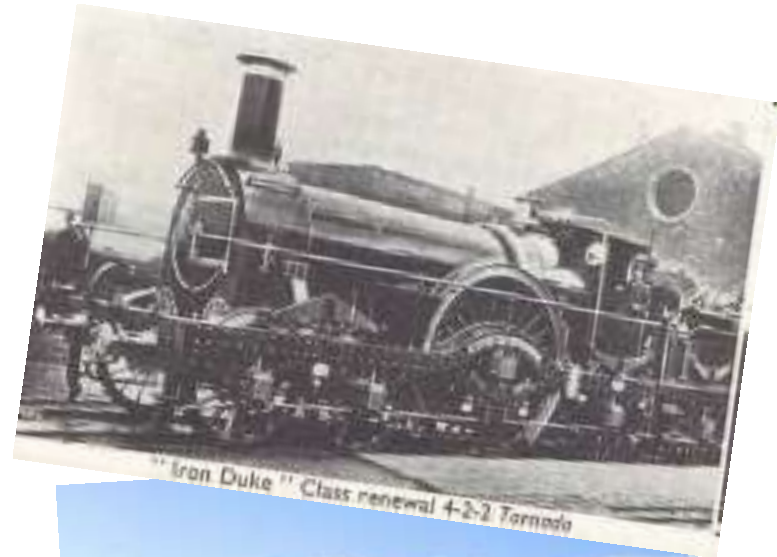


History lesson

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Railways were built along river valleys

- ◆ *They follow and cross river floodplains*
- ◆ *Shallow gradients suited the early technology*
- ◆ *...motorways and roads go over the landscape*
- ◆ *Railways now interwoven with other Infrastructure..*



History lesson

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Railways cut through the landscape, making them vulnerable to:

- ◆ *Floods*

- ◆ *Fluvial, surface water, coastal*

- ◆ *High groundwater levels*

- ◆ *and saturation*

- ◆ *Extreme rainfall*

- ◆ *on top of saturation*

Leading to Safety Hazards



Railway system

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The railway 'system' is today much more sensitive to weather than say, 50 years ago. Consider:

- ◆ *Signalling and switch control systems...*
- ◆ *Telegraph wires*
- ◆ *Trains wheel diameters...think about*
 - ◆ *Underslung power...?*
 - ◆ *Whitemetal bearings...?*
- ◆ *No electronics on trains...*



Things to remember

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Water is the Civil Engineer's
greatest enemy

– Thomas Telford

(..is nothing new?)

Water goes downhill.....

- John Dora



Network Rail Objectives ¹⁰

- 💧 To run a safe, reliable railway that the country can afford
- 💧 For earthworks the main concern is to prevent derailments, and to run trains to time
- 💧 Derailment – 28th June 2012
Loch Trieg, Scotland



Barrow-on-Soar, December 2012



- Embankment saturation
- Flooding at toe
- RAIB “...and none of Network Rail’s processes had identified this”

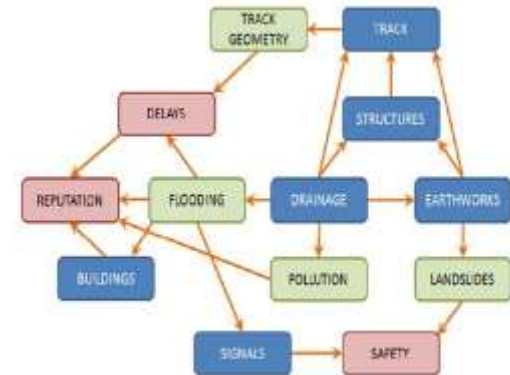
Falls of Cruachan, June 2010 (??)



- 💧 Rockfall
- 💧 Highest risk?
- 💧 NR Policy

Systems' impacts, less catastrophic?

- 💧 Impact on track quality
- 💧 Impact on overhead line 'registration'
- 💧 Impact on itself...
- 💧 Drainage impact on earthworks' stability
- 💧 All bring a 'performance' hit, while maintaining safety...
- 💧 What will climate change bring?



Hartlepool, Nov 2012

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💧 Defective
Drainage

💧 2,072mins

💧 36 cancelled

💧 £33,087 Sch. 8



Littleport, January 2012

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- Embankment desiccation?
- System impact
- Movement of the OLE mast foundations, plus wind..

Nothing new...

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- 💧 Fenny Compton
- 💧 Grouting in progress...
- 💧 (grouting??)



Early construction

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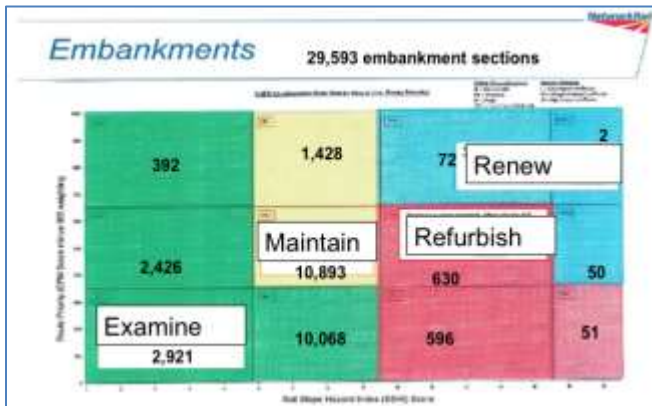
- 💧 Standards?
- 💧 Compaction?
- 💧 Trial and error...



© National Railway Museum/Pictorial Collection

Practitioners have...

- 💧 Standards ✓ ...examinations etc
- 💧 Policies ✓ ...targets (too many?)
- 💧 Funding ✓ ...but not enough (so they tell me!)
- 💧 Pressures ✓ ...climate change, delivery..



LNE Earthworks CP5 Policy

Network Rail's Draft Delivery Plan for Control Period 5 - Indicators

Network-wide asset management indicators

Table 24: Network-wide asset condition robustness

| Principal Asset | Description | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|------------------|---|---------|---------|---------|---------|---------|---------|
| Track | Rail breaks and immediate action defects per 100km | 4.18 | 4.23 | 4.17 | 4.10 | 4.05 | 3.88 |
| | Track geometry (Poor Track Geometry) | 2.84% | 2.87% | 2.87% | 2.79% | 2.75% | 2.74% |
| | Track failures (service affecting) | 5,060 | 5,302 | 5,282 | 5,179 | 5,060 | 5,051 |
| Signalling | Signalling failures (service affecting) | 17,559 | 16,885 | 16,854 | 16,651 | 16,441 | 16,200 |
| | Telecoms failures (service affecting) | 1,041 | 1,783 | 1,370 | 1,330 | 1,332 | 1,204 |
| Electrical Power | AC traction power failures (service affecting) | 1,014 | 1,091 | 1,051 | 1,045 | 1,034 | 1,035 |
| | DC traction power failures (service affecting) | 310 | 317 | 311 | 306 | 304 | 293 |
| | Non traction operational power supply failures (service affecting) | | | | | | |
| | Buildings - fit-active faults (2826) (attention within 2hrs, fix within 24hrs) & (attended within 24hrs, fix within 7 days) | 6,062 | 6,914 | 6,167 | 6,979 | 6,811 | 6,607 |
| Structures | Number of open work items with a risk score P12 | 5,721 | 6,450 | 1,367 | 1,380 | 1,377 | 1,274 |
| Cartworks | Cartwork failures | 91 | 78 | 76 | 73 | 70 | 67 |
| Pumps | Pumps failures (service affecting) | 4,611 | 4,432 | 4,360 | 4,332 | 4,283 | 4,207 |

NR Draft Delivery Plan 2013

Practitioners want (need?)...¹⁹

- 💧 Better resilience ...now and for future climate
- 💧 Tools ...that help prioritisation
- 💧 Proactive remediation ...predict and prevent!
- 💧 Early results ...prefer not to wait!
- 💧 Risk based? ...think consequences..
- 💧 Real time warnings ...knowing key risks

- Very keen to support iSmart, with
 - Data
 - Pragmatism and practical advice
 - Data, information...

Looking forward to iSmart making a big impact.

Positively.

Remember the pressures NR staff are under!

In extremis...

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- 💧 Real time direct warnings to trains...
- 💧 Safety is paramount...



Finally...

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Thank You!
Any Questions?

Plug for TRaCCA – click [here](#)