

Rational Systems and Software Engineering **Symposium**



Managing Complexity In The Rail Sector

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AGENDA

- Current Challenges
- Capacity
- Performance
- Maintenance
- Innovation



Current Challenges



Passengers at rush hour, Victoria Station, London, 1927

Capacity



[Fauvasse](#), 1944. ©TfL London Transport Museum collection

Capacity



2014 REUTERS/Luke MacGregor

Capacity

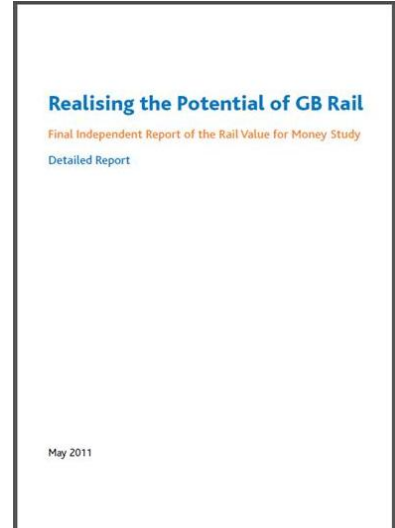


Current Challenges

“there is a widespread recognition that the GB rail industry still has major problems in terms of efficiency and costs.” Sir Roy McNulty

Barriers to efficiency:

- The Roles of Government and industry
- Fragmentation
- Incentives which are either ineffective or misaligned
- Lacks best-practice...from a whole-system perspective
- Whole-system approaches are difficult to apply



Capacity

Network Data

- Passengers journeys / year
- Passenger kilometres /year
- Length of network (km)
- No of Stations
- Staff
- Busiest station - Waterloo

Network Rail

- 1,503m
- 58.4m
- 14,504
- 2,500
- 34,000 (not including TOCs)
- 96m/y

London Underground

- 1,229m
- 10.1m
- 402 (45% tunnels)
- 270
- 19,000
- 82m/y

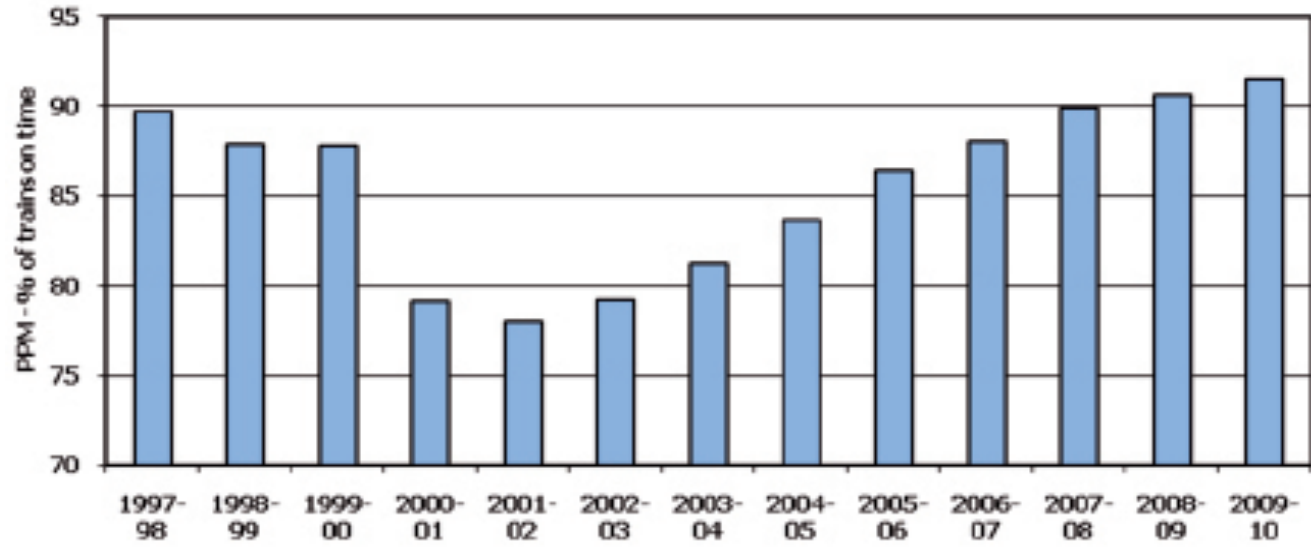
Source ORR Dataportal 2013



Performance

Train Reliability

(public performance measure – percentage of trains on time)



Source: *National Rail Trends 2008–09 Yearbook*.

Note: Public Performance Measure (PPM) data are not available for 1996/97.



Performance

Rail Passenger km forecast growth 2008 to 2034

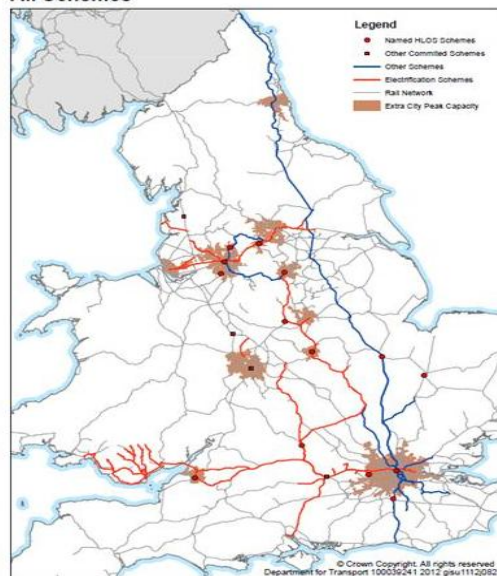


High Level Output Statement (HLOS) CP5

Network Rail

Railways Act 2005 Statement for Control Period 5 (37.6bn)

All Schemes



CP5 2014 – 2019

- Electrification of key routes
- Increase capacity
- Faster journey times
- Increase commuter capacity Urban areas
- Improved links major ports and airports

Structure

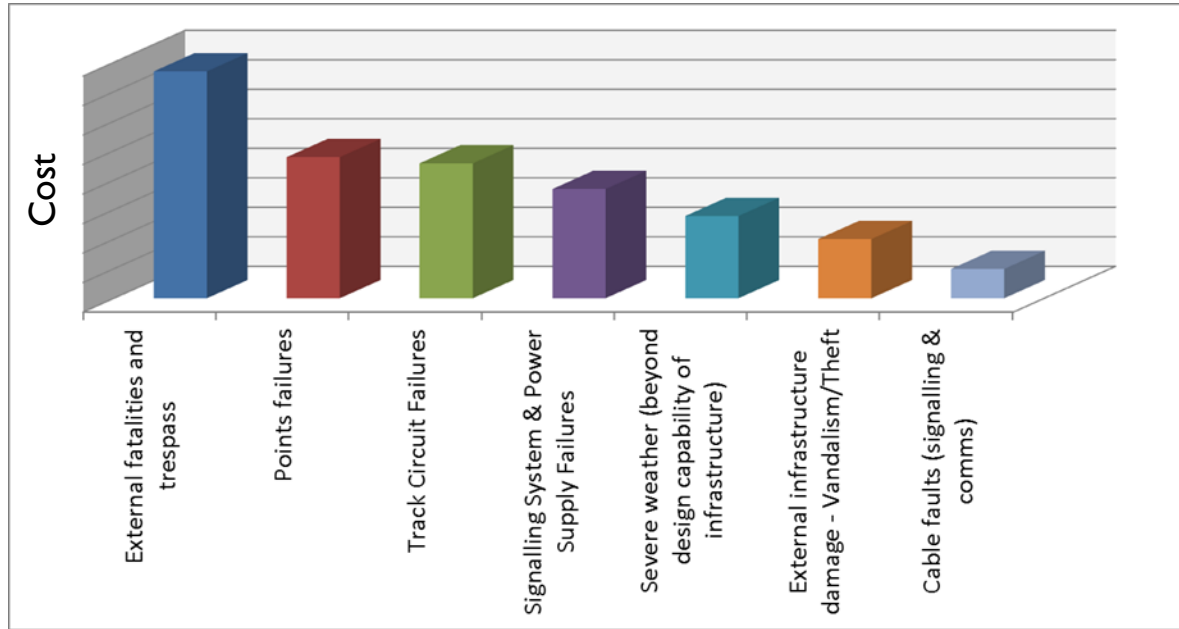
- Safety
- Reliability
- Capacity
- Financial stability
- Customer satisfaction
- Environmental performance
- NOT specifying how these strategic outputs are
- to be met

Committed Projects

- Thameslink
 - Crossrail
 - Intercity Express Programme
 - Birmingham New Street station upgrade
 - Reading station upgrade
 - West Coast Main Line Stafford capacity upgrade
 - West Coast Main Line power supply upgrade
 - East West Rail (Oxford – Bedford, Aylesbury – Calvert and links)
 - Electrification of the Great Western Main Line to Cardiff, Oxford and Newbury
 - Electrification of the 'North West Triangle'
 - Electrification of the 'North trans-Pennine line'
 - Elements of the Northern Hub
- #### Electric Spine
- Southampton Port – Basingstoke (conversion from 750 dc);
 - Basingstoke – Reading;
 - Oxford – Leamington – Coventry;
 - Coventry – Nuneaton;
 - Oxford – Bletchley – Bedford (East West Rail core route);
 - Bedford – Nottingham and Derby, and Derby – Sheffield (Midland Main Line); and
 - Kettering – Corby

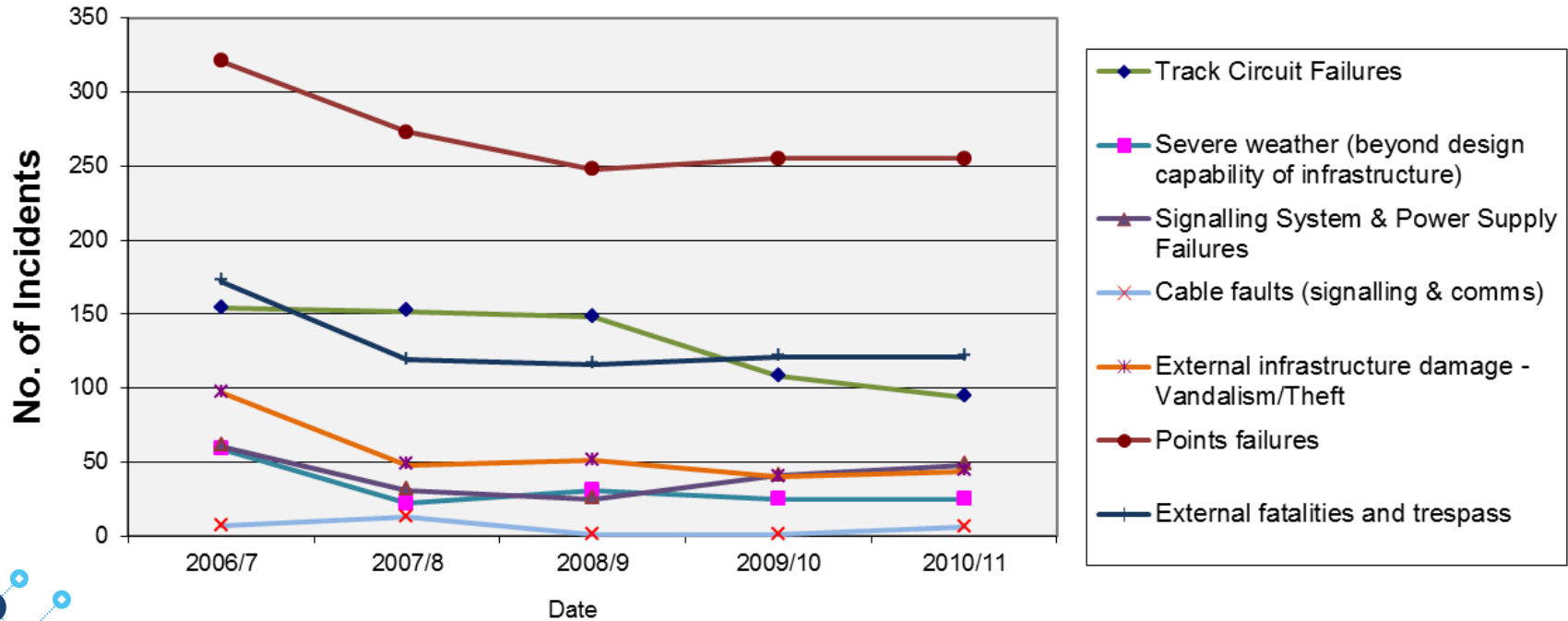
Delay Incident Cost (2007 - 2011)

Top 7 Categories - Infrastructure



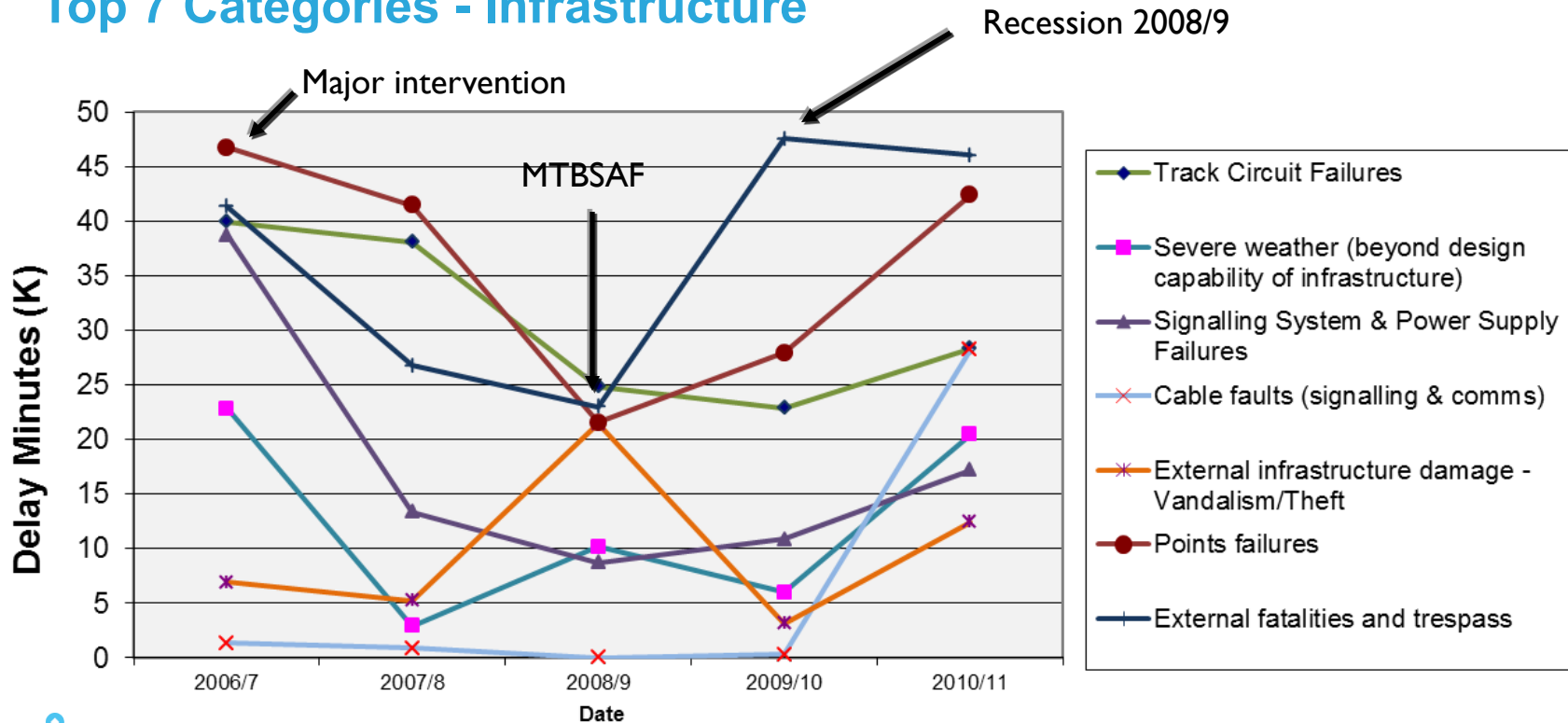
Delay Incidents (2007 - 2011)

Top 7 Categories - Infrastructure



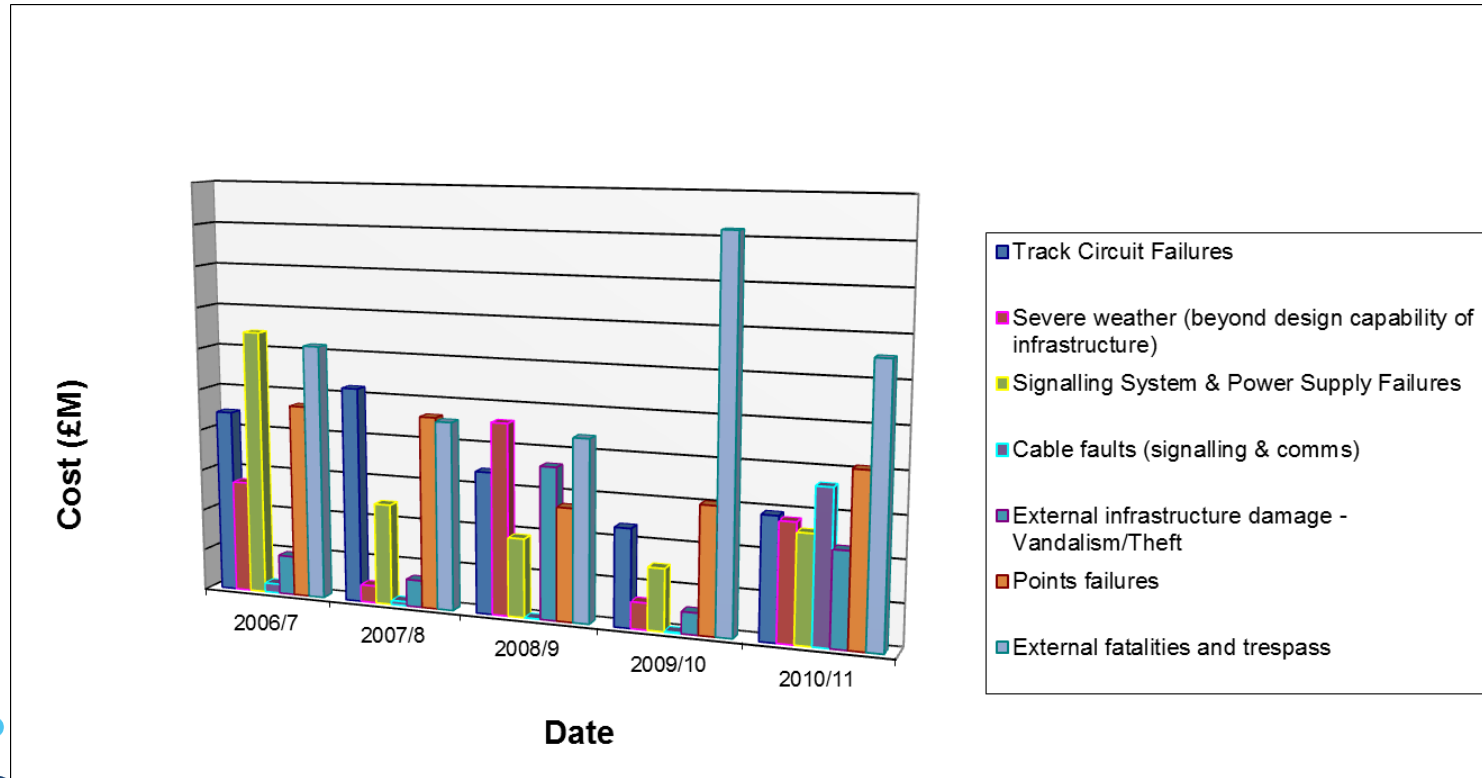
Delay Minutes (2007 – 2011)

Top 7 Categories - Infrastructure



Delay Attribution Costs (2007 – 2011)

Top 7 Categories - Infrastructure



Maintenance

- Access periods
 - Overnight
 - Possessions
 - Adjacent line working
 - Gold blockades
- Access points
 - Location
 - Type
 - Distances / Separation
 - Environment



Context Diagram – Mind Maps



Passenger Behaviours



Soft Systems - Vandalism



Google Maps

Current standard:

- 1.4m non electrified
- 1.8m electrified

- English Heritage
- Local councils
- Pressure groups

Innovation

Design for Reliability & Maintainability

- High output maintenance machines
- Energy efficiencies operational costs
- Moving block signalling
- Step free access
- Regeneration of communities
- Off site & Modular construction



Caversham Bridge



Conclusion

“there is a widespread recognition that the GB rail industry has major problems in terms of efficiency and costs.” Sir Roy McNulty

The Roles of Government and industry

- Realistic assumptions used in performance models HLOS
- Provision of suitable maintenance periods
- Short term planning

Fragmentation

- TOCS / FOCS / NR

Incentives which are either ineffective or misaligned

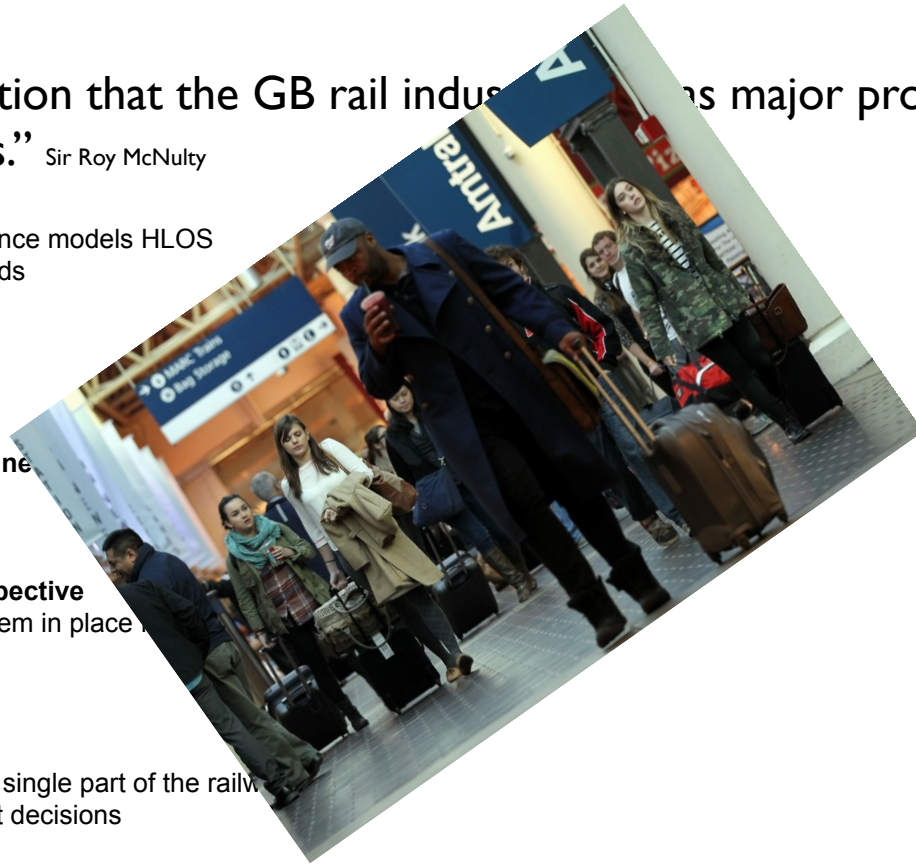
- Vertically integrated systems
- Reform franchising / incentives

Lacks best-practice...from a whole-system perspective

- DfT to have common management system in place
- Cross industry information systems
- Asset management

Whole-system approaches

- Difficult to draw a boundary around any single part of the railway
- Systems thinking to include government decisions



Thank You.

