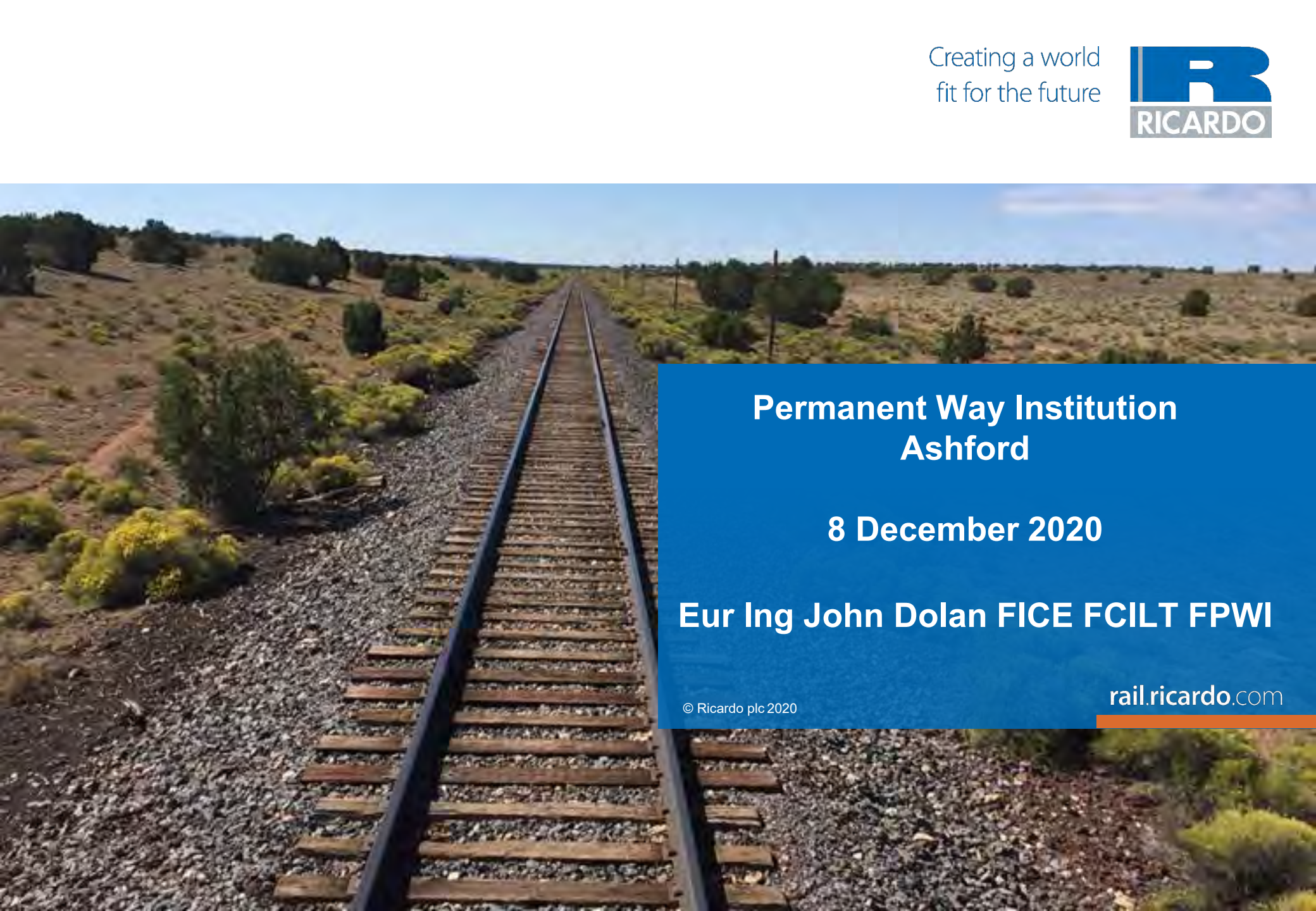


A photograph of a railway track stretching into the distance through a dry, hilly landscape with sparse vegetation under a clear blue sky. The track is made of steel rails and wooden sleepers on a gravel bed.

Permanent Way Institution Ashford

8 December 2020

Eur Ing John Dolan FICE FCILT FPWI

A photograph of a railway track stretching into the distance through a dry, hilly landscape with sparse vegetation under a clear blue sky. The track is made of steel rails and wooden sleepers on a gravel bed.

Infrastructure Asset Management

- Get it right
- Get it wrong

Experts in critical and complex railway systems

We are rail industry specialists within the Ricardo group working to ensure that communities around the world are served by safe, resilient, high-performance railways.

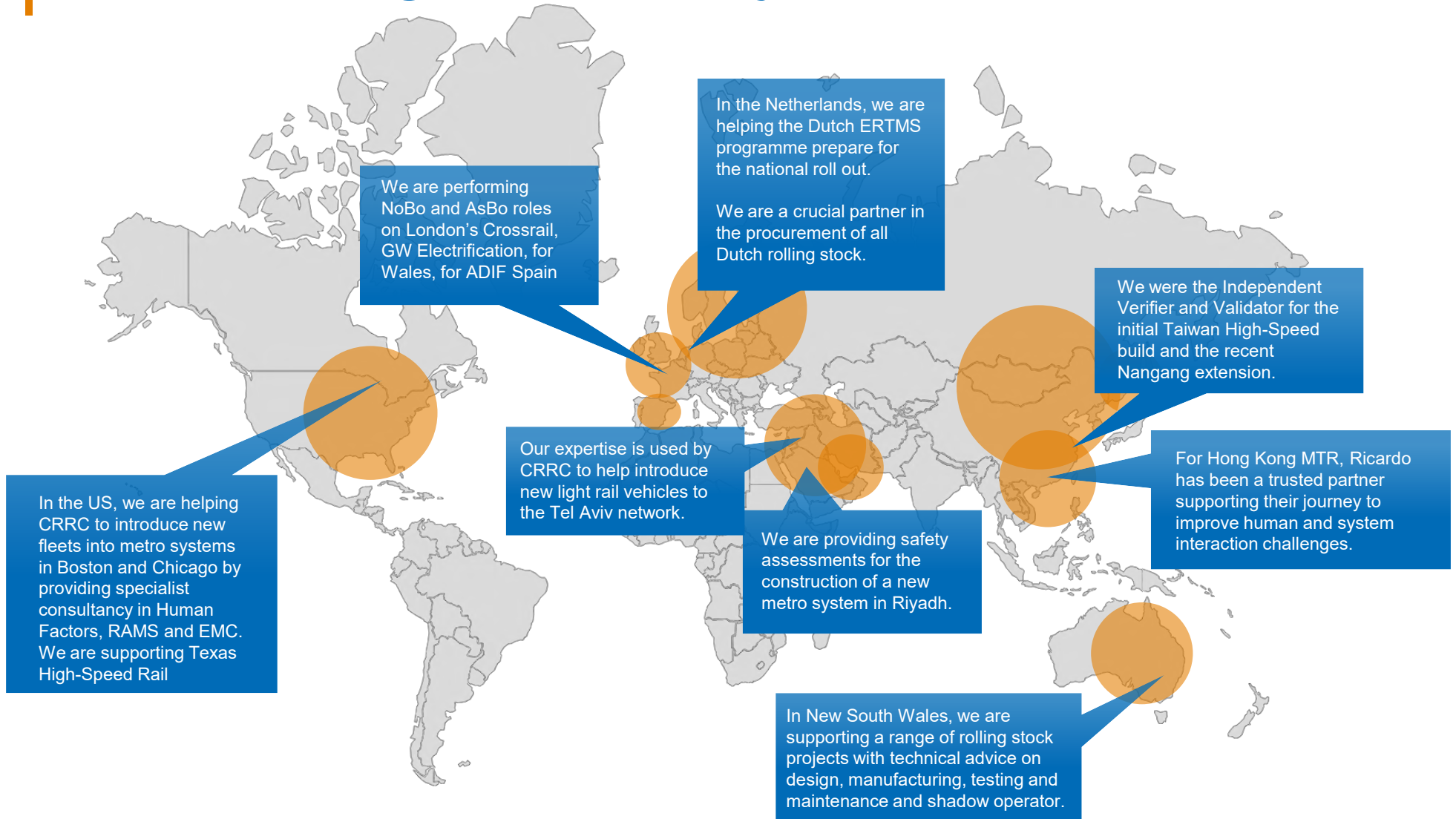
Our expertise lies in understanding the complex and critical systems that underpin an efficient rail service, providing clients with skills and insight to navigate the sector's operational, commercial and regulatory demands.

Core service areas

- Systems engineering
- Asset optimisation
- Strategy and Planning
- Independent assurance
- Carbon reduction



Some of our global rail projects



The Infrastructure Asset Manager's version
of Kipling's "serving men"

I keep six honest serving-men
(They taught me all I knew);
Their names are What and Why and When
And How and Where and Who

What's Out There?

- Asset Condition Assessment
- Tram loops (diagram v reality)

What Does It Do?

- Top of cutting slope interceptor channels
- Watford Tunnel RAIB
- “Keep” on grooved tram rail

What Does It Interact With?

cross-functional interfaces,

- Light Rail, vibrating bridge and vibrating stretcher bars, switch back contact
- earthing and bonding of metal structures
- London, welding ramp to platform
 - Edinburgh Gateway AC v DC

What Are The Key Risks?

- Serviceability Limit State v Ultimate, Light Rail again
- Bridge strikes (and HSE hay carts)
- Pigeons / bridge bearings – Health & Safety...and bats!

What Are The Critical Limits?

- Maintenance Threshold, 90% better
- Maintenance Limit, should not be worse
- Safety Standard, must not be worse

The first two are management tools, linked to reliability and frequency of condition information. The last requires mitigation

What Condition Is It In?

But this is purely a “snap shot”; it is one point on a degradation curve.

How Fast Is It Deteriorating?

Take rail wear – side wear of x mm on the Chesham branch may mean years of life. Side wear of x mm on the Caxton curve may mean that a speed restriction will be needed by the end of the week – degradation is so rapid, replacement should have been planned already

Does It Matter?

Do you understand the risks associated with the assets and the interfaces?

What could happen, how likely is it?

Then you know if it matters!

Does It Matter?

Do you know the true cost of getting it wrong?

Both the US NTSB and French BEA-TT include repair costs in accident reports, but not loss of track access charges, civil damages, etc

Railtrack getting it wrong (1)

Railtrack let RT1A maintenance contracts for each of the twenty five or so old BR Areas

They were not the same – at least one did not include rail lubricators.

The contractor's contract management team told the maintenance engineer to stop maintaining them, so he did

Railtrack getting it wrong (2)

What happened?

Train wheels and rail both started to wear very quickly, to the extent that the train service was seriously affected by units “stopped” for tyre turning

Still getting it wrong (1)

Visual inspection and non-destructive testing are key elements of risk mitigation

- By competent people who know what to look for
- Who can report what they find
- Who have adequate track access
- Who cover the full extent of the inspection
- At the correct frequency
- And competent management interprets and actions the findings

Still getting it wrong (2)

Hatfield 2000

- Rail known to be in poor condition
- Rail known to be untestable
- Known to have unsatisfactory access for inspection
- Knowledge of crack growth risk in Mill Heat Treated rails lost in Railtrack, although in PWI textbook!
- Longer term benefits of rail grinding not quantified, so, on cost grounds, no longer carried out
- Rail replacement planned but deferred

Still getting it wrong (3)

Grayrigg 2007

- Poor set up of points
- Repeated visits finding switch back contact
- Light Rail!
- Repeat maintenance visits found loose components
- Visual inspection did not cover correct area
- Components came free under train

Not just here – SNCF (1)

Bretigny 2013 – technical

- Known difficult location, with reduced asset life
- Complicated track layout , many components
- Heavy traffic affecting quality of inspections, staff repeatedly having to stand clear
- No increased surveillance
- Bolts not regarded as critical assets
- No spanner for specified torque – LUL issue too
- Limited visibility of bolt, in 4'

Not just here – SNCF (2)

Photo from BEA-TT Accident Report



Not just here – SNCF (3)

Bretigny 2013 – Organisational

Asset management – RFF imposed productivity requirements without considering practicalities, basing decisions on economic logic and lowest immediate cost

Planning – ageing infrastructure meant more reactive repairs at expense of planned maintenance

Organisation - Staffing reductions not related to local risk mitigation needs; difficulties filling remaining skilled posts

Safety culture eroded - lookouts assisting in work because gangs too small to carry out activities

Not just here – SNCF (4)

What happened?

Loose nuts cause fishplate holes to fret under dynamic track movement

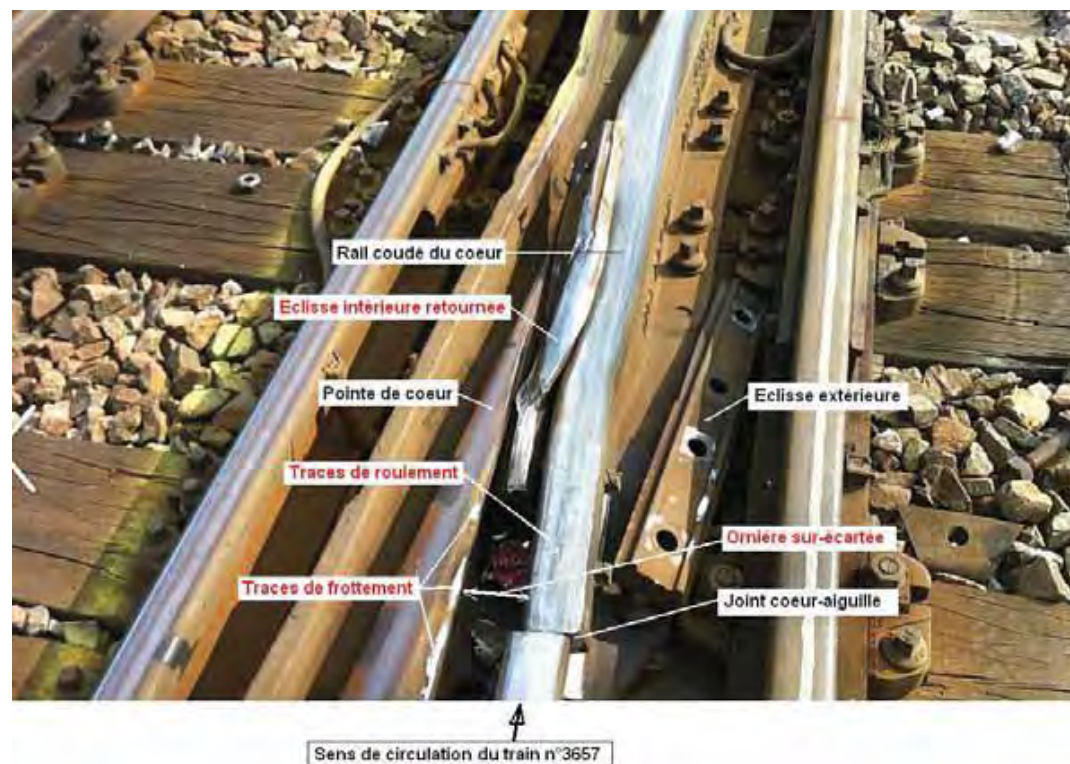
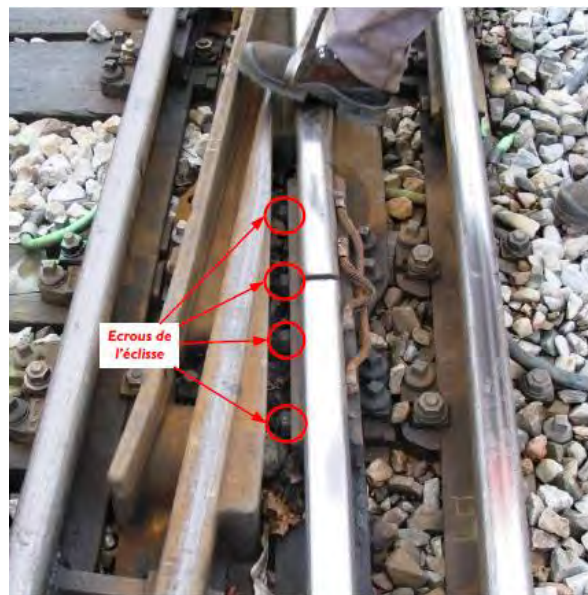
Patroller, although diligent, does not observe

Fishplate breaks up at bolt hole under train

Remaining part rotates and lodges in flangeway

Not just here – SNCF (5)

Photos from BEA-TT Accident Report



Not just here – SNCF (6)

Corail train travelling at 85mph derails

7 deaths, 4 at the station

Not just here – Holland (1)

ProRail (Dutch Network Rail) let performance based contracts

- Standard track designs from ProRail
- Only limited ProRail track maintenance standards
- Most maintenance standards prepared by contractors
- No risk-based assessment of failure
- Switch back contact not seen as risk
- Track access limited, to minimise disruption

Not just here – Holland (2)

ProRail had a “hands-off” approach

- Switch wear did not cause immediate disruption
- Change in contractor, switch condition not reviewed
- Contractor monitored by returns, not site data
- No knowledge of actual condition
- Switch wear - wheels were striking open switch back
- Unplanned loads imposed on locking equipment
- Shades of Light Rail!

Not just here – Holland (3)

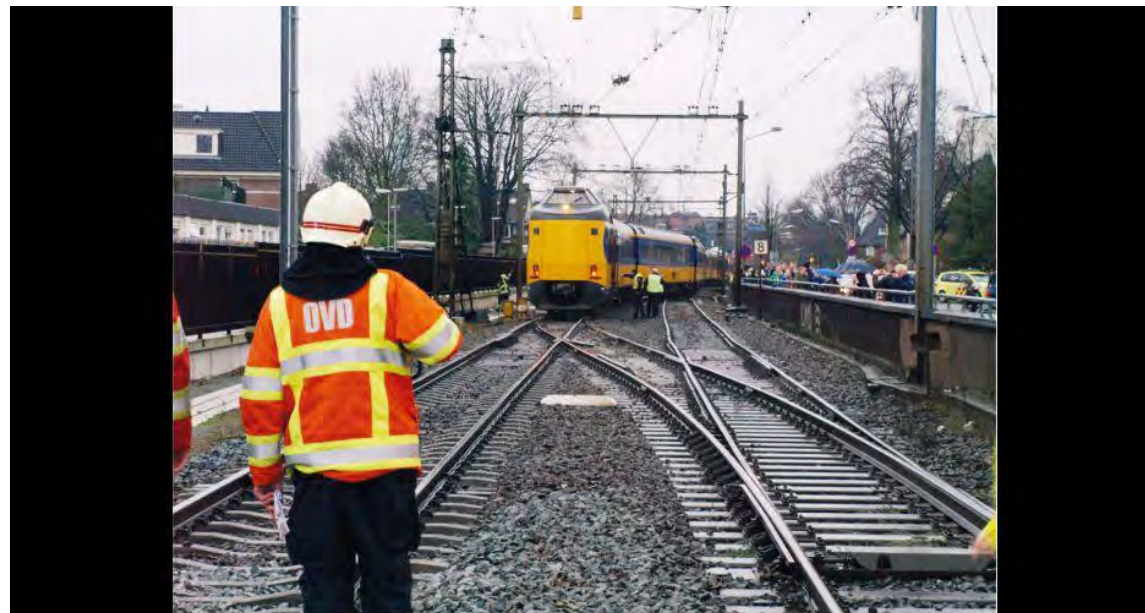
Design of switch - and risk assessment

- Included split ring to reduce perceived risk of run-through derailment
- Even facing points not normally trailed
- Split ring should not be taking routine load
- Switch back contact imposing impact load
- Split rings were breaking under impact load
- No investigation of unexpected load by Prorail or maker
- Maker redesigns split ring without querying failure cause
- Poor manufacture of ring, with stress raisers

Not just here – Holland (4)

Photo from Dutch Safety Board Accident Report

- Split ring failed in facing point (bottom right)
- Switch blades not connected
- Train derailed, limited casualties



Asset Manager's Serving Men



- What's Out There?
- What Does It Do?
- What Does It Interact With?
- What Are The Key Risks?
- What Are The Critical Limits?
- What Condition Is It In?
- How Fast Is It Deteriorating?
- Does It Matter?

Washington DC (1)

- Metro, serving DC, Virginia, Maryland
- 2015

Track recording vehicle ran 9 July 2015

Gauge over $\frac{3}{4}$ " above safety limit

Immediate removal from service required

No action taken

Derailment due to wide gauge 6 Aug 2015

- Special Safety Oversight investigation

Washington DC (2)

- Derailment due to wide gauge 29 July 2016
 - Gauge $1\frac{3}{4}$ " above immediate action limit
 - 16 of 18 bearers defective in turnout
 - 400" (10m) of rail unrestrained by fastenings
 - Inspection required twice weekly
 - Inspected monthly
- 16,828 outstanding track defects on system
- Gauge ties in photo added after derailment

Washington DC (3)

Photo from NTSB Accident Report



Washington DC (4)

Special Safety Oversight investigation reported 8 August 2016 (after 2016 incident)

- 1. Track inspectors receive inadequate training*
- 2. There is insufficient time for track inspection*
- 3. Excessive wear and deficient bearer condition in junction work is not being identified and addressed*
- 4. The track geometry vehicle is underutilised as part of the track inspection programme*

Washington DC (5)

- 5. *The Track Maintenance and Inspection Manual is not a field document focused on inspection safety limits*
- 6. *There is not a clear process in place for track inspectors and supervisors to impose and remove speed restrictions*
- 7. *There is a failure to use inspection data to inform and prioritise track maintenance*
- 8. *Maintenance managers require additional training and resources to act on inspection data*

Washington DC (6)

- 9. Current inspection and maintenance activity does not adequately address tunnel drainage systems*
- 10. Additional supervision is needed for both track inspection and track maintenance*
- 11. The same quality control testing program is not used for direct labour installed fastenings that would apply to those installed by a contractor while building a new line segment*
- 12. In certain instances, welding practices are used which are inconsistent with the construction standards*

Asset Manager's Serving Men



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49th year in the industry



Highlight

A barrister explaining why she did not cross-examine my expert evidence destroying her case

"Our expert said it was unchallengeable...and even I could understand it"

This was the Maidstone East derailment, 1993

What's going on here ... and why?



Photo from Chemin der Fer de la Baie de Somme

