Rail Accident Investigation in the UK

Presentation to the PWI London Section

Jon Graham

Inspector of Rail Accidents

Jonathan.graham@raib.gov.uk

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Agenda

- A bit of history
- RAIB's Role
  - Who works for us?
  - Where do we cover?
  - What do we produce?
- Some examples

For more information visit raib.gov.uk

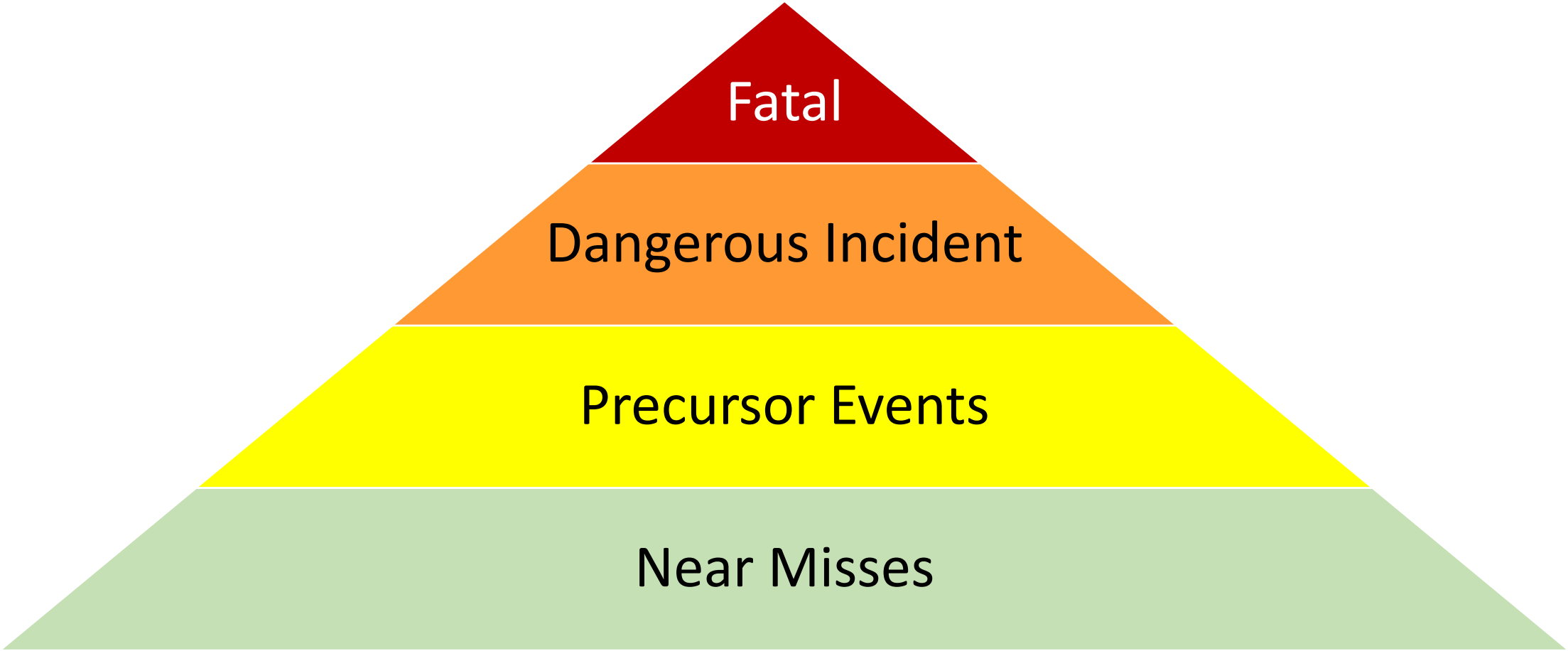
Why bother investigating?

"Those who cannot remember the past are condemned to repeat it."

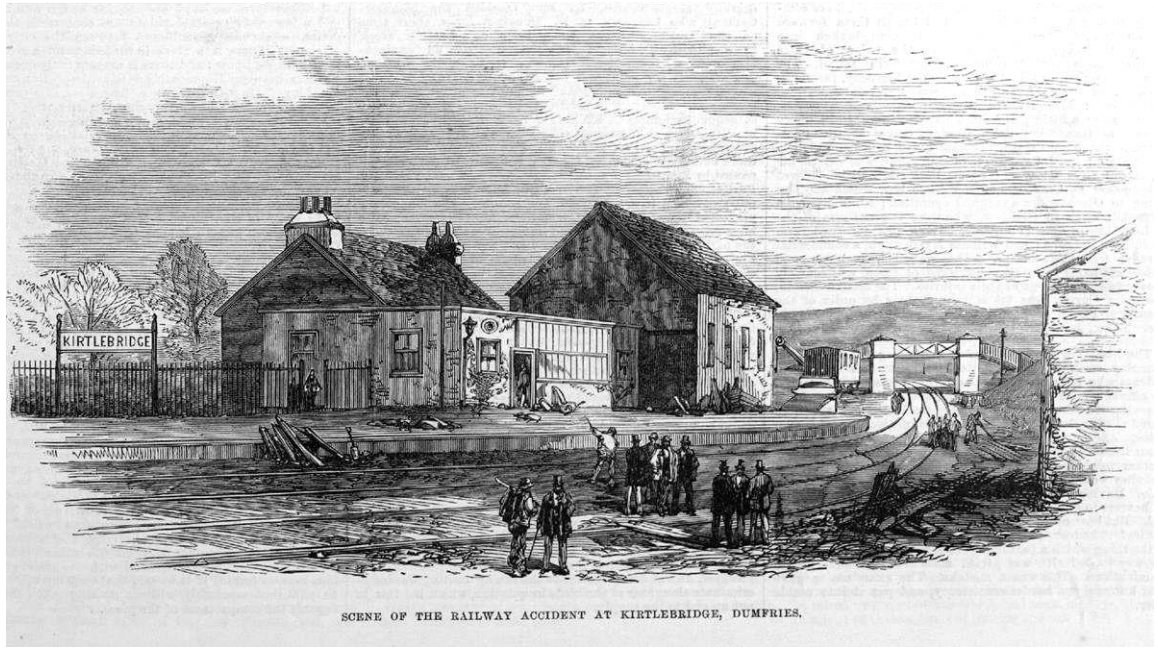
George Santayana

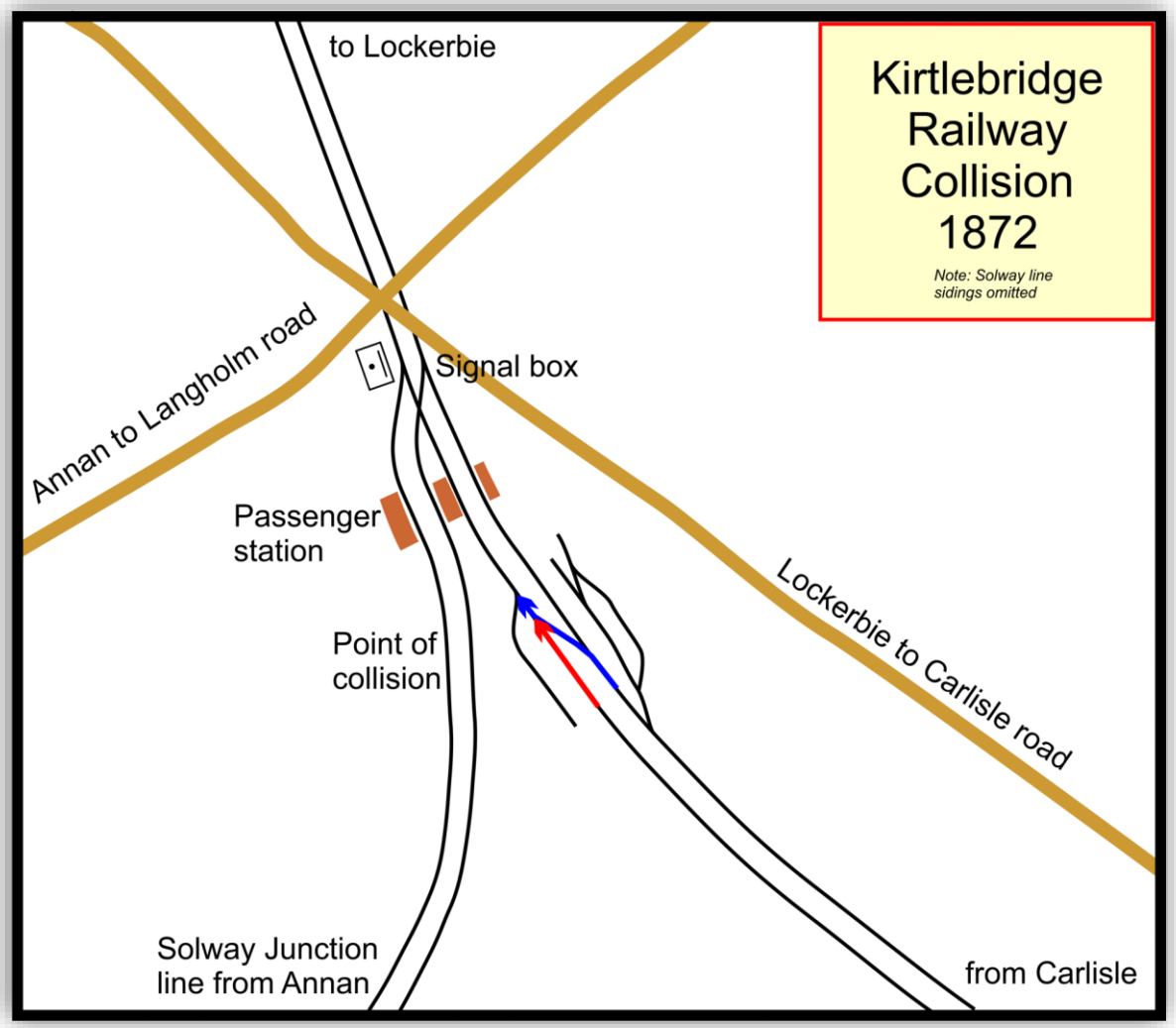
Reason in Common Sense (1905)

One of many models…



Kirtlebridge, 1872 - LOCK





Shambolic system of work.
No interlocking, failure of communication between the person in charge of shunting and the signaller allowed an express train to collide with a goods train shunting in the station. 11 people died.

Clayton Tunnel, 1861 - BLOCK

Time-interval “control” system, combined with unreliable traction and unreliable communications. 23 dead after collision in tunnel.

Led to the fundamental Block concept of only having one train in each section, and positively proving this, rather than basing safety on time intervals

Armagh incline, 1889 - BRAKE

Inadequate (non-existent) brake systems, combined with various operational errors. 80 dead, 260 injured, 1/3 of which were children

Quintinshill, 1915

- 226 dead following double collision.
- Signalman lost situational awareness – overlooked a train standing adjacent to his SB.
- No safety defences beyond vigilance.
- No consideration of human factors, fatigue, supervision etc.

Harrow & Wealdstone, 1952

- Double collision, caused by a train passing a signal at danger (SPAD). 112 fatalities.
- Almost half the fatalities were railway staff travelling to work.

Harrow & Wealdstone - 2

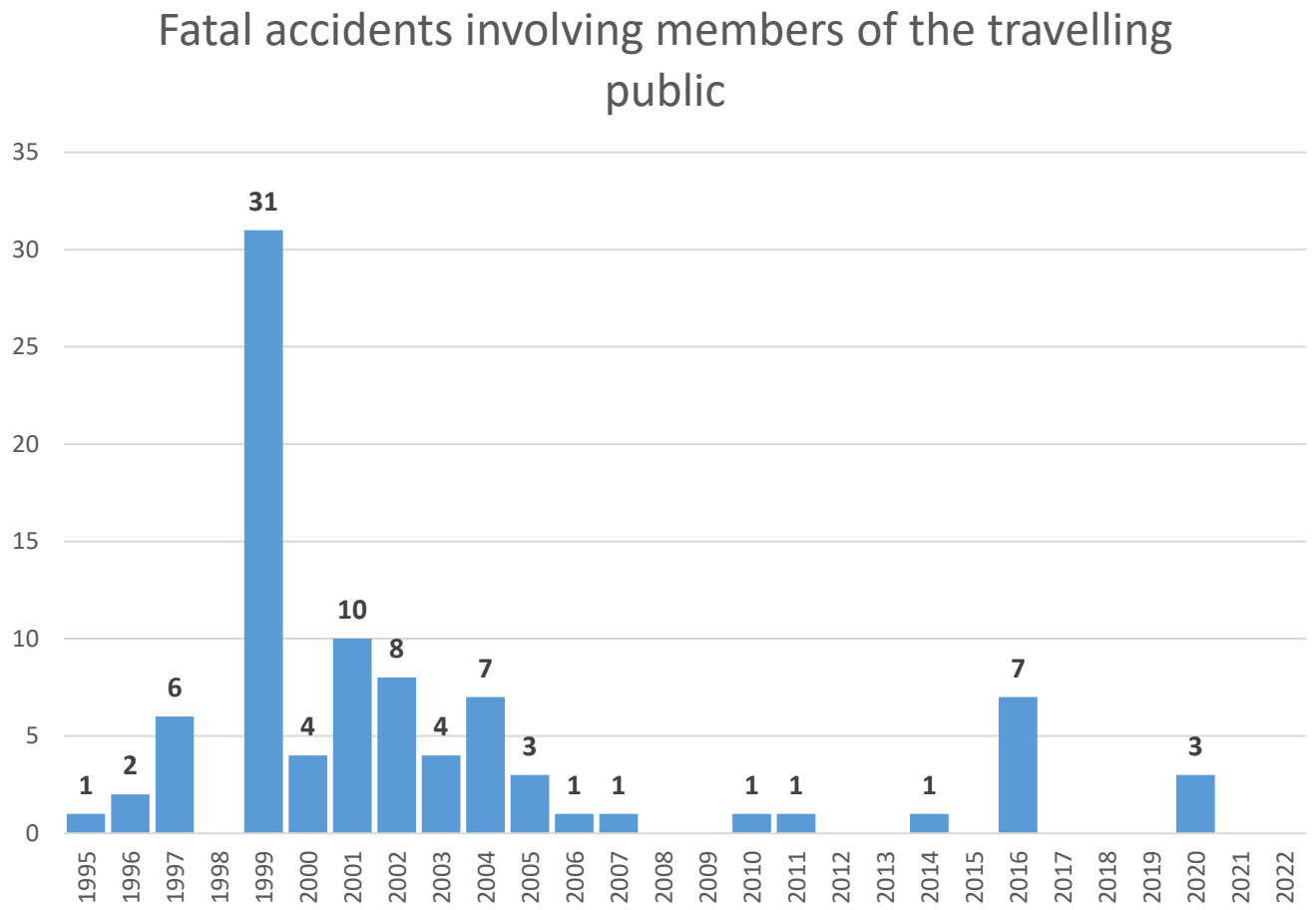
- Lock, Block & Brake – note that two of three protect against Signallers making errors.
- Brake - last-ditch defence in many situations.
- Drivers ALWAYS correctly obeying signals taken as a “given”. Some efforts made (eg GWR ATC) to support the driver, but not much.
- Arguably from around 1900, the greatest precursor of railway risk swung from being in the signalbox to driver in the cab.
- The idea of “why people make errors” was very alien until more recent times.
- Harrow led to the adoption of AWS – a simple electro-magnetic aid for the driver.

Clapham, 1998

- Signal failure due to a wiring fault.
- 35 dead.
- New wiring installed, but the old wiring was still in place and not secured. False feed led to an incorrect aspect showing.
- Major issues with safety culture.
- Hidden Inquiry followed, which included 93 recommendations including:
  - Many of the principles of SMTH as we know it
  - Control of fatigue

The late 90s and 2000s … another difficult time for the railway industry…

- High profile accidents including:
  - Southall
  - Ladbroke Grove
  - Potters Bar
  - Ufton Nervet
  - Hatfield
  - Grayrigg
  - Sandilands
  - Carmont
  - Etc…



Ladbroke Grove, Oct 1999 – Cause: SPAD
Outcome: head on collision (130 mph)
31 fatalities, > 500 injuries

Lord Cullen's Report
2003 Railways and Transport Safety Act

Radical change in rail industry's safety management

RAIB Purpose

- Investigation of accidents and incidents to **improve railway safety** and **inform the public**.
- Independent of all other parties.
- Does not establish blame or liability.

Geographical Coverage: All of Network Rail

Geographical Coverage – Trams and Metros

Geographical Coverage – Channel Tunnel and Heritage

What type of accidents are investigated?

The RAIB must, by law, investigate serious rail accidents which have an obvious impact on railway safety regulation or management, and involve a collision or derailment which result in, or could result in…

The death of at least one person	**Serious injury to five or more people**	**Extensive damage to rolling stock, infrastructure or the environment**	**Any other accident which, under slightly different circumstances, could have the same consequence**

The RAIB will investigate other incidents at its discretion, based on:

- **How serious the incident is; and**
- **The likely safety lessons to be learned**

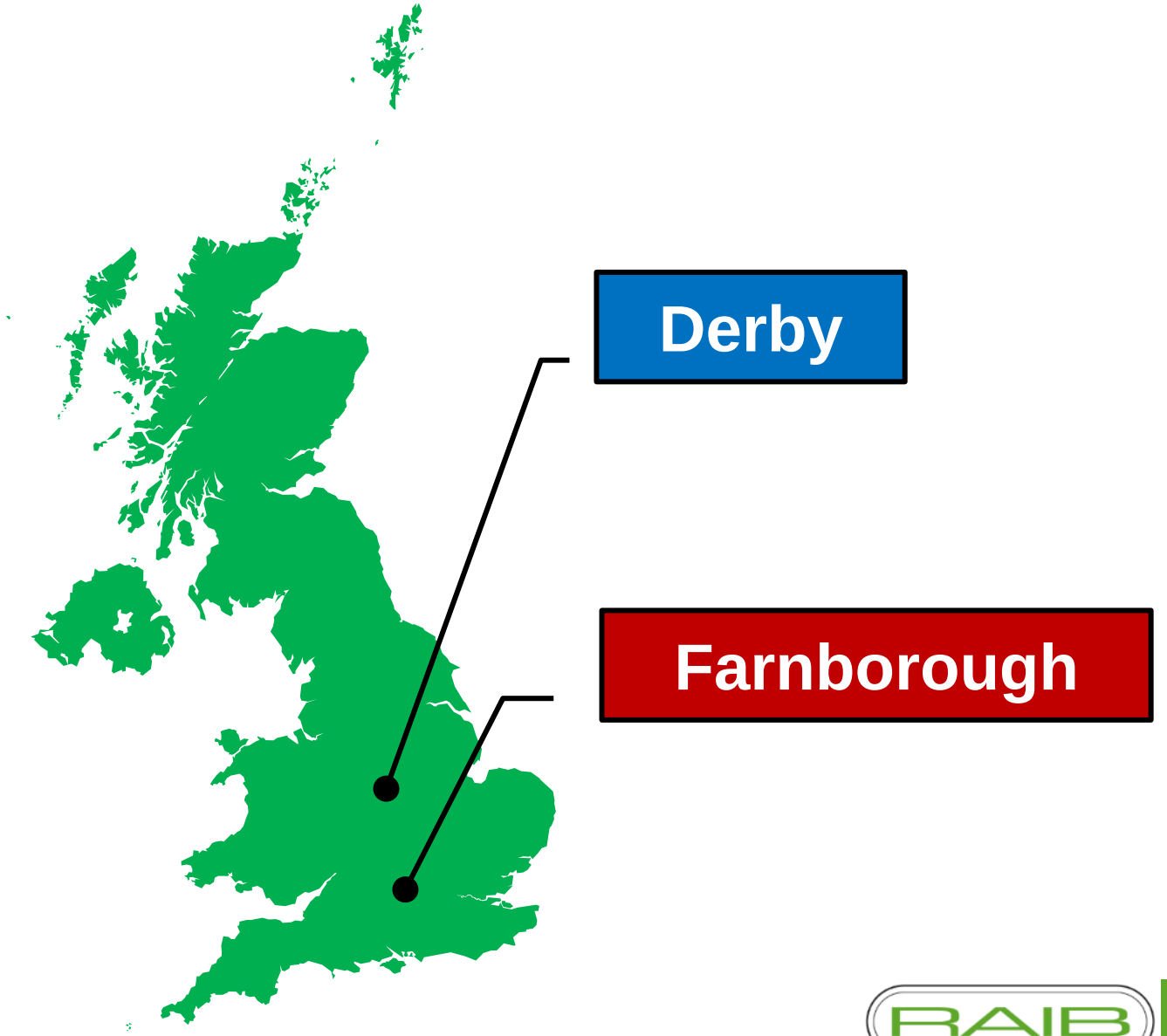
What don’t we investigate, and who does instead?

Worker incidents (except those involving a moving train)	**Trespass or suicide**	**Accidents or incidents where there are no likely safety lessons to be learned for the operational rail system management**
ORR or HSE	**British Transport Police (or Home Office Police)**	**Duty Holders (e.g. Network Rail)**

Where are we based?

- RAIB staffing:
  Chief Inspector
  Deputy Chief Inspector
  5 Principal Inspectors
  18 Inspectors
  20 Support staff

- At least five staff on-call
  - 1 Duty Coordinator
  - 2+ Derby Inspectors
  - 2+ Farnborough Inspectors
- On-call 24/7, 365 days/year
- Travel by whatever means is appropriate.



RAIB Inspectors

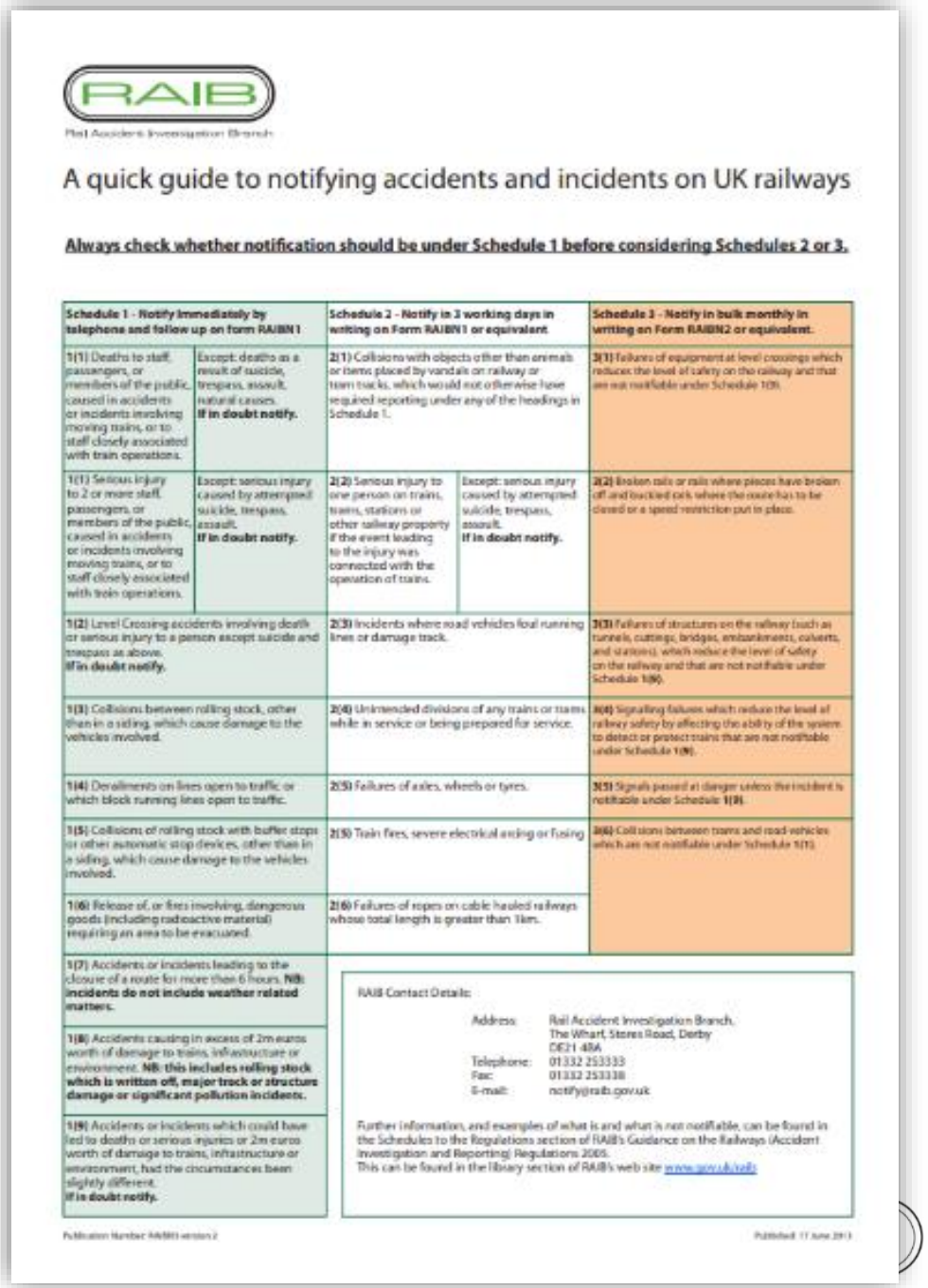
- Most are ex-rail industry, but also from police, ORR, MoD and HSE.
- Wide range of underlying experience
  - Track
  - Signalling
  - Traction and Rolling Stock
  - Civil Engineering
  - Heritage
  - Human Factors
  - Investigation and Incident Management
- Extensively trained in investigation techniques
- Trained in evidence collection and analysis
- Trained to interview witnesses
- Family liaison
- An underpinning knowledge across the railway disciplines
- Know the right questions to ask!

RAIB Inspector's Powers

- Enter railway property
- Enter land adjoining the railway
- Enter any other land (if appropriate)
- Seize evidence
- Make records, take photos/videos
- Interview witnesses and compel them to answer
- Seize documents/records

Notification and Deployment

1. RAIB notified by duty holder
2. DC decides on course of action
3. Inspectors deployed if required
4. AA deployed if required
5. DC remains contact while inspectors are travelling
6. Lead inspector takes charge
7. Undertake preliminary investigation



RAIB

Rail Accident Investigation Branch

A quick guide to notifying accidents and incidents on UK railways

Always check whether notification should be under Schedule 1 before considering Schedules 2 or 3.

Schedule 1 - Notify immediately by telephone and follow up on form RAIBN1		**Schedule 2 - Notify in 3 working days in writing on Form RAIBN1 or equivalent**		**Schedule 3 - Notify in bulk monthly in writing on Form RAIBN2 or equivalent.**
1(1) Deaths to staff, passengers, or members of the public, caused in accidents or incidents involving moving trains, or to staff closely associated with train operations.	Except: deaths as a result of suicide, trespass, assault, natural causes. **If in doubt notify.**	2(1) Collisions with objects other than animals or items placed by vandals on railway or tram tracks, which would not otherwise have required reporting under any of the headings in Schedule 1.		3(1) Failures of equipment at level crossings which reduces the level of safety on the railway and that are not notifiable under Schedule 1(8).
1(1) Serious injury to 2 or more staff, passengers, or members of the public, caused in accidents or incidents involving moving trains, or to staff closely associated with train operations.	Except: serious injury caused by attempted suicide, trespass, assault. **If in doubt notify.**	2(2) Serious injury to one person on trains, trams, stations or other railway property if the event leading to the injury was connected with the operation of trains.	Except: serious injury caused by attempted suicide, trespass, assault. **If in doubt notify.**	3(2) Broken rails or rails where pieces have broken off and buckled rails where the route has to be closed or a speed restriction put in place.
1(2) Level Crossing accidents involving death or serious injury to a person except suicide and trespass as above. **If in doubt notify.**		2(3) Incidents where road vehicles foul running lines or damage track.		3(3) Failures of structures on the railway (such as tunnels, cuttings, bridges, embankments, culverts, and stations), which reduce the level of safety on the railway and that are not notifiable under Schedule 1(9).
1(3) Collisions between rolling stock, other than in a siding, which cause damage to the vehicles involved.		2(4) Unintended divisions of any trains or trams while in service or being prepared for service.		3(4) Signalling failures which reduce the level of railway safety by affecting the ability of the system to detect or protect trains that are not notifiable under Schedule 1(9).
1(4) Derailments on lines open to traffic or which block running lines open to traffic.		2(5) Failures of axles, wheels or tyres.		3(5) Signals passed at danger unless the incident is notifiable under Schedule 1(3).
1(5) Collisions of rolling stock with buffer stops or other automatic stop devices, other than in a siding, which cause damage to the vehicles involved.		2(5) Train fires, severe electrical arcing or fusing		3(6) Collisions between trains and road vehicles which are not notifiable under Schedule 1(1).
1(6) Release of, or fires involving, dangerous goods (including radioactive material) requiring an area to be evacuated.		2(6) Failures of ropes on cable hauled railways whose total length is greater than 1km.		
1(7) Accidents or incidents leading to the closure of a route for more than 6 hours. **NB: incidents do not include weather related matters.**				
1(8) Accidents causing in excess of 2m euros worth of damage to trains, infrastructure or environment. **NB: this includes rolling stock which is written off, major track or structure damage or significant pollution incidents.**				
1(9) Accidents or incidents which could have led to deaths or serious injuries or 2m euros worth of damage to trains, infrastructure or environment, had the circumstances been slightly different. **If in doubt notify.**				

RAIB Contact Details:

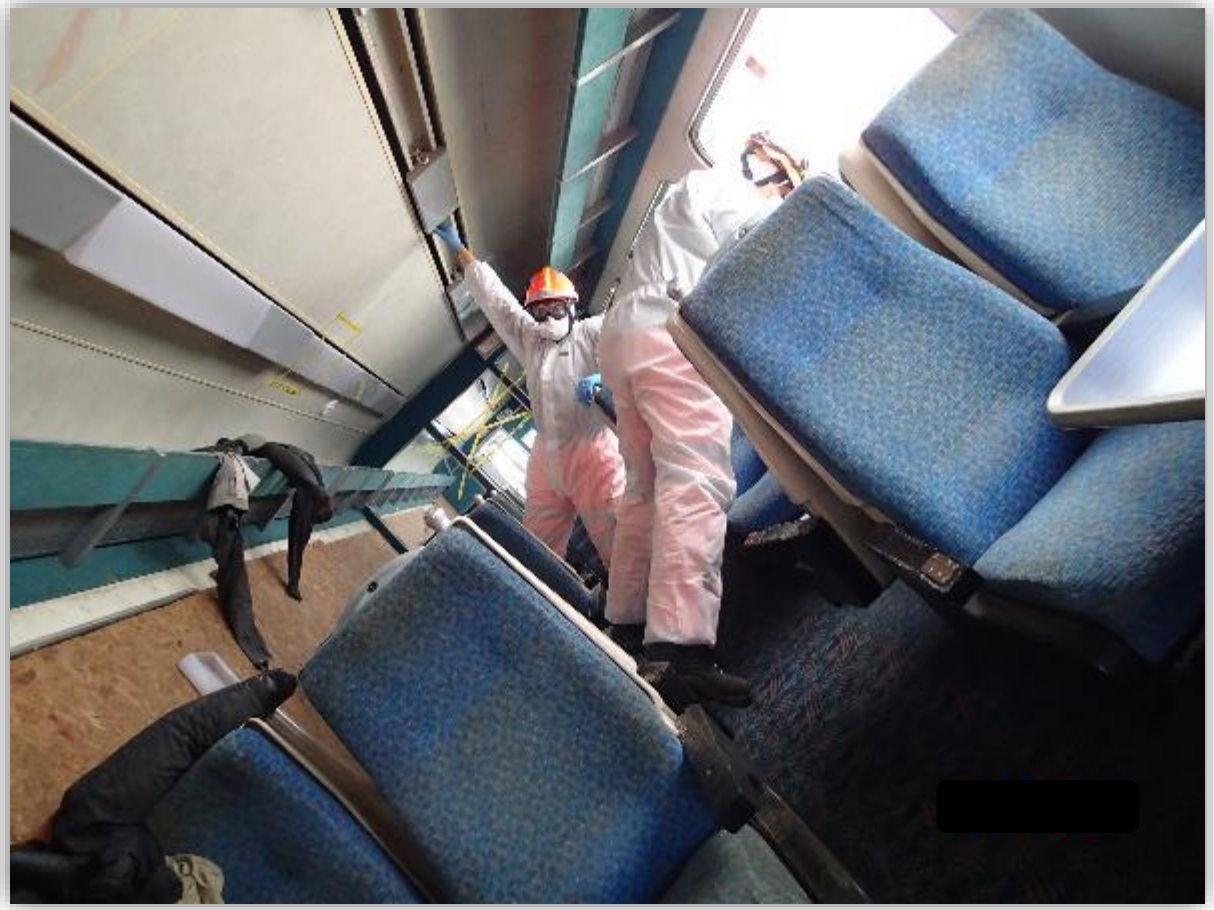
Address: Rail Accident Investigation Branch, The Wharf, Stores Road, Derby DE21 4BA
Telephone: 01332 253333
Fax: 01332 253338
E-mail: notify@raib.gov.uk

Further information, and examples of what is and what is not notifiable, can be found in the Schedules to the Regulations section of RAIB's Guidance on the Railways (Accident Investigation and Reporting) Regulations 2005.
This can be found in the library section of RAIB's web site www.gov.uk/raib

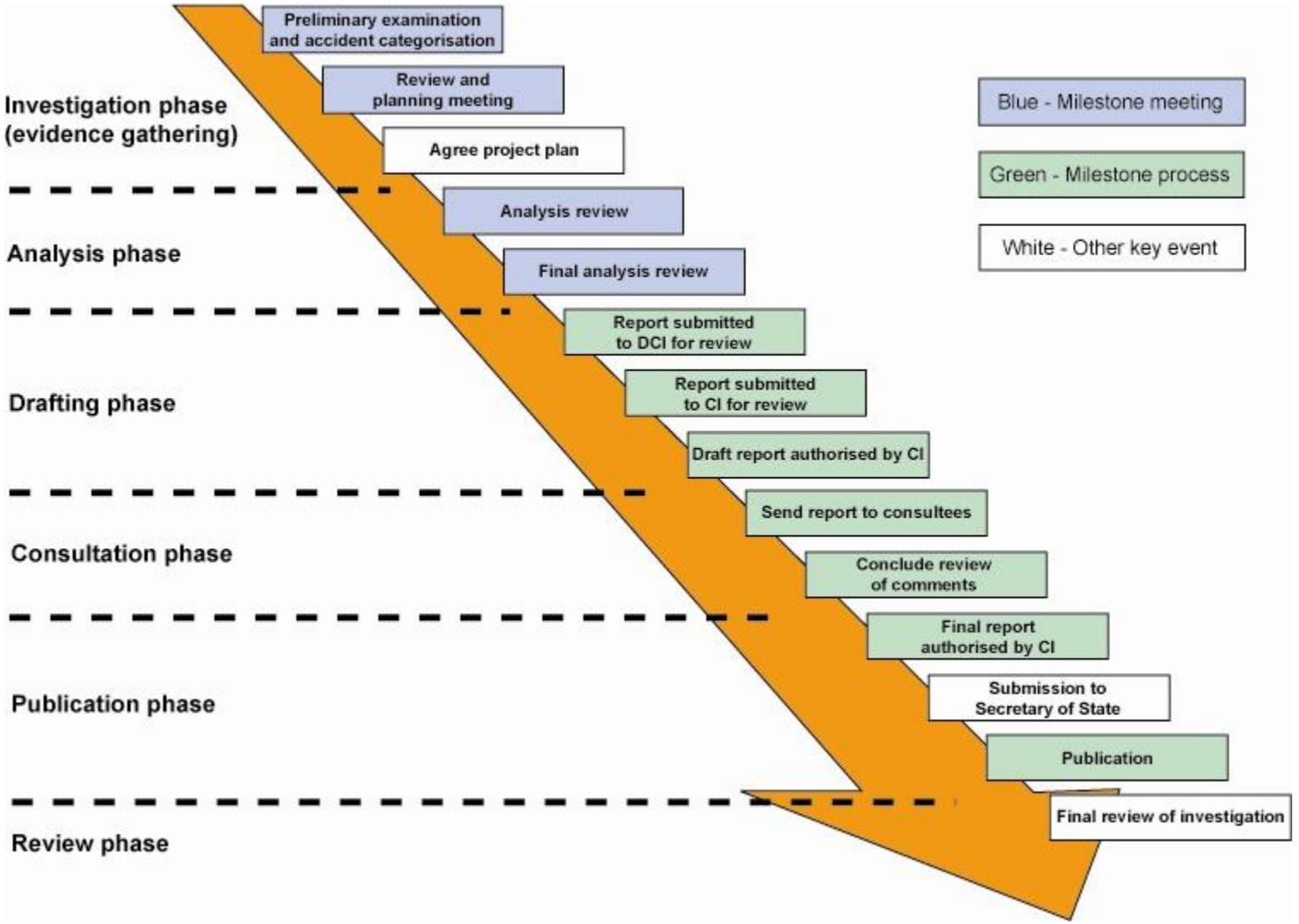
Publication Number: RAIBN1 version 2 — Published: 17 June 2013

Sources of Evidence (by no means exhaustive!)

- Post Mortem
- Medical/Injury Information
- Physical Evidence
- Level Crossing/Signalling data loggers
- Train OTDR (black box)
- Train FFCCTV
- Site photos (incl reconstruction of conditions)
- Site surveys (incl drone surveys)
- Track Measurements
- Witness accounts (drivers/crew/staff/public)
- Maintenance records
- Laboratory testing of equipment
- Brake tests
- Etc…



Basic structure



Output - Recommendations

- Produce recommendations to the industry
  - Responsibility for follow-up lies with the ORR.
  - The party who the recommendation is addressed to has a duty to implement, or provide justification if not.
  - We can raise concerns if we don't feel that something has been closed out as intended.

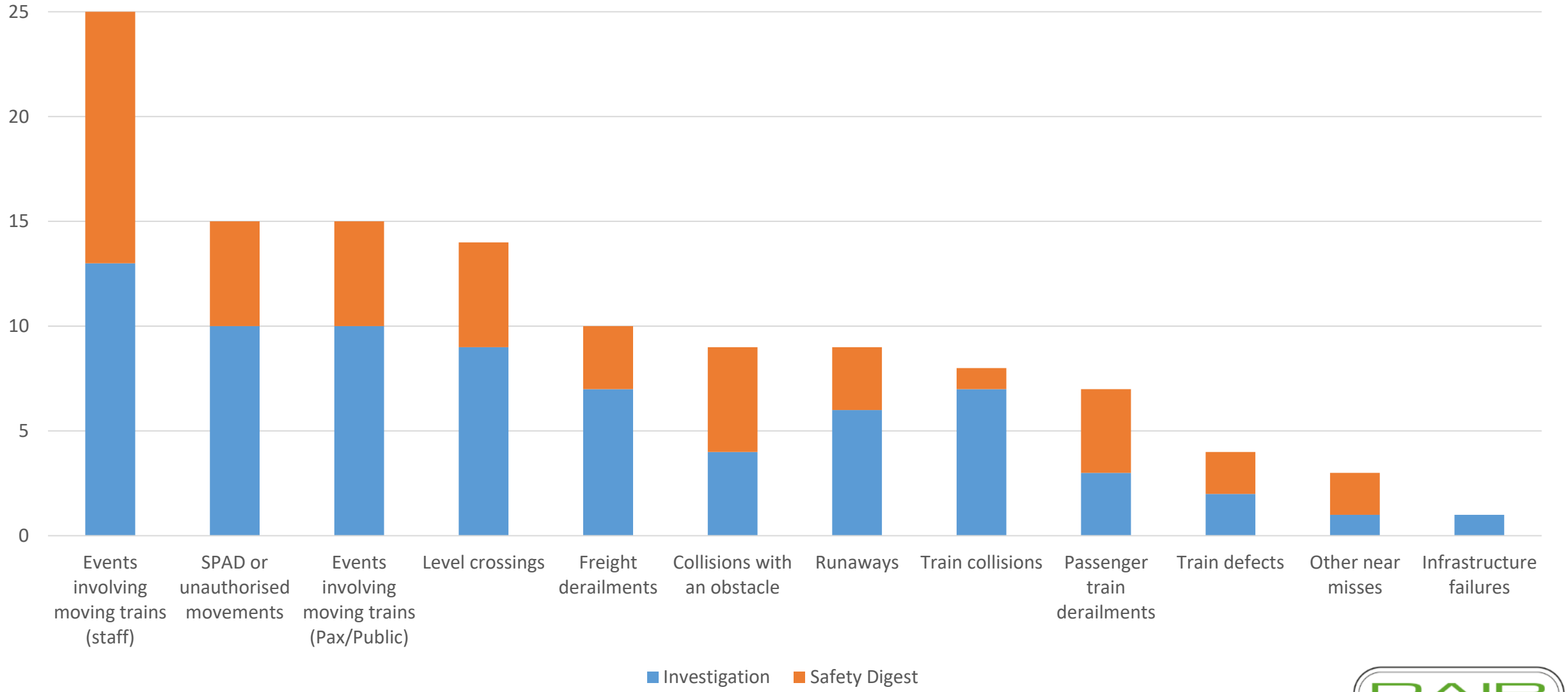
Investigations to date

- Published approximately
  - 406 Investigations
  - 10 Class Investigations
  - 125 Safety Digests/Bulletins
  - 330 Industry Reviews
- Currently undertaking
  - 13 Investigations
  - 2 Safety Digests

Loch Eilt

Derailment due to landslip

Recent Themes (Reports launched 2018-2022)



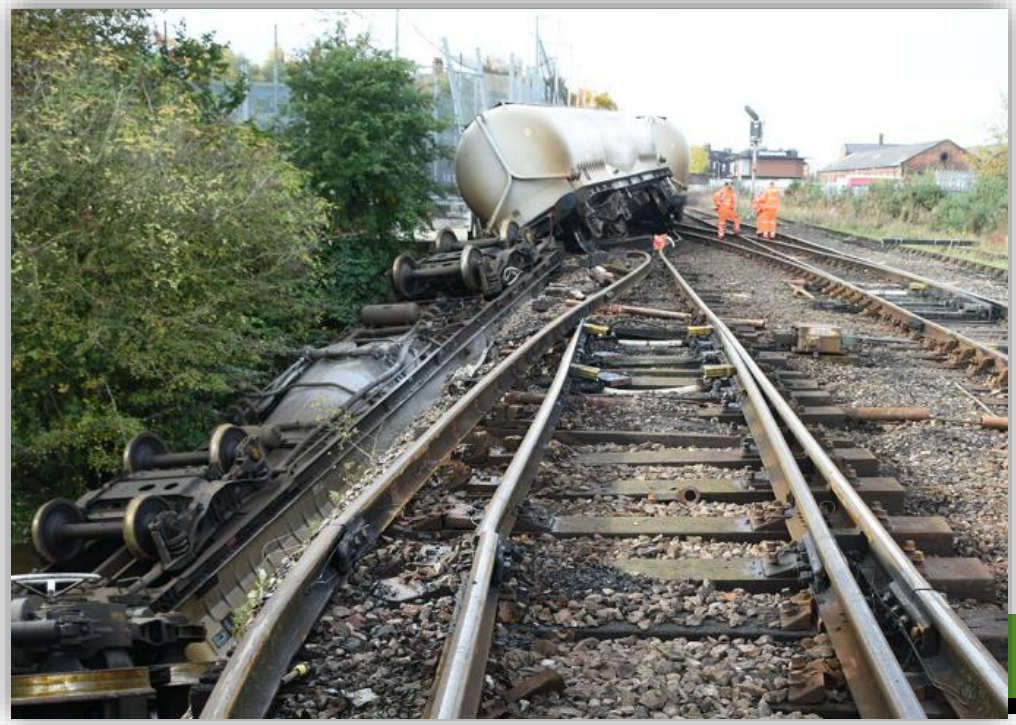
Carmont
12 August 2020

Llangennech, 26 Aug 2020

- A fortnight after Carmont
- Significant environmental damage, fuel spillage and major fire
- SSSI and Special Area of Conservation (SAC)
- Defect in the brake system

Low Adhesion

- Some recent high-profile incidents with low adhesion as a factor:
  - Pencoed and Llanharan
  - Fisherton Tunnel, Salisbury (top right)
  - Petteril Bridge Jn, Carlisle (bottom right)



Range of railhead adhesion on the rail network		
Adhesion level	**Typical coefficient of friction**	**Description**
High	> 0.15	Clean rail wet or dry
Medium	0.10 to 0.15	Damp rails with some contamination
Low	0.05 to 0.10	Typical autumn mornings due to dew / dampness often combined with light overnight rust
Very low	<0.05	Severe rail contamination often due to leaves but sometimes other pollution

Trackworker incidents and accidents
(Published since Jan 2017 and including ongoing investigations)

Paddington

Penkridge

Chalfont & Latimer (LU)

Llandegai Tunnel

Rowlands Castle

Surbiton

Roade

Kirtlebridge

Margam

Gatwick Airport

Stoats Nest (#2)

Ynys Hir

Sundon

Peterborough

South Hampstead

Dundee

Clapham Jn

Pelaw (T&W Metro)

Egmanton

Camden

Shawford

Dutton Viaduct

Clapham (Yorkshire)

Wimbledon

Great Chesterford

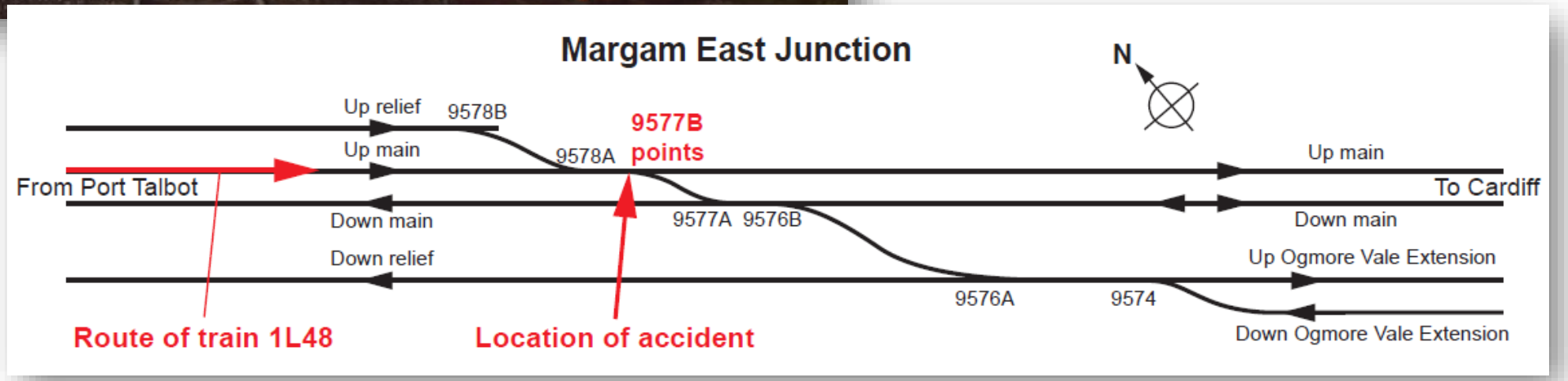
Ascot

Surbiton

Recent Years

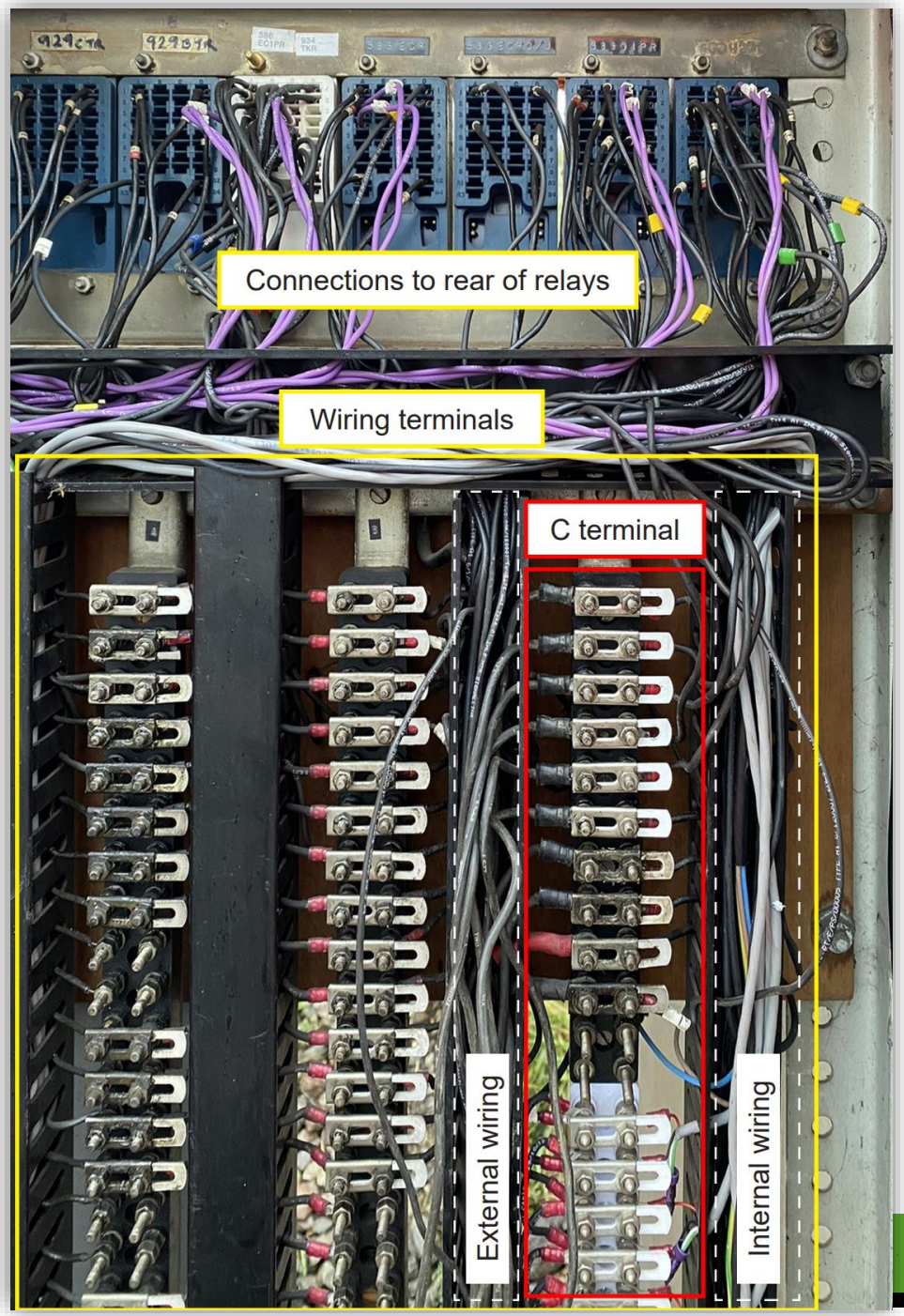
Margam

[RAIB Report 11/2020]



Wingfield, 2022

- Cross-over in wiring introduced following overnight engineering work
- The testing following the work did not identify the issue
- Led to a signal interchanging the red and yellow aspects, and hence two trains in section
- The potential for a more severe incident was reduced by actions of the signallers and drivers involved



Signalling Processes

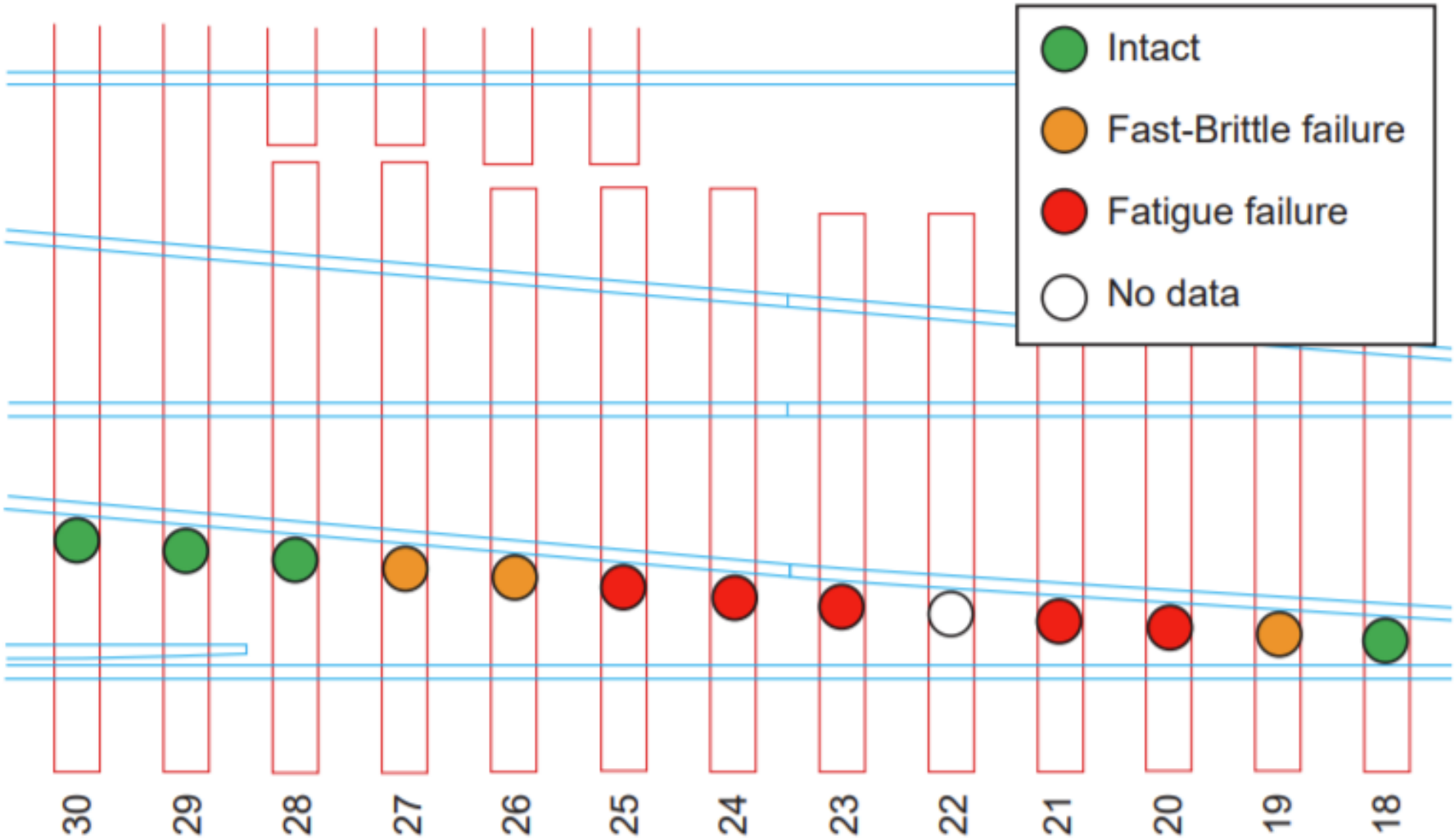
Cardiff East Junction

Waterloo

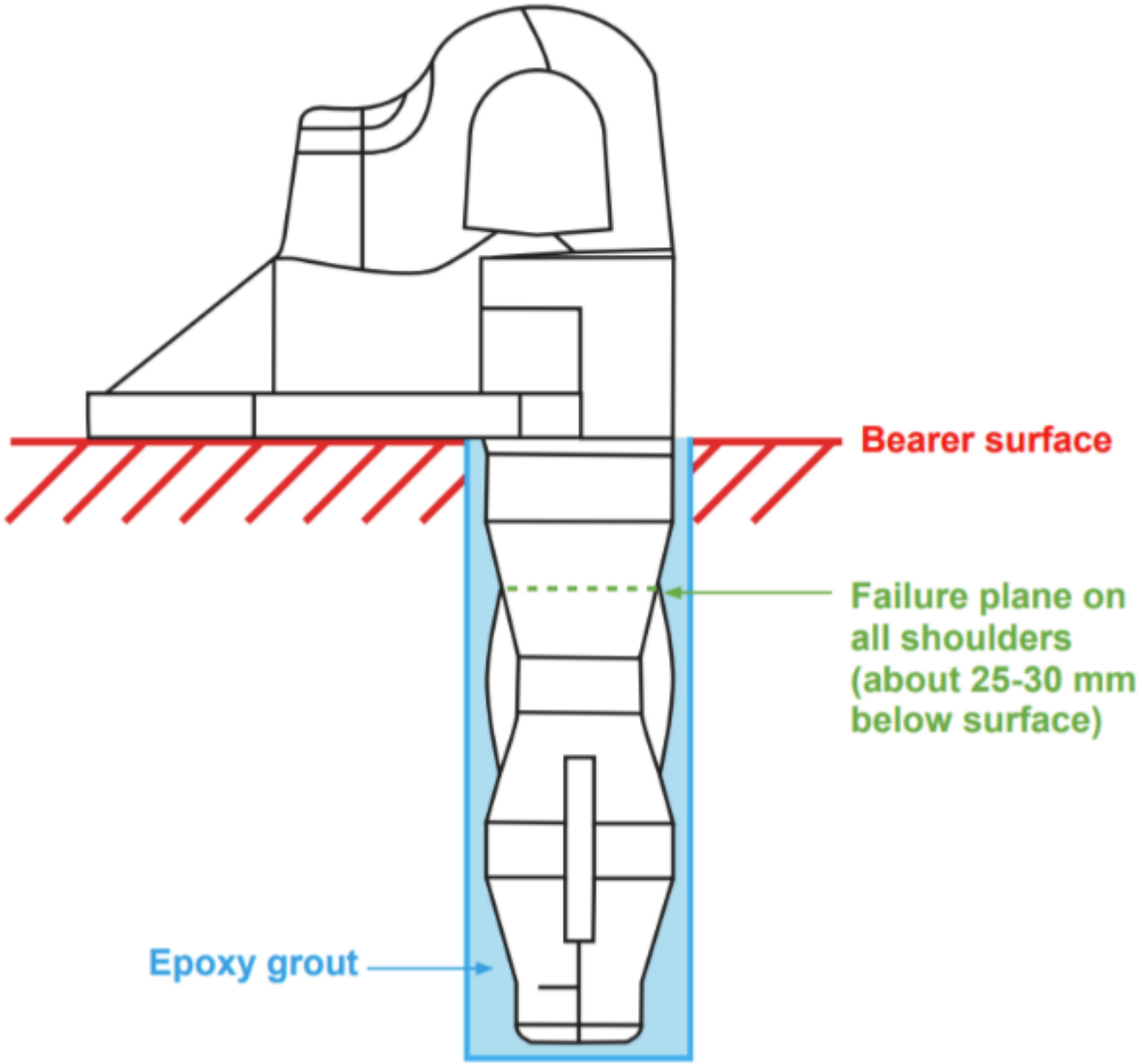
All of these investigations suggest that some in the rail industry may be forgetting the lessons learnt following the aforementioned Clapham accident.

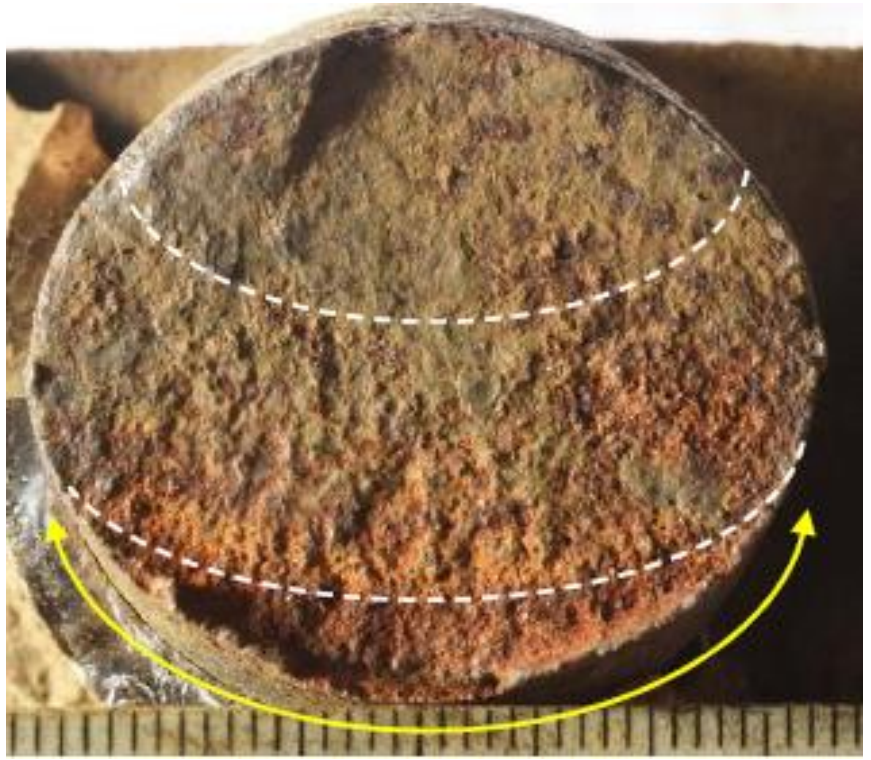
Eastleigh Derailment

Eastleigh Derailment



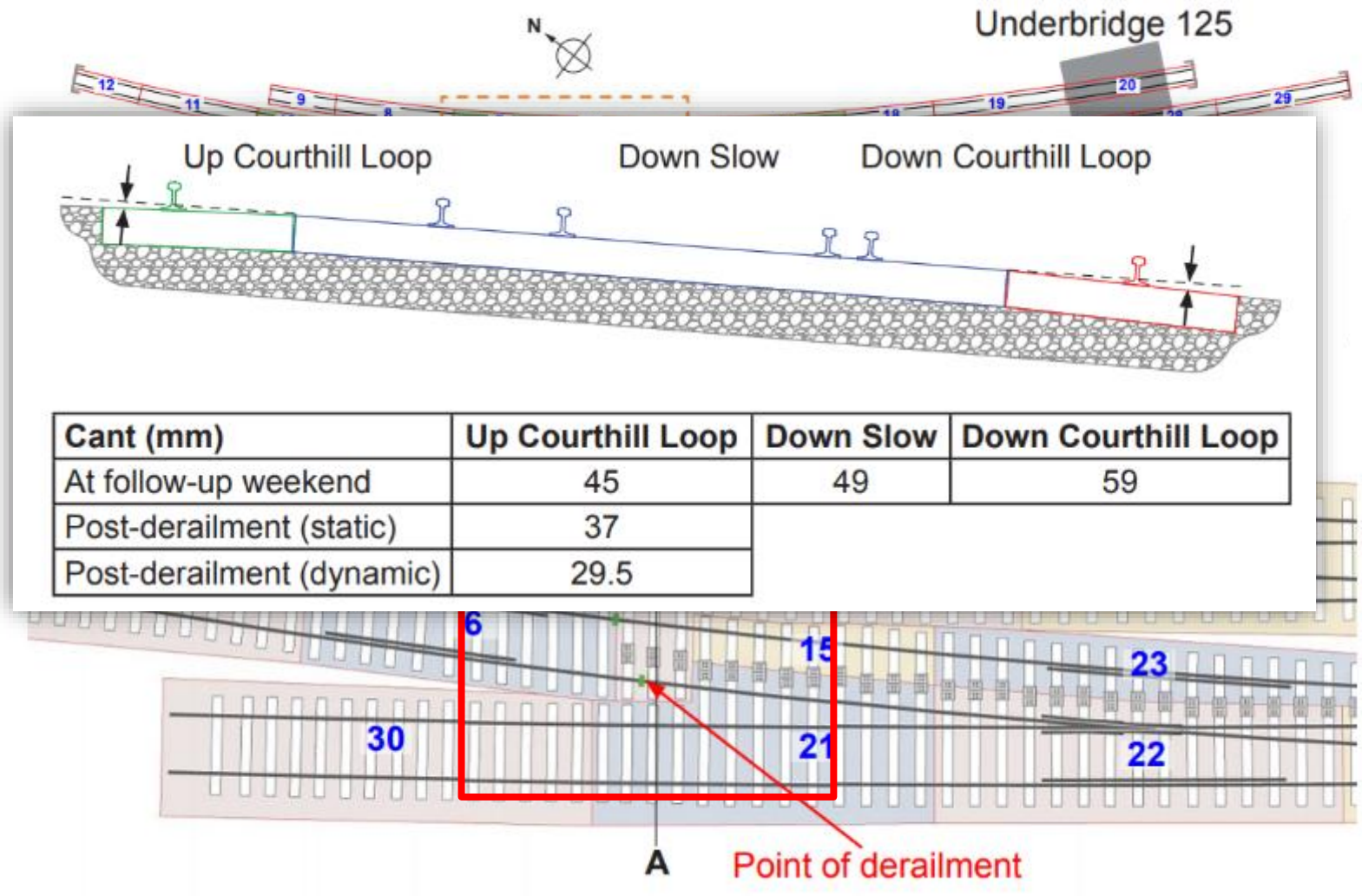
Eastleigh Derailment





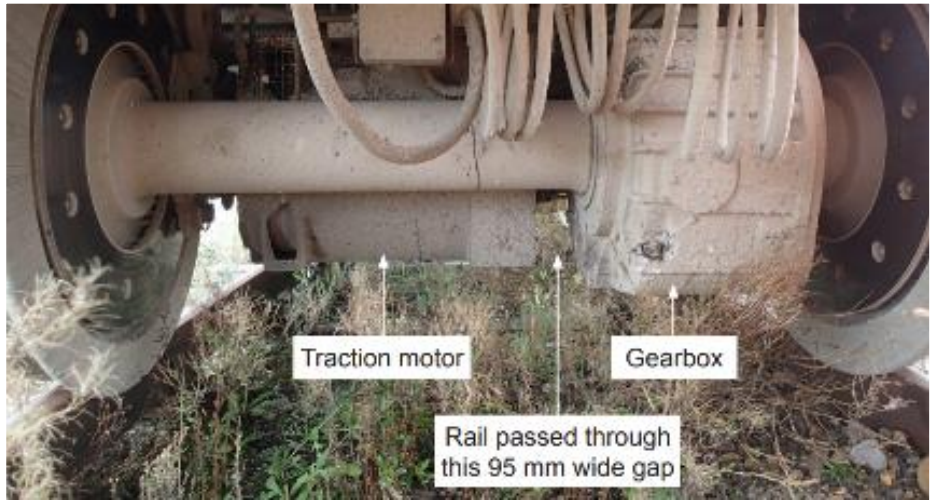
Lewisham Derailment

Lewisham Derailment



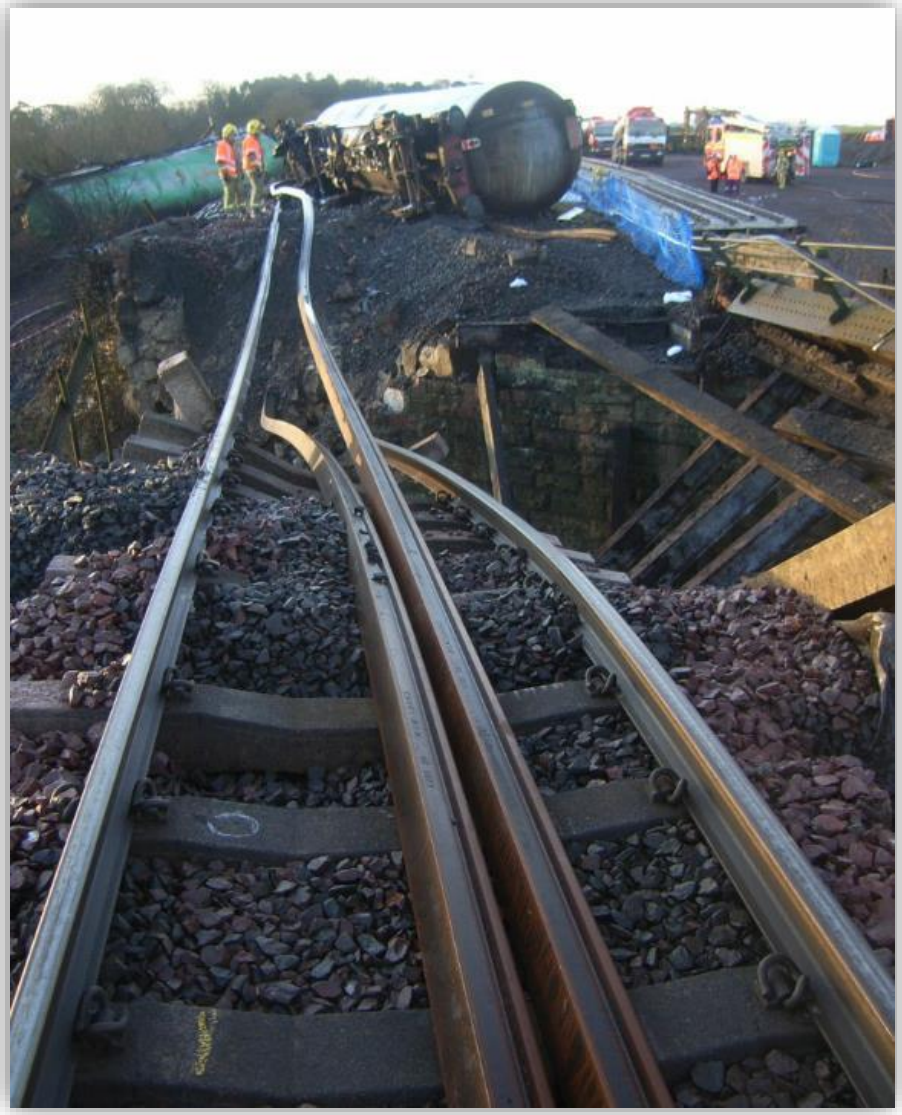
Cant (mm)	Up Courthill Loop	Down Slow	Down Courthill Loop
At follow-up weekend	45	49	59
Post-derailment (static)	37		
Post-derailment (dynamic)	29.5		

Watford Landslip, Derailment and Collision



Summary and general musings

- The site phase is the tip of the iceberg – the issues that lie beneath take much more time.
- In pure safety terms, you can learn as much from smaller incidents and near misses as a major one – harder to get people to take remedial action though!
- Many of the accidents investigated by the RAIB were not predicted as credible by any formal techniques applied by designers, maintainers or operators.
- Most investigations reveal how combinations of factors combined to create a dangerous event – including human factors.



Summary and general musings

- Investigations highlight the vulnerability of existing risk mitigation measures and assist the design of new measures.
- Investigations provide valuable intelligence to those with the responsibility for safety.
- Investigations demonstrate to those affected and wider society that action is being taken and lessons will be learnt.
- Investigations should be effective catalysts for change in the industry.
- A challenge for us all – how can we learn from the past, and then help those that follow us not re-make our mistakes?

RAIB

Rail Accident Investigation Branch

- Any questions?
- More information on all these incidents is available at raib.gov.uk, where you can also sign up for email updates and view all reports
- **jonathan.graham@raib.gov.uk**

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