Beyond Human Error

A HOF Approach to understanding incidents and controlling major risks

European Rail Safety Days, November 2021

Porto

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Introduction

- The link between ‘Controlling Major Risks’ and Human and Organisational Factors
- Three case studies:
  - Multi-SPAD signal
  - Increase in driver incidents over time in one depot
  - Multiple overspeeds through a PSR

How does including HOF in investigations contribute to controlling major risks?

- Questioning attitude
  - Avoid attributing incidents to simply ‘human error’. We question what may have influenced the error and how those factors can be addressed, rather than just focussing on the individual
- Resilience
  - Looking for system-wide factors which can be improved for the benefit of all end-users and in a range of conditions
- Risk awareness
  - Raising awareness of how people operate, and what can contribute to errors, creating major risks

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Case Study 1: Multi-SPAD Signal

- Three SPADs at this signal in 8 years
  - 2011, 2017, 2019
- Signal is on the approach to a loop platform
  - Signal at the end of the loop is approach controlled
  - Therefore, signal is usually encountered at yellow
  - Approximately once a day, a train crosses in front of a train scheduled to approach, so the signal is red

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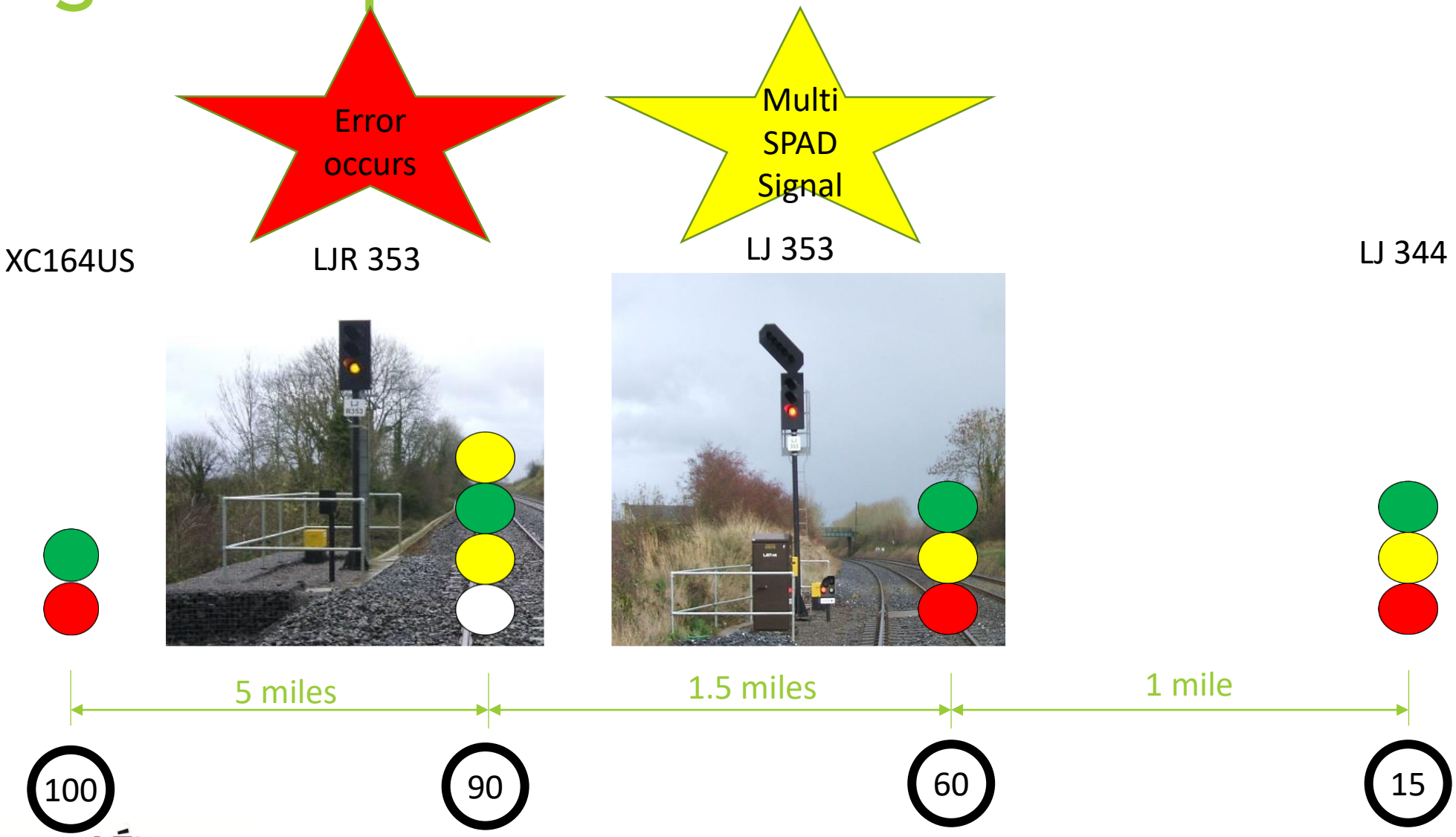
Signal Sequence



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Reports of SPAD investigations

- Causal factors included:
  - Drivers not reacting correctly to yellow signal aspects and CAWS warnings
  - Late braking due to distraction
  - Reliance on past experience
  - Issues with route learning
  - Lack of use of error prevention techniques

- All focussed on the individual errors made
- No insight into the specific risk at this location

HF Analysis Approach

- Based on the information contained with the existing investigation reports
- SPAD Hazard Checklist
  - Based on cognitive task analysis of the train driving task and a database of human factors SPAD hazards
  - 69 checklist items over 5 categories
    - Vigilance, Detection, Recognition, Interpretation, Action failures
- Accimap constructed for the 2017 event
  - Graphical method of analysing the systemic causes of accidents and incidents
  - Event is placed at the bottom and causes branch upwards

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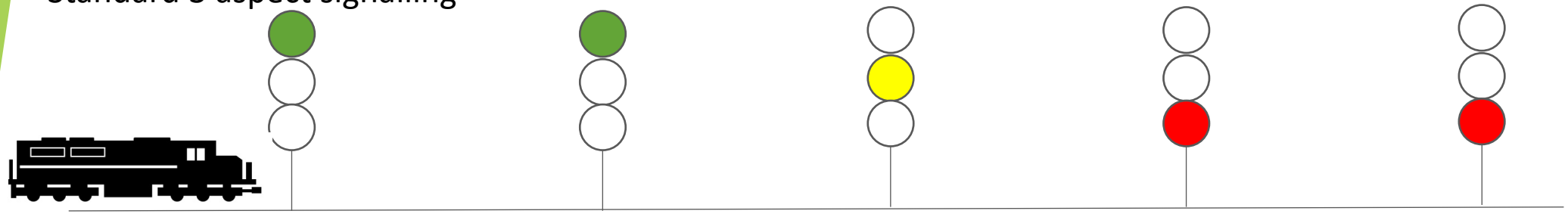
Unusual signalling sequence

Standard 3 aspect signalling



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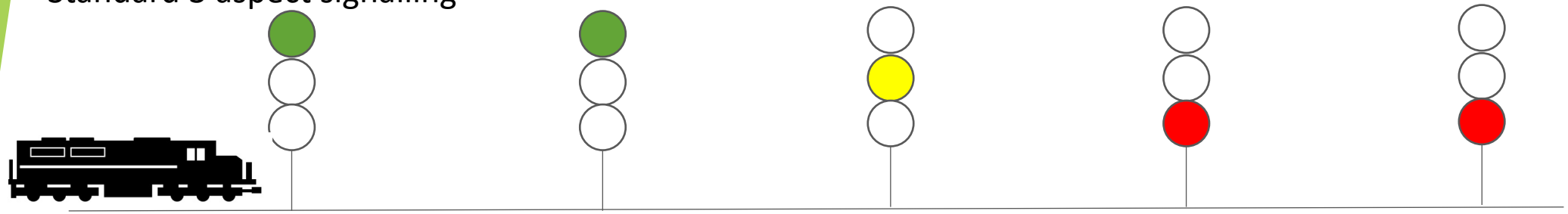
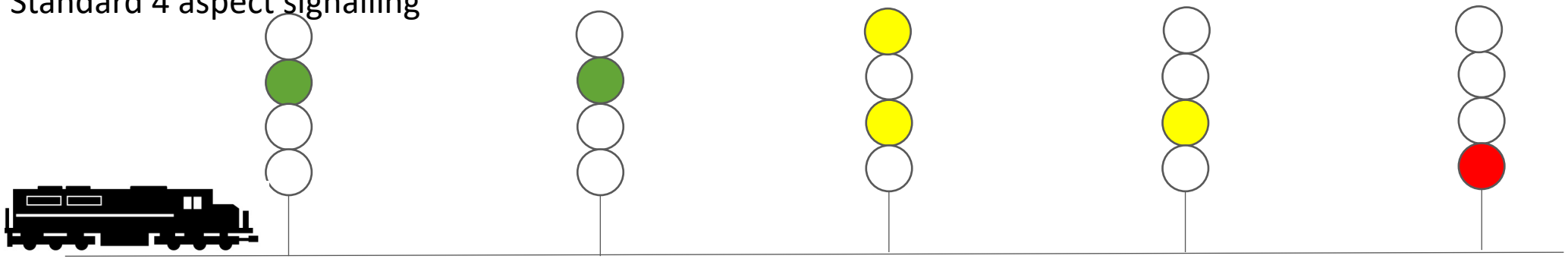
Standard 3 aspect signalling



Standard 4 aspect signalling



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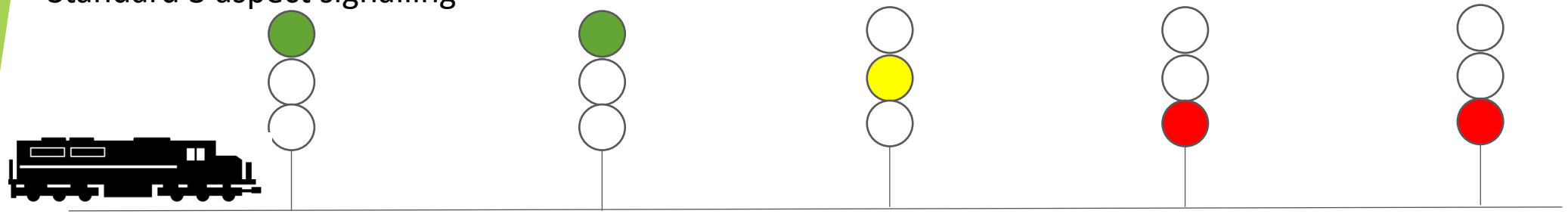
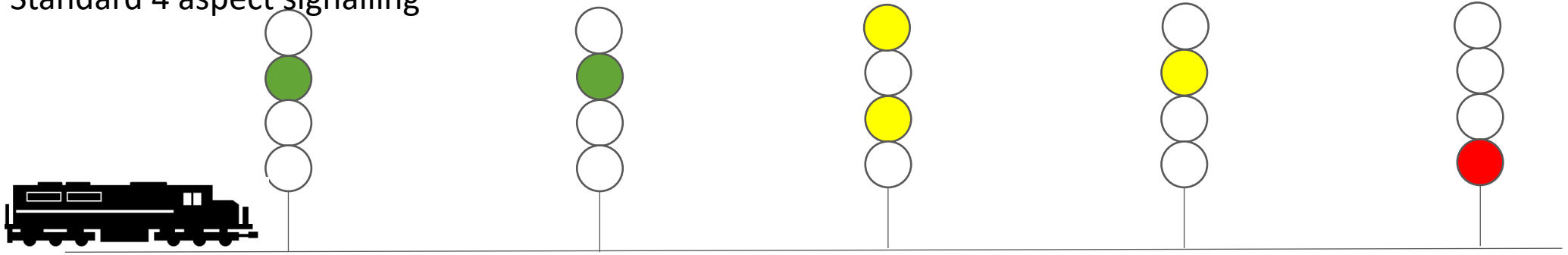
Unusual signalling sequence

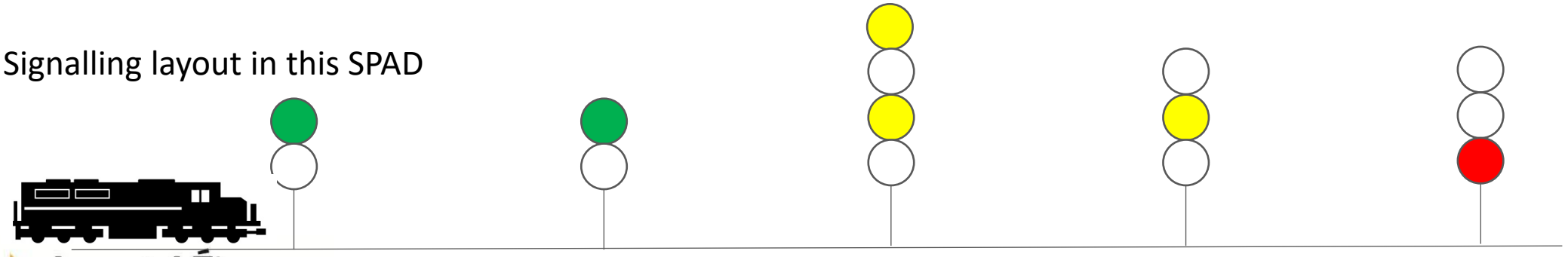
Standard 3 aspect signalling



Standard 4 aspect signalling



Signalling layout in this SPAD



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Factors identified as possibly contributing to the SPADs

- Approach control on the signal in the platform sets a strong expectation for the signal before the one SPADed to be a double yellow
- The isolated 4 aspect signal introduces the possibility to confuse which signal is red
- CAWS uses the same tone for yellow and double yellow aspects
- Restricted view of the SPADed signal limits the opportunity to recover from the error

Case Study 2: Increase in driving incidents

- Increasing trend in driving incidents identified in a depot
- Investigation report findings:
  - Provision of incorrect information (fail to call incidents)
  - Fog
  - Reliance on past experience
  - Non-compliance with rules
  - Non-application of non-technical skills
- Human factors support requested to determine whether there was any additional support that could be offered

Approach to HF Analysis

- Interviews with driver competence assessors and depot managers
  - Reported an increase in driver rest day working
  - Correlation between drivers having incidents and drivers who tended to work rest days
  - All internal rules around maximum days worked, hours worked, etc. were complied with
- Application of the Fatigue Risk Index (FRI) to actual hours worked
  - FRI is applied to the base roster, but this does not account for shift swaps or rest days worked
  - Hours for 6 drivers over 88 days were put through the FRI
    - 3 drivers tend not to work rest days
    - 3 driver tend to work rest days

Results

	Fatigue scores		Risk scores	
	Average	Maximum	Average	Maximum
Non-rest day workers				
Driver 1	10.2	21.2	0.9	1.1
Driver 2	8.4	25.1	0.9	1.2
Driver 3	5.9	12	1.0	1.6
Rest day workers				
Driver 4	11.8	25.5	1.0	1.4
Driver 5	9.2	25.2	1.2	2.2
Driver 6	9.6	20.5	1.1	1.6

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Case Study 3: Overspeed Analysis

- Increasingly using automatic detection of overspeeds through temporary and permanent speed restrictions
- Nine overspeeds were recorded through one PSR in 1 year
  - Other PSRs on the same track recorded no overspeeds
- Findings of investigations:
  - Lost focus and situation awareness
  - Did not use self-checking skills
  - Did not use error prevention techniques
  - Did not comply with the rule book

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HF Analysis Approach

- Cab-ride in each direction over the full route, and for each section of monitored PSR notes were taken on:
  - The length and permitted speed
  - The permitted speeds approaching the PSR
  - The railway features within the PSR, e.g. stations, loops, points, level crossings, signals, vegetation
  - Driver observations and behaviour

HF Results

Several factors identified which could contribute to the overspeeds

1. Underload – the only features through the PSR were two whistle boards
2. Speed differential – Speed through the PSR is 70mph, compared to line speed of 80mph
3. Lack of visual speed cues – PSR is situated in a bog with few trees or vegetation

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Discussion

- Questioning attitude: Developing a questioning attitude in relation to why multiple individuals make the same error is very important in understanding the risks to be controlled
  - Case study 1: Design of signalling system influences SPAD rates
  - Case study 2: Rostering system influences number of incidents
  - Case study 3: Track layout influences speed related errors
- Resilience: Finding system level interventions can help reduce the potential for errors
  - Case study 1: Change signalling standards
  - Case study 2: Recruit more drivers
  - Case study 3: Install additional speed sign
- Risk awareness: Raise awareness of how system design can influence error so that the importance of human centred design, and reporting, is realised

Thanks for listening

Q&A

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