voestalpine Signaling Fareham Ltd.

John Smith, CEO

September 2019

voestalpine
ONE STEP AHEAD.

RAILWAY SYSTEMS

PERFORMANCE ON TRACK®

Innovative System Solutions for Future-Proof Networks

voestalpine

ONE STEP AHEAD.

voestalpine Railway Systems

RETHINKING URBAN TRAFFIC SYSTEMS

Innovative and Intelligent Products, System and Service Solutions

Manganese Crossing

Plate Integrated Roller System

Axle Counter

Elastic Rail Fastening System

Point Machine with Internal Locking

Super Premium Rails

Diagnostic and Monitoring Systems for Track, Fixed Assets and Rolling Stock

3

» **Global market leader for railway infrastructure system solutions**

  » offering outstanding products, logistics and services for rails, turnouts, signaling and monitoring applications and the most extensive and integrated track portfolio

» **Founded on 160 years of experience**

  » pioneering technical expertise as well as engineering knowledge

  » our products and services result in outstanding benefit to our customers

voestalpine SIGNALING Fareham Ltd.

voestalpine

ONE STEP AHEAD.

voestalpine SIGNALING Fareham

» Fareham is our competence centre for railway infrastructure monitoring

» Over 20 years experience providing solutions to global customers

» Monitoring solutions across multiple asset types

   » Points, Track Circuits, Signalling power supplies (earth leakage), Points heating

   » Rail temperature, Level crossings, flood monitoring

   » Bespoke customer solutions e.g. platform screen doors

» Data acquisition inc. sensors, data loggers and network communication devices

» Roadmaster central server system for data processing and analytics, alarms, HMI

» Project delivery; 1 to >1,000 installations

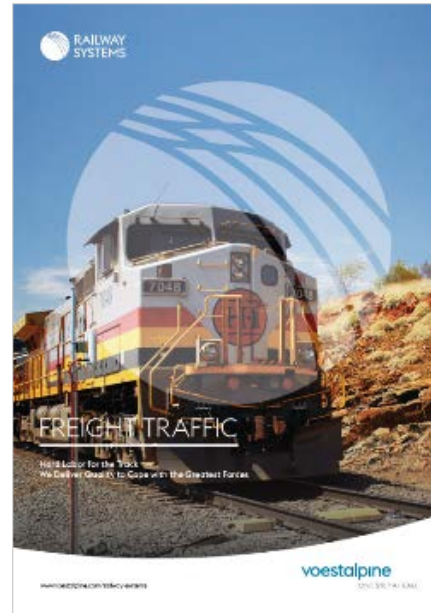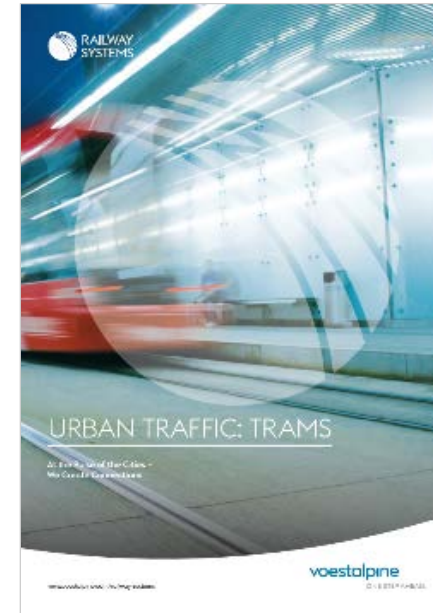» Expertise in business case development, industrialisation and benefits realisation

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Customer segments

HIGH SPEED Traffic	MIXED Traffic	FREIGHT Traffic	URBAN Traffic

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Global Presence

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N America
Calgary Transit
TTC Toronto
Metrolinx
Chicago Transit
NYCTA
Harris County
Metro
Mexico

S America
Sao Paulo
Ferromex

Europe
Network Rail
Bane Nor
Eurotunnel
Irish Rail
OBB
SBB
DB

Middle East
Doha Metro
RTA Dubai Metro
Etihad Rail

SE Asia
Hong Kong
Rapid KL
TRA Taiwan
LMRC

Australia
Sydney Trains
MTS
MTM
Adelaide Metro
V-Line
QR
PTA
Rio Tinto
ARTC
FMG

RAILWAY SYSTEMS

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Network Rail framework suppliers

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INTELLIGENT INFRASTRUCTURE
DELIVERING THE DATA-DRIVEN RAILWAY

Tim Flower, Head of Maintenance
September 2019

Britain's railway today

- Britain's railways are a remarkable success story – we are the fastest growing, and one of the safest and most reliable railways in Europe.

- Passenger numbers have doubled in the last twenty five years and are continuing to grow.

- We run more trains than Spain, Switzerland, Holland, Portugal and Norway combined.

- Network Rail employs 40,000 people across the UK, and supports 89,000 full-time jobs in our supply chain. The railway and its supply chain support 216,000 jobs across Britain.

- Network Rail continues to evolve to ensure the needs of our customers – passengers and train companies – are at the heart of what we do.

INTELLIGENT INFRASTRUCTURE
DELIVERING THE DATA-DRIVEN RAILWAY

Why do we need Intelligent Infrastructure?

- Large parts of the network are now full with no contingency for when things go wrong – disrupting our passengers.

- We are spending over £20 million every day just to operate, maintain and renew the railway, which in many places is still 50 to 150 years old, yet much more heavily used than it was originally designed for.

- A single fault at one place at rush hour can have a knock on effect to services hundreds of miles away, many hours later.

- We need to embrace innovation to deliver a better performing railway

INTELLIGENT INFRASTRUCTURE
DELIVERING THE DATA-DRIVEN RAILWAY

The asset management challenge

20,000 Miles of track

820 Signal Boxes

7,400 Commercial Properties

37,000 Bridges and Tunnels

23,000 Switches & Crossings
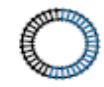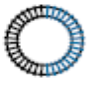
19 Managed Stations

6,700 Level Crossings

NetworkRail

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DELIVERING THE DATA-DRIVEN RAILWAY

Complexity of Physical Asset ↑		What is it & Where is it	Why & How does it Impact on Performance	When will it impact on Performance	What is the best treatment	What is the optimal advice - learning & AI
Network				Timetable Planning	Whole System Modelling	
Asset System	Schematics		Infrastructure Reliability Tool	Track WLCC Tier 2 model		
Discrete Asset						
Component	Historical Work Management System		E&P Decision Support Tool	Track Decision Support Tools		
		Descriptive Twin	**Diagnostic Twin**	**Prognostic Twin**	**Prescriptive Twin**	**Automated Twin**

Align compatible, real time, precise data

Increasing Complexity Of Digital Twin →

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DELIVERING THE DATA-DRIVEN RAILWAY

Developed from work for IAM Patrons, Kersley,T.(Network Rail), Foley,J (EAMS) & Pocock,D (Jacobs)

12

NetworkRail

Safe

- **10%** improvement in train accident risk
- **13%** improvement in level crossing risk
- **54%** improvement in Lost Time Injury Frequency Rate

Reliable

- **12%** improvement in delayed trains in 2019/20
- **28%** improvement in delayed trains by the end of CP6

Efficient

- **3.5bn** incremental efficiency savings between 2019-2024

Putting people first

- **50%** improvement in the number of women employed
- **25%** improvement in occupation related mental health absence

Environmental Impacts

- **25%** improvement in carbon emissions
- **18%** improvement in energy consumption

INTELLIGENT INFRASTRUCTURE
DELIVERING THE DATA-DRIVEN RAILWAY

The Journey so Far

ORBIS 7 years and 20+ projects

ORBIS was a **seven year, £330m digital transformation programme** designed to place quality asset data at the heart of decision-making in Network Rail.

CAPTURE

My Work Application
- > 14,000 devices deployed
- > 15 million work orders closed

Asset Data Capture
- > 155,000 signalling scripts completed (75% of assets)

Aerial Survey Data Capture
- Entire network viewable with high resolution imagery and LIDAR data (for surface and terrain modelling)

STORE

Asset Data Store
- Contains more than 2 terabytes of data
- Consolidates more than 20 source systems in to 1 place Provides the sole source of data into LADS
- Enables Decision Support Tool (DST) benefits in CP6

Geo-RINM Viewer
- 8,000 current users
- Will be available to external users
- 150 data layers of rail information
- Aerial survey imagery

EXPLOIT

Linear Asset Decision Support Tool
- Approximately 600 users
- Now includes Overhead Line Equipment

Operational Property Decision Support Tool
- £27.6m benefits realised

Signaling Decision Support Tool
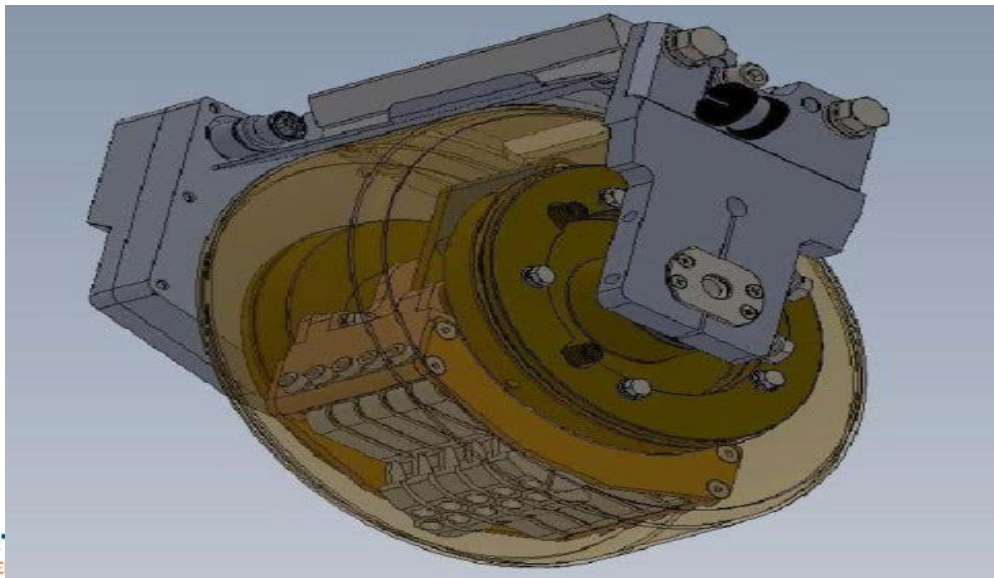- C. £39m benefits forecast

Track Decision Support Tool
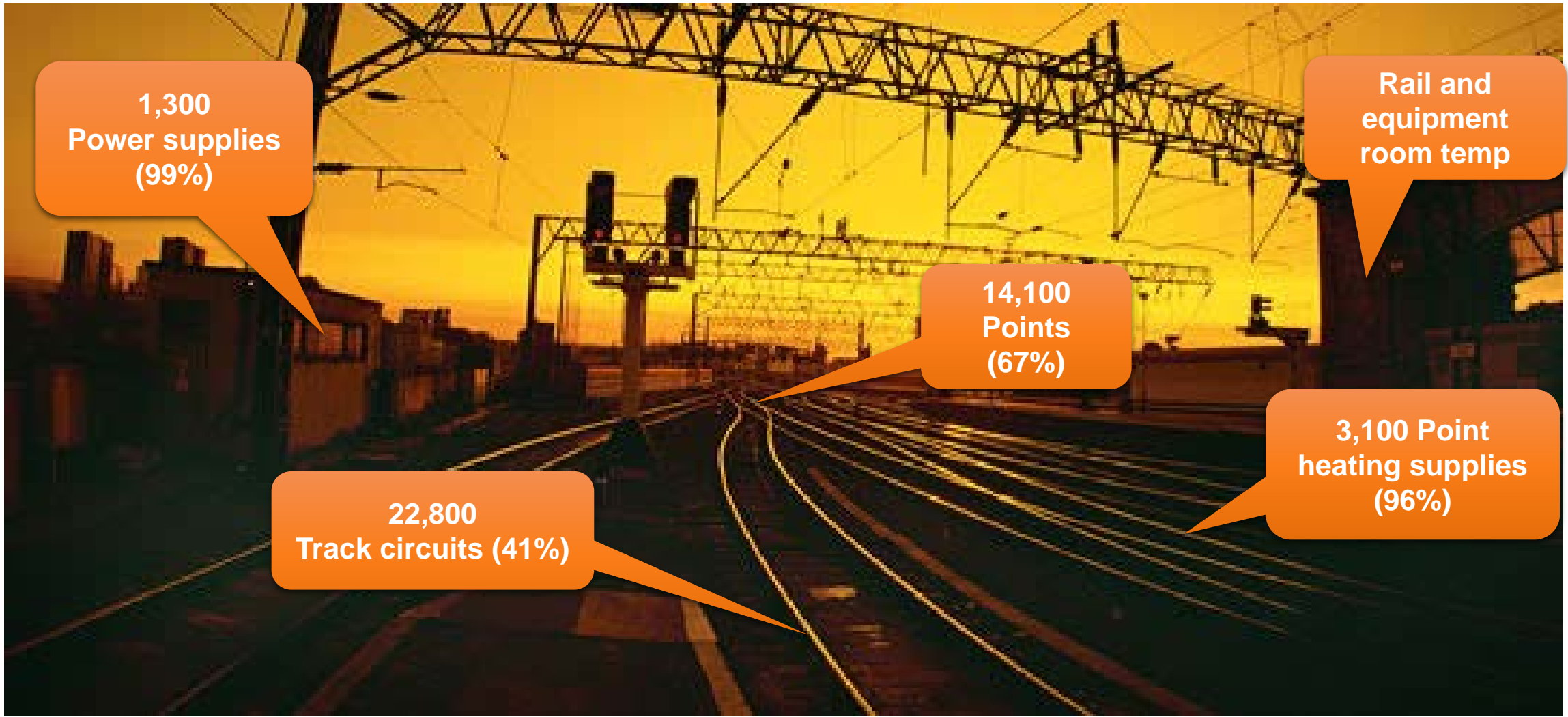- £32m benefits realised
- £52m additional forecast CP5

EP Decision Support Tool
- £0.5m benefits forecast

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DELIVERING THE DATA-DRIVEN RAILWAY

1,300
Power supplies
(99%)

Rail and
equipment
room temp

14,100
Points
(67%)

3,100 Point
heating supplies
(96%)

22,800
Track circuits (41%)

INTELLIGENT INFRASTRUCTURE
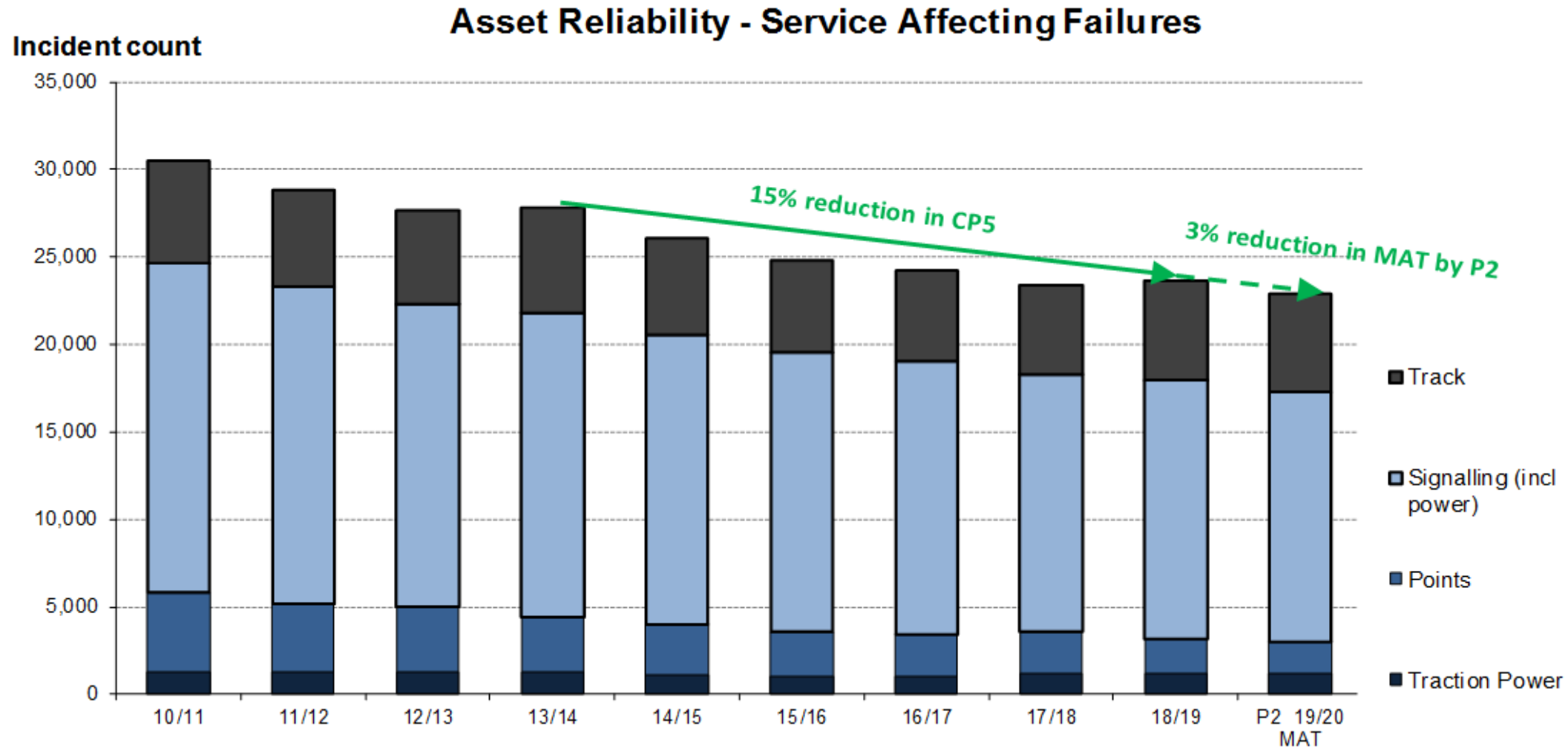DELIVERING THE DATA-DRIVEN RAILWAY

Broken rails – 1998-99 to 2018-19

NetworkRail

- In 2018/19 we had 93 broken rails, the lowest ever a compared to our previous best of 95 in 2016/17
- This represents a reduction of 90% in 15 years
- 50% increase in traffic over the same period with reducing access
- How do we achieve 50 by 2030? – 30 by 2050?
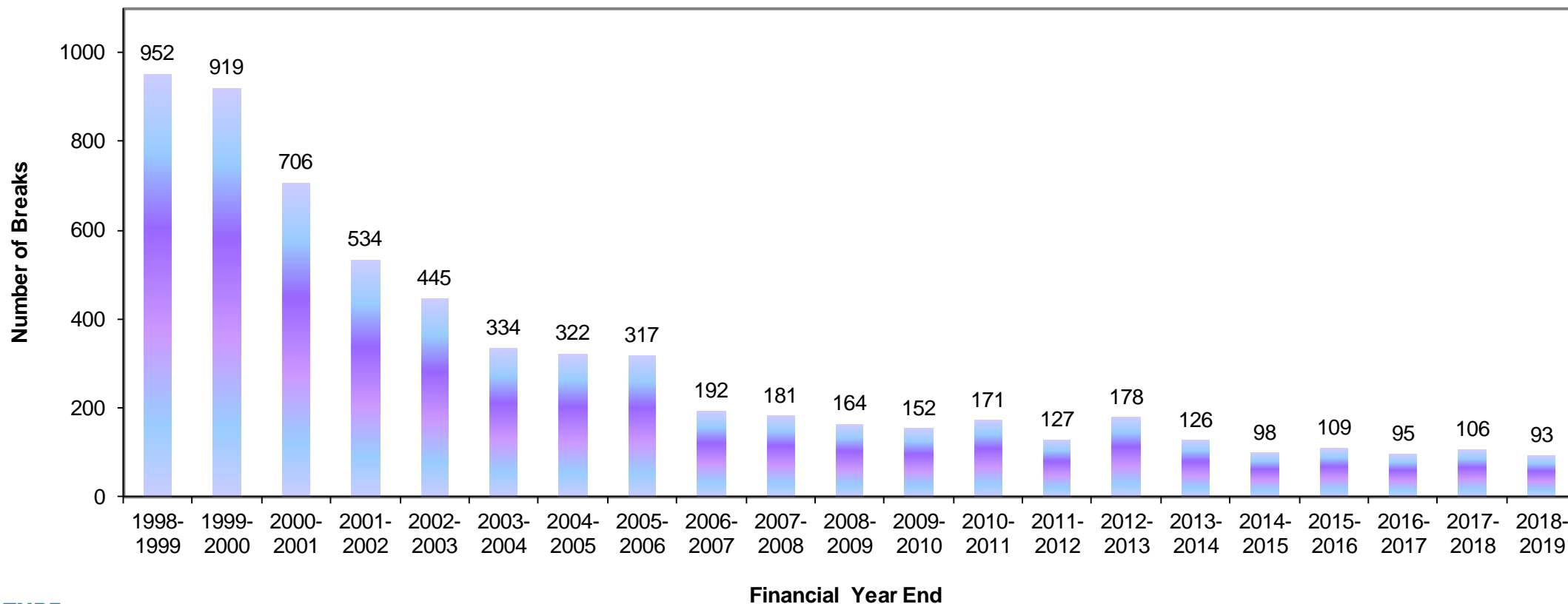
INTELLIGENT INFRASTRUCTURE
DELIVERING THE DATA-DRIVEN RAILWAY

Service Affecting Failures

Asset Reliability - Service Affecting Failures

"Delivering for passengers and freight by inspiring and collaborating across the rail industry to leverage data and emerging technologies"
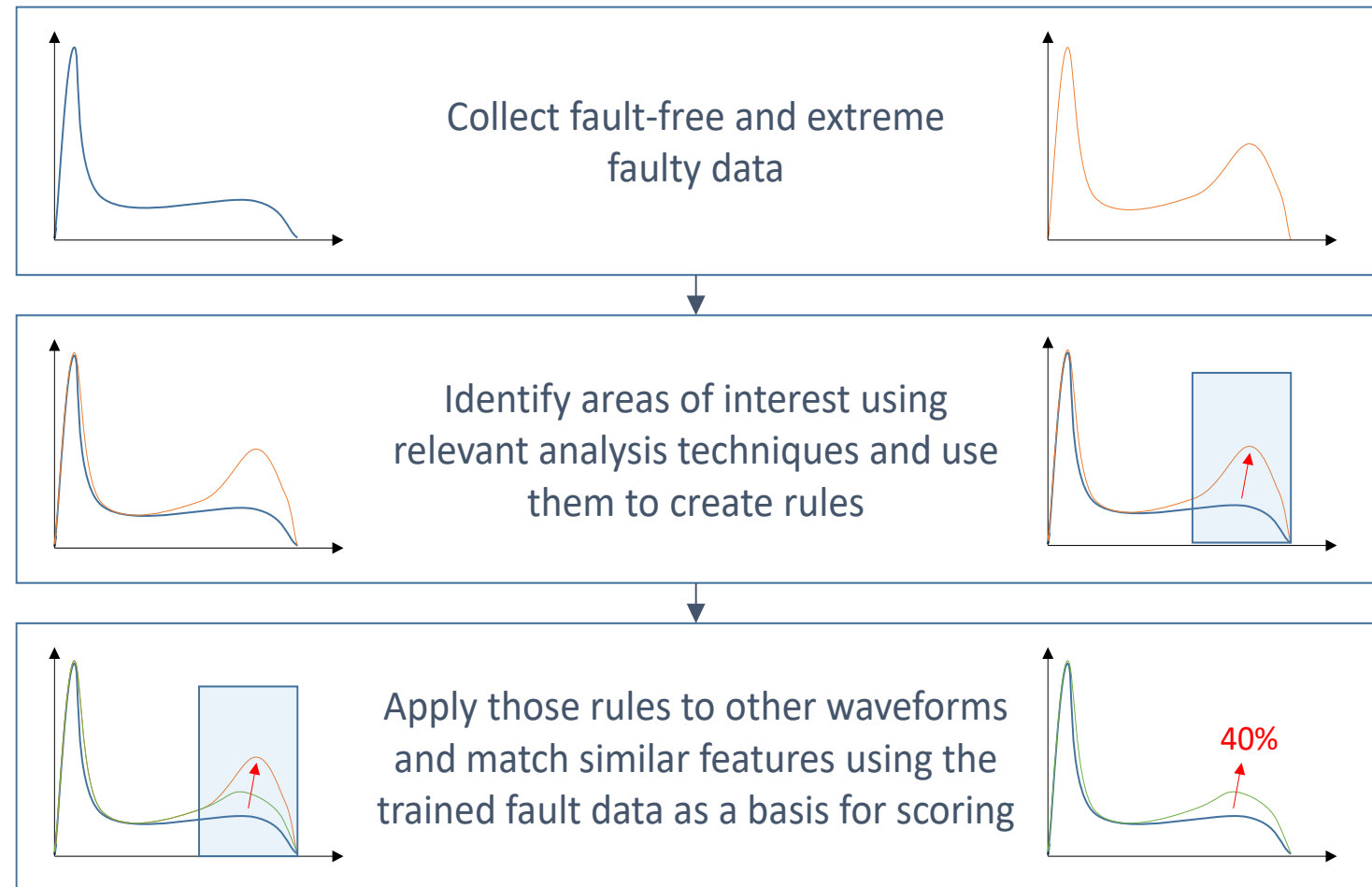
- **We want to:** move from time based, fix-on-fail maintenance, to intelligence-led predict and prevent regimes

- **We need to:** deliver for passengers and freight customers

- **We will do this by:** capturing, analysing and exploiting asset data to help the routes prioritise the most critical work

- **We are targeting:** 10% service affecting failure improvement

- **As a result we will:** safely and affordably improve asset management; reduce faults and service affecting failures; drive greater safety and availability of the railway
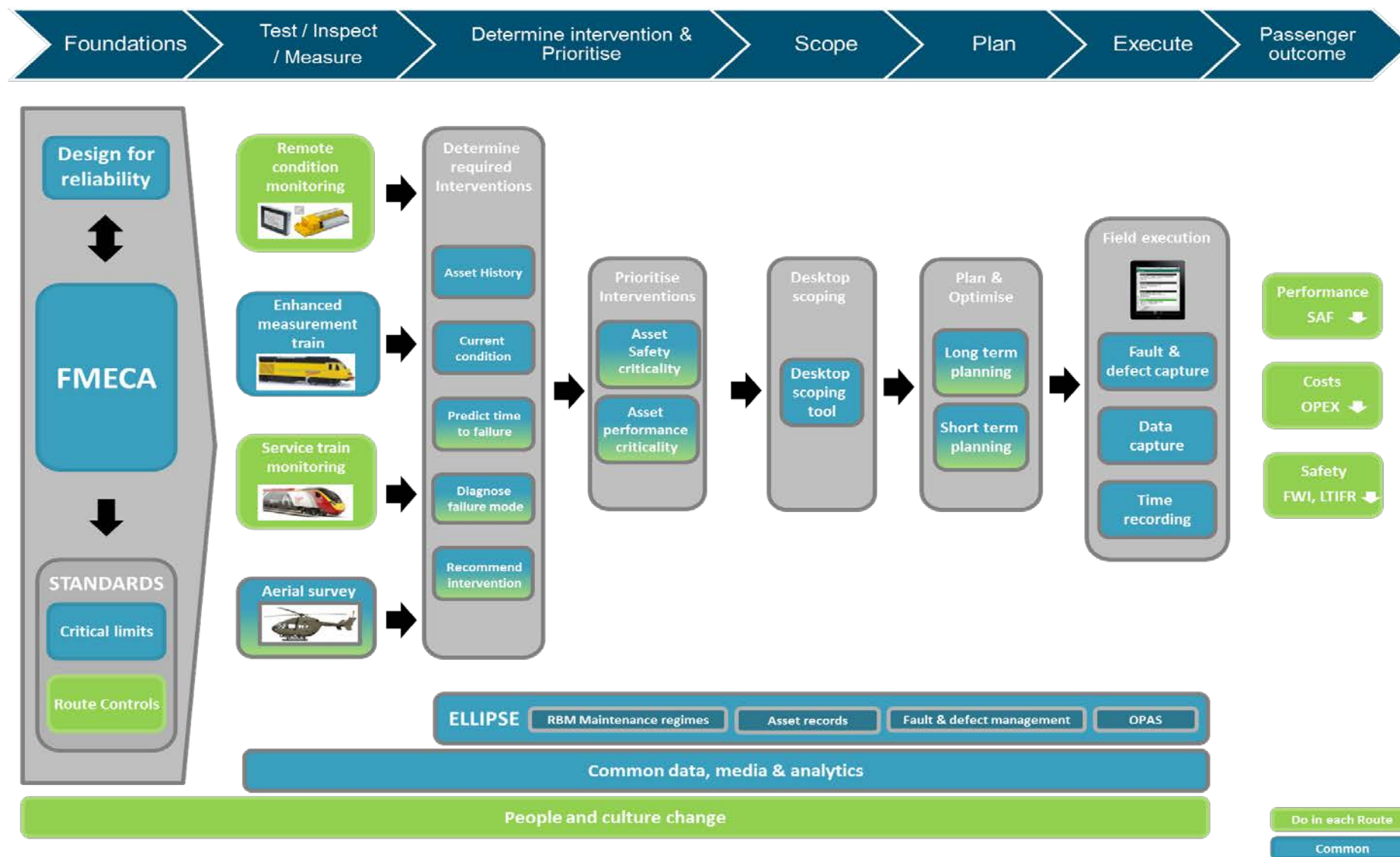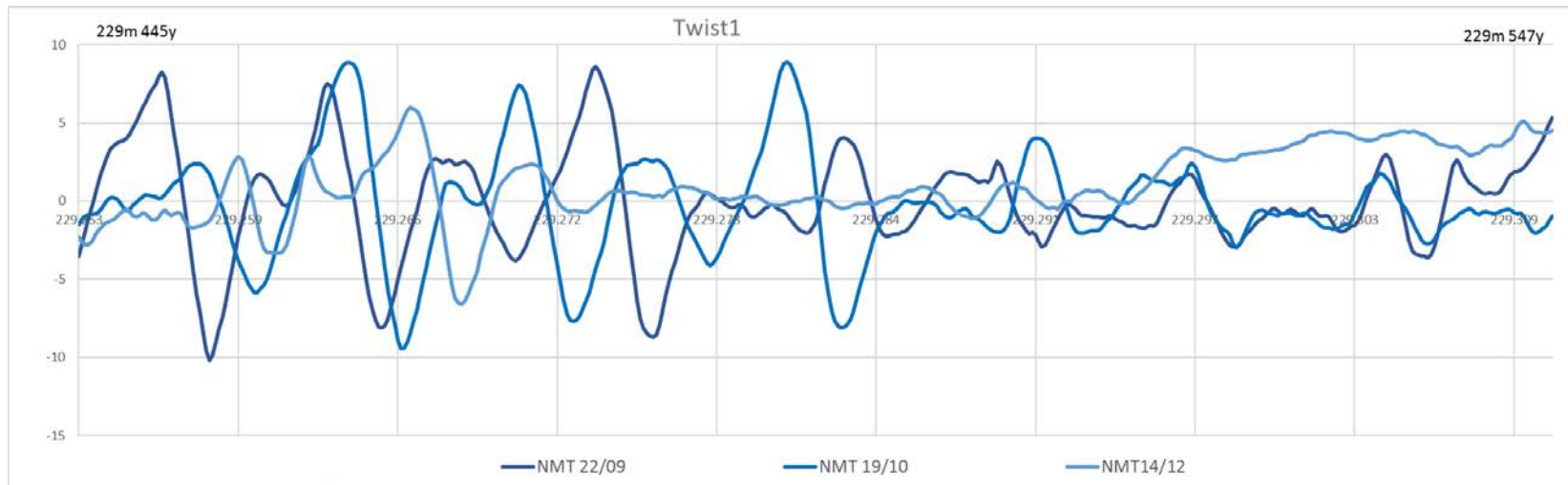
Predictive and diagnostic analytics

- Fault diagnosis for points and prediction of time to failure of track circuits

- Expert systems and machine learning for Points monitoring

- Bayesian Reasoning for track circuits

- All solutions have considered and fully tested human factors

- Deployment planned Mar 20

Collect fault-free and extreme faulty data

Identify areas of interest using relevant analysis techniques and use them to create rules

Apply those rules to other waveforms and match similar features using the trained fault data as a basis for scoring

40%

INTELLIGENT INFRASTRUCTURE
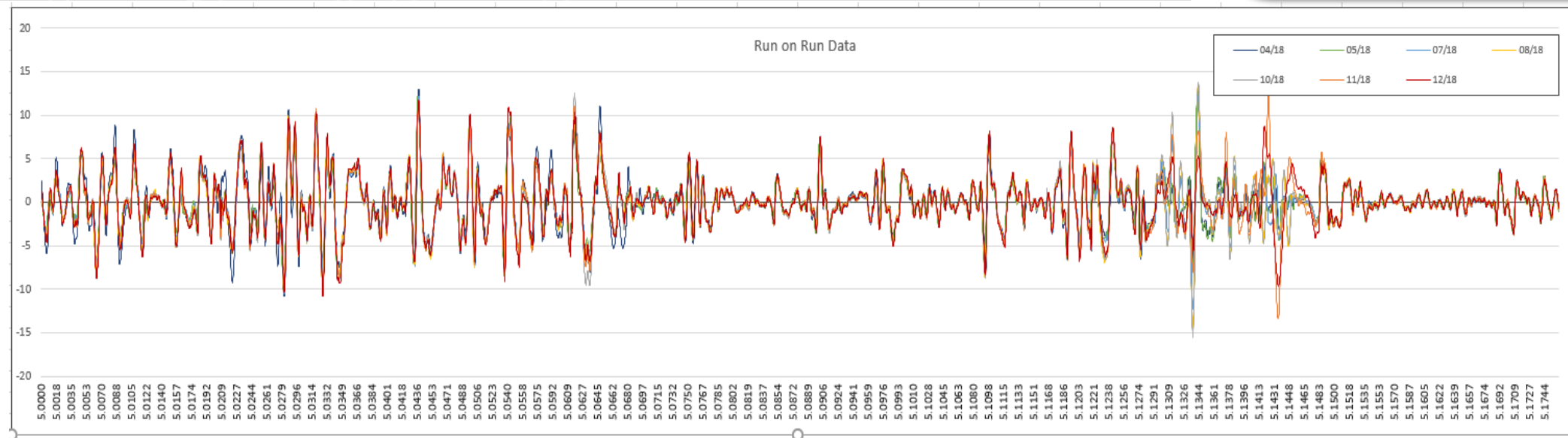DELIVERING THE DATA-DRIVEN RAILWAY

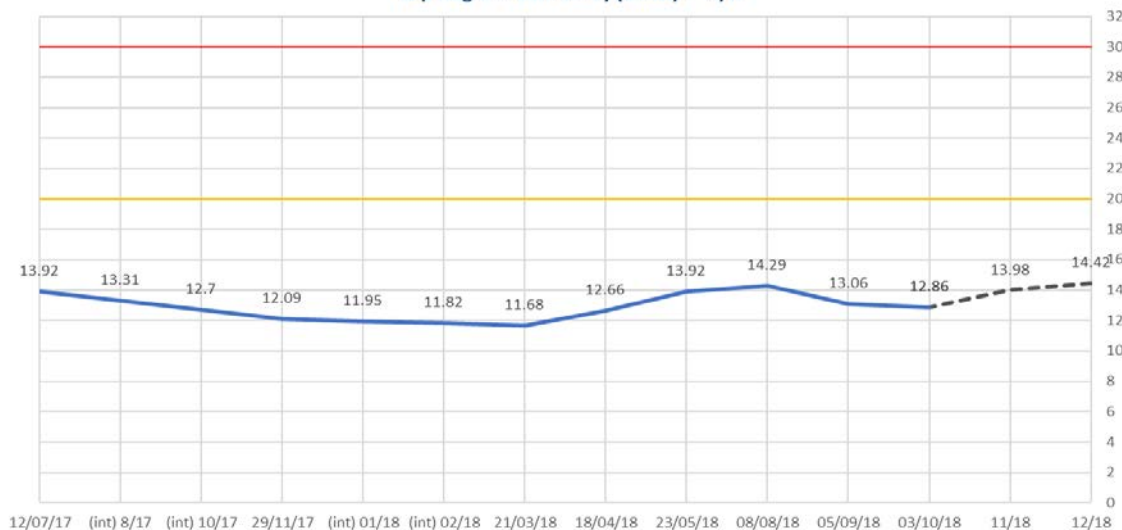# Alignment of track geometry traces

Algorithms developed to allow for alignment of multiple track geometry traces.

- Identification of Repeat Faults
- Run on Run trend analysis
- Identify track works and effectiveness
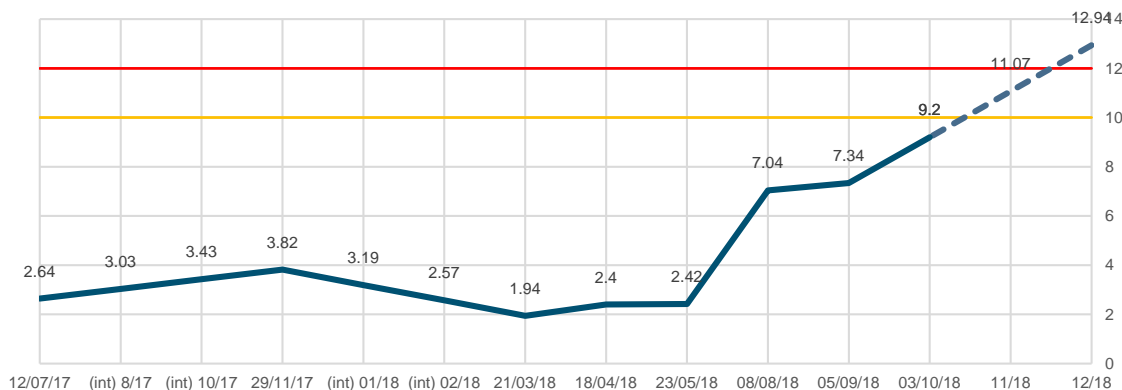- Network Model Changes.

Supporting risk based maintenance decision making

Dip Angle - 88m 30.4y (1.4ch) - N/A

Alignment - 88m 433.8y (19.7ch) - Embankment near River Evenlode

Algorithms developed to identify rates of change in TG measures.

- Track deterioration between train runs.

- Monitor issues over time

- Identify P – F curves

- Identify rates of change and predict when issues will become actionable.

- Define to maintenance when to intervene.

- Shift to intervention based on rates of change rather than set RBM levels.

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DELIVERING THE DATA-DRIVEN RAILWAY

NetworkRail

Improved workforce safety – better asset management to remove unplanned maintenance work.

Implement network-wide operating model, training and competency framework – driven by structured continuous improvement.

Maintenance work based on asset condition – using accurate data on degradation and failure rates (and backed by associated standards).

New products designed for reliable operation – failure modes removed; maintenance needs minimised.

Planned interventions based on asset degradation risk – reducing impact to passengers

Better knowledge of asset life and whole-life cost – supports improved renewal (and refurbishment decisions).

Long-term view drives whole-life cost modelling – supports accurate investment and funding decisions.

Planned and efficient work – clarity on access and resources needed.

On-board train monitoring – reducing costs and delivering real-time information to improve track geometry management.

All the data in one place – Ellipse captures complete picture of asset, work planned, completed and accurate failure diagnostics.

Aligned maintenance and asset management operation through ISO55001 – data recognised and managed as a critical asset.

Clear KPIs – driving 'predict and prevent' maintenance regimes.

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DELIVERING THE DATA-DRIVEN RAILWAY

Supporting today's engineers to make better decisions

Intelligent Infrastructure will drive the data-driven railway:

- Giving our engineers access to up-to-data on assets when and where they need it

- Supporting engineering knowledge with trusted data to make better-informed decisions

- Allow the routes to carry out 'predict and prevent' maintenance and renewals

- Move away from outdated 'fix on fail' regimes

- Understand what is likely to go wrong and when and the impact a failure will have on railway

- Intervene 'with the right work, at the right time, in the right place'

INTELLIGENT INFRASTRUCTURE
DELIVERING THE DATA-DRIVEN RAILWAY

Inspiring tomorrow's engineers…

Network Rail have established a team of early engagement leads from its routes and functions across the country to support the educational drive to promote science, technology, engineering and maths – STEM – opportunities for young people

The Intelligent Infrastructure programme will take a leading role in supporting this ambition by applying real-world experience for children to make the connection between STEM subjects and the new economy

Britain needs to prepare more young people to fulfil jobs and opportunities in STEM fields due to an aging workforce and to meet the needs of an increasingly innovative and data-driven world market

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