



# KONUX - AI IN TRACK MONITORING

Tim Flower: Account Director, KONUX

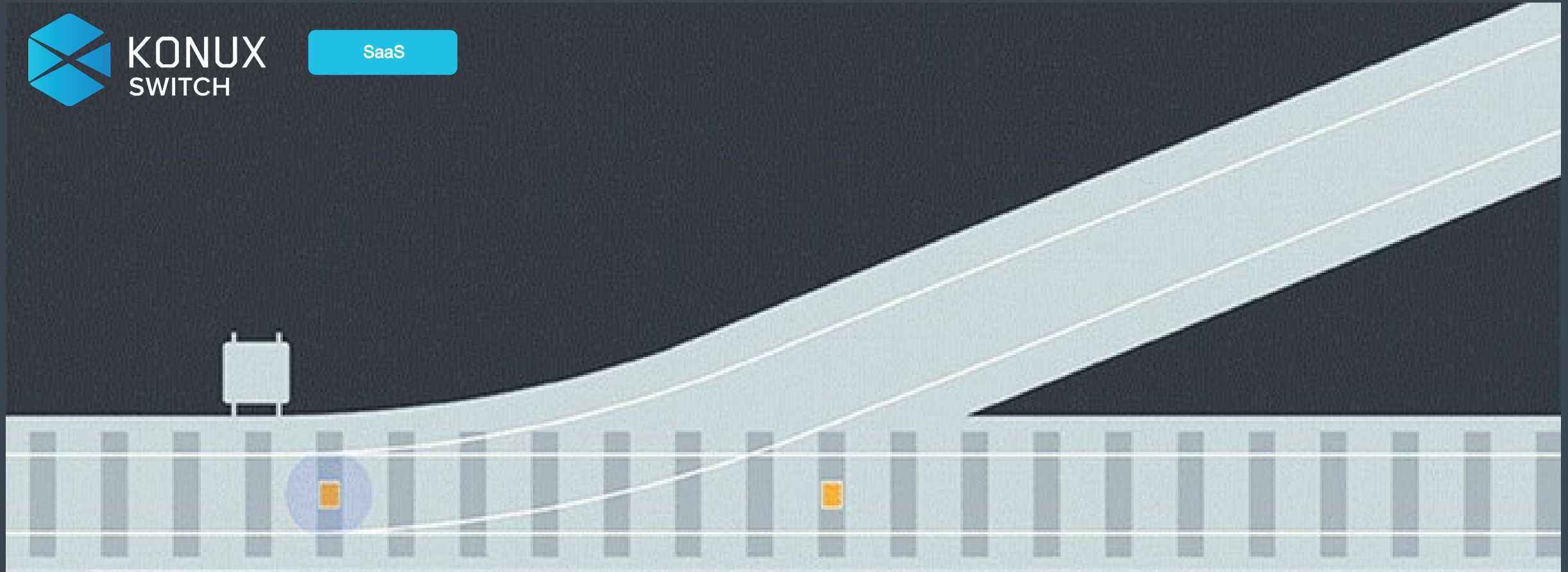
10 April 2025





KONUX  
SWITCH

SaaS



# WHY KONUX?

## SHOCK AND VIBRATION

In addition to void measurement, KONUX are the only supplier providing vibration and shock loading related insights

These insights identify **50% more** defects than voiding alone

## CROSSING DEFECTS

**80%** of broken crossings and **78%** of all closed crossing defects identified at least 28 days in advance

## DELAY MINUTES

**65%** of S&C delay minutes (including those occurring within the Points Operating Equipment) identified at least 28 days in advance

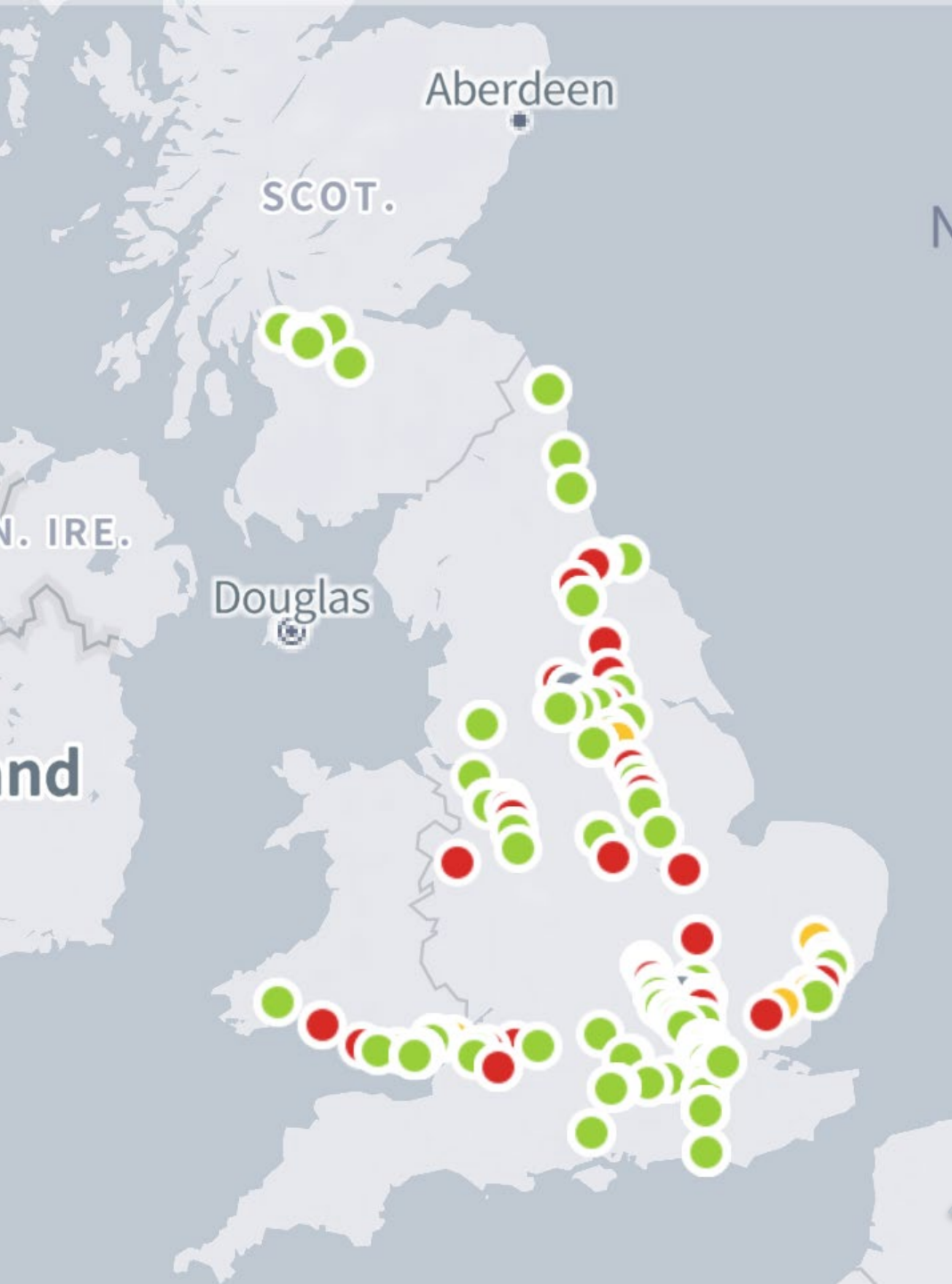
## MAINTENANCE EFFECTIVENESS

**100%** success rate of identifying unsuccessful maintenance

A significant number of interventions made the asset worse

Fitment supports Reliability Centred Maintenance regimes

If you only want to measure voiding there are several options- if you want all the above insights then you need KONUX



## KONUX Switch

# NETWORK RAILCOVERAGE

| Route               | Device volume | Pipeline | Overall total |
|---------------------|---------------|----------|---------------|
| Anglia              | 36            | 10       | 46            |
| Central             | 4             | 0        | 4             |
| East Coast          | 348           | 0        | 348           |
| East Midlands       | 42            | 141      | 183           |
| Kent                | 11            | 0        | 11            |
| North & East        | 82            | 0        | 82            |
| North West          | 20            | 20       | 40            |
| Scotland            | 223           | 0        | 223           |
| Sussex              | 184           | 0        | 184           |
| Technical Authority | 26            | 0        | 26            |
| Wales               | 155           | 0        | 155           |
| Wessex              | 42            | 0        | 42            |
| West Coast South    | 438           | 26       | 464           |
| Western             | 59            | 26       | 85            |
| Grand Total         | 1670          | 223      | 1893          |



# Crossing Health

## RELATIVE ACCELERATION

- We can't rely solely on **absolute acceleration** values
- Crossings by design have differing **wheel transfer lengths** and therefore differing rates of **load transfer**
- Absolute acceleration will vary even on **new crossings**
- **Sleeper type** and **train speed** are important factors

1 in 9.25



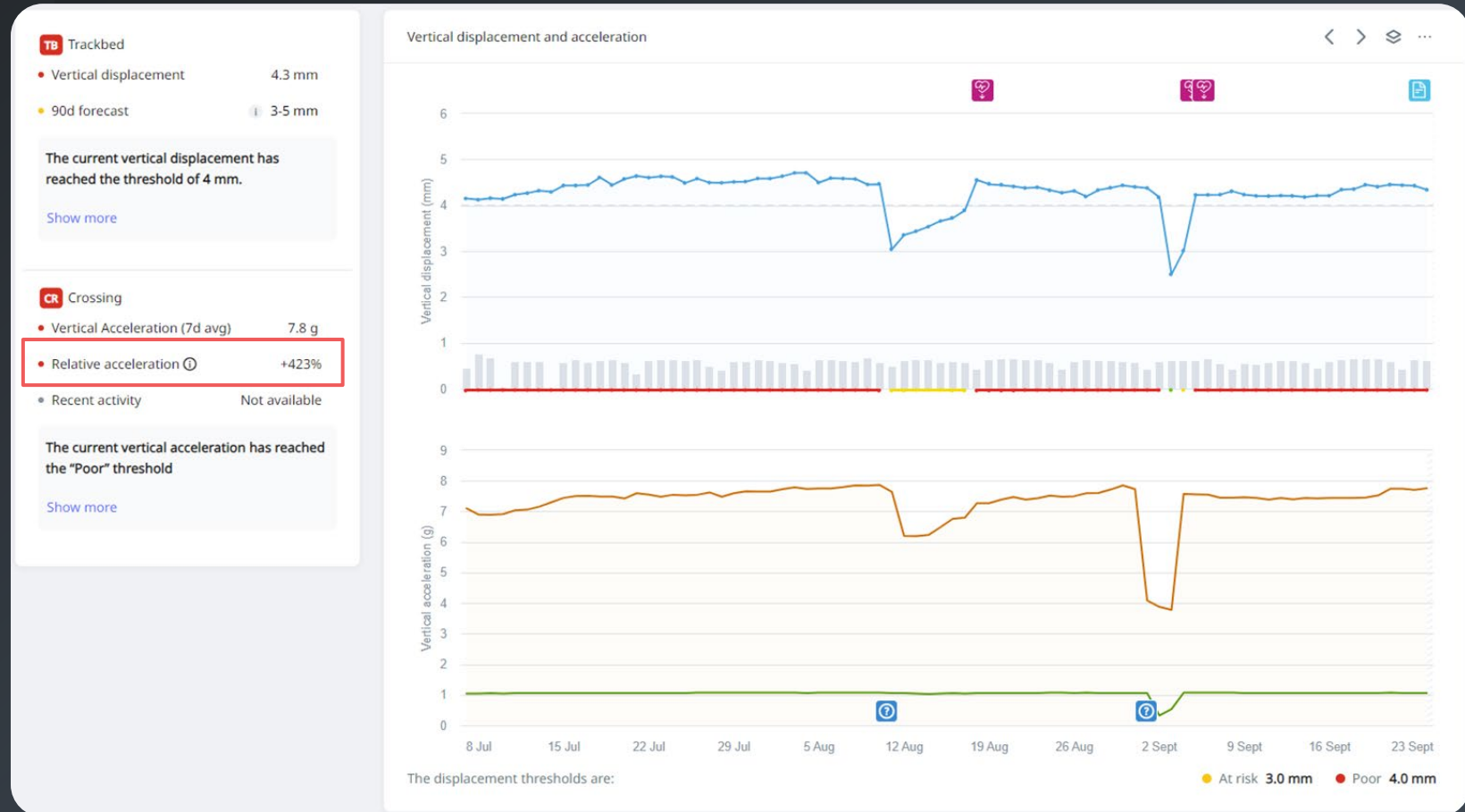
1 in 27



# Crossing Health

## RELATIVE ACCELERATION

- Moderate absolute acceleration of **7.8g**
- Very high relative acceleration of **+423%**
- Inspection indicated misshapen nose due to the **high impact forces** at the location
- Note the **relatively low** vertical displacement values

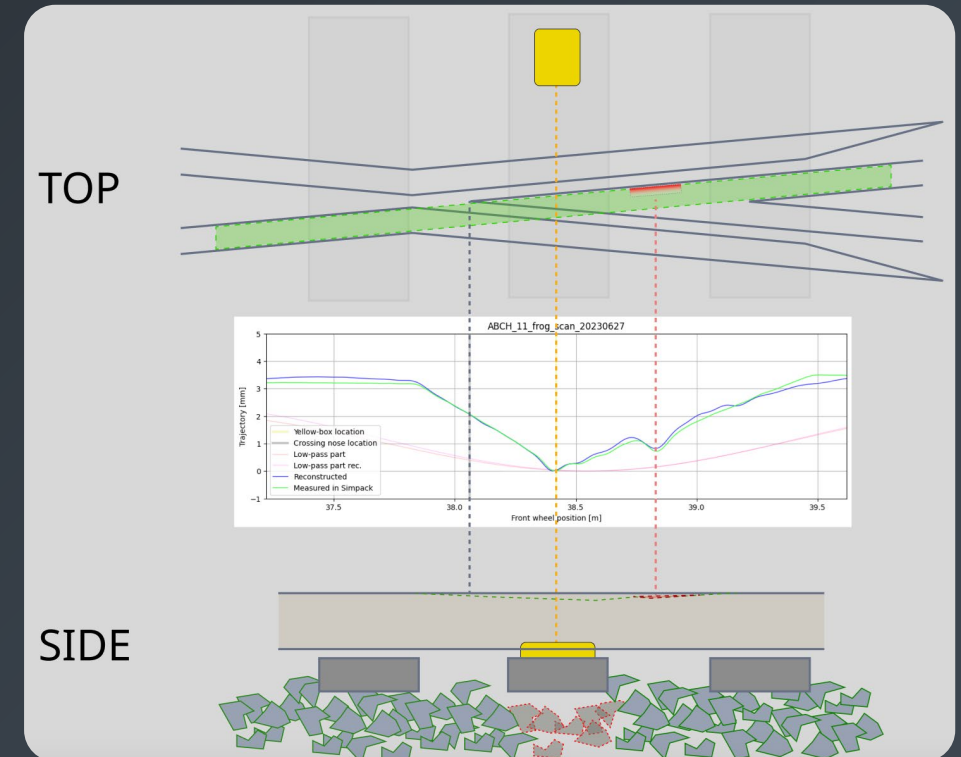
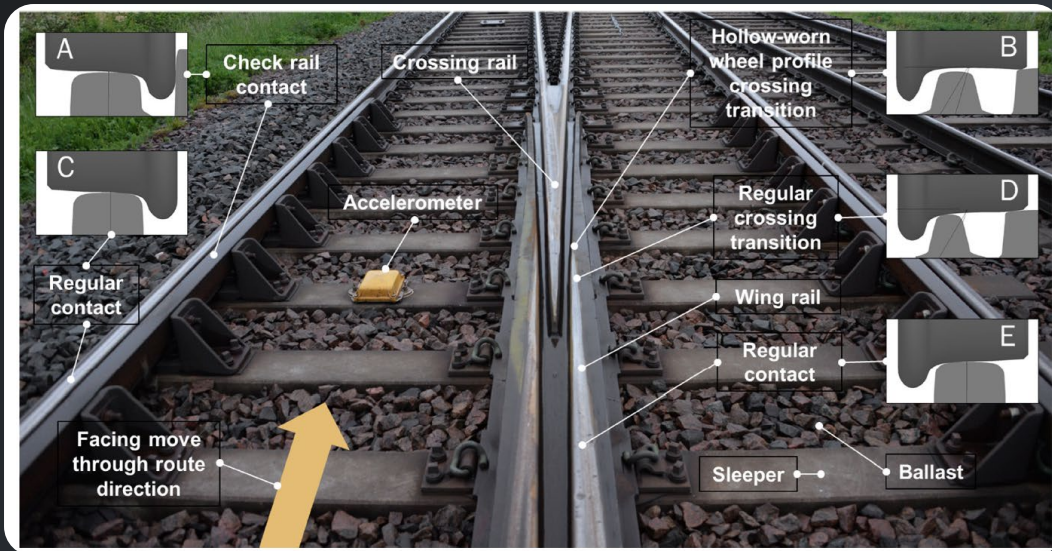




# The KONUX Crossing Health model

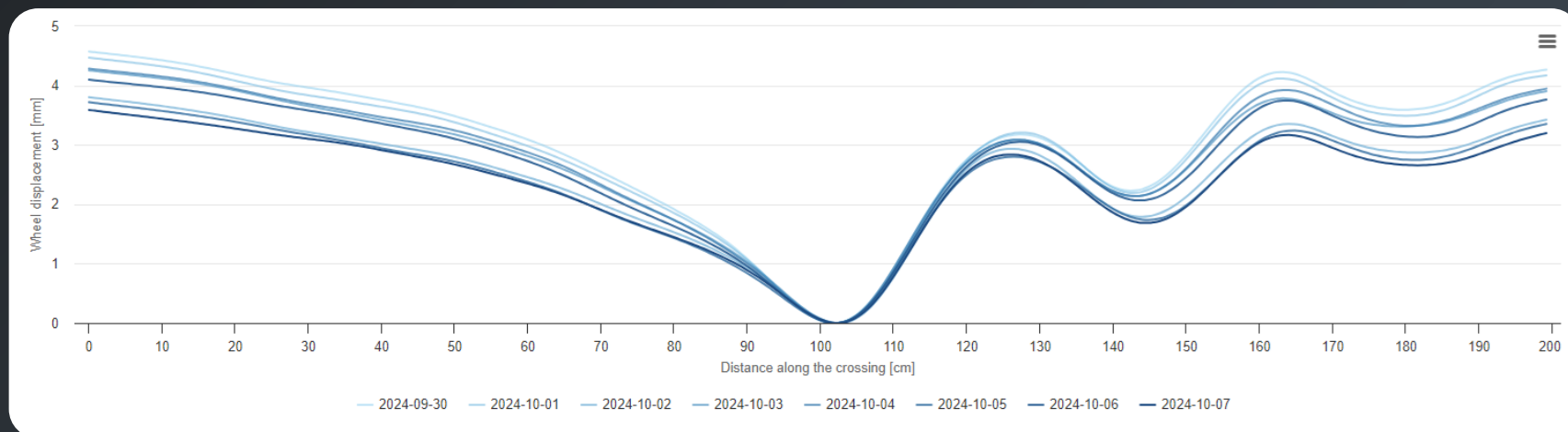
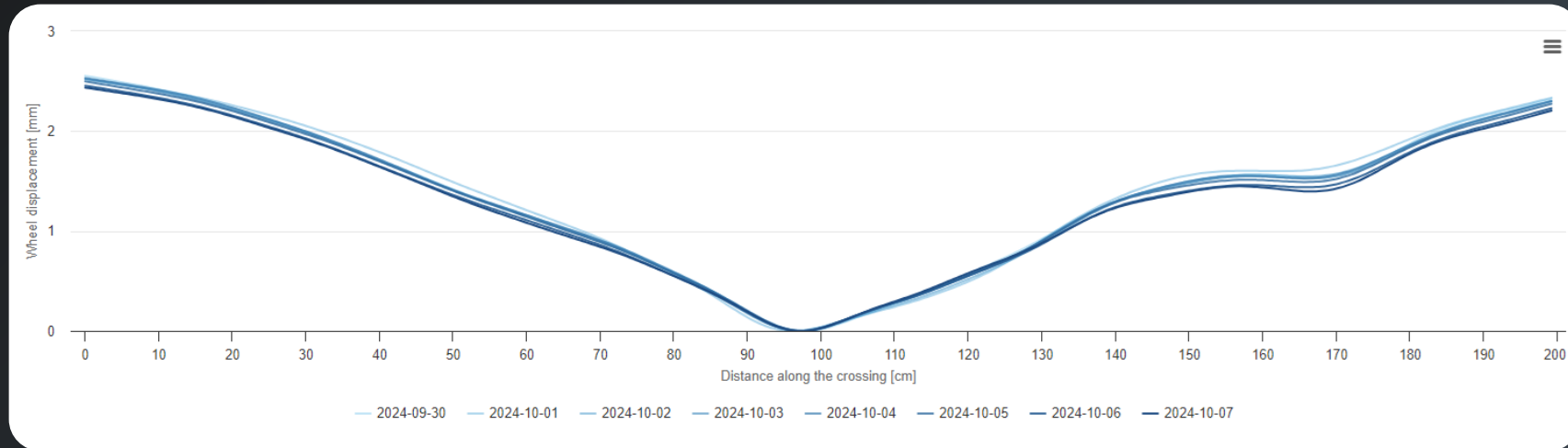
## WHEEL TRAJECTORY RECONSTRUCTION (WTR)

- To further enhance the model, what about if we could give insights into specific **rail head condition** and **impact force** of the wheels themselves?
- Application of a kinematic model combined with the **existing acceleration** data from KONUX devices can now be used to provide relative **wheel trajectory reconstruction**



# The KONUX Crossing Health model

## WTR EXAMPLES



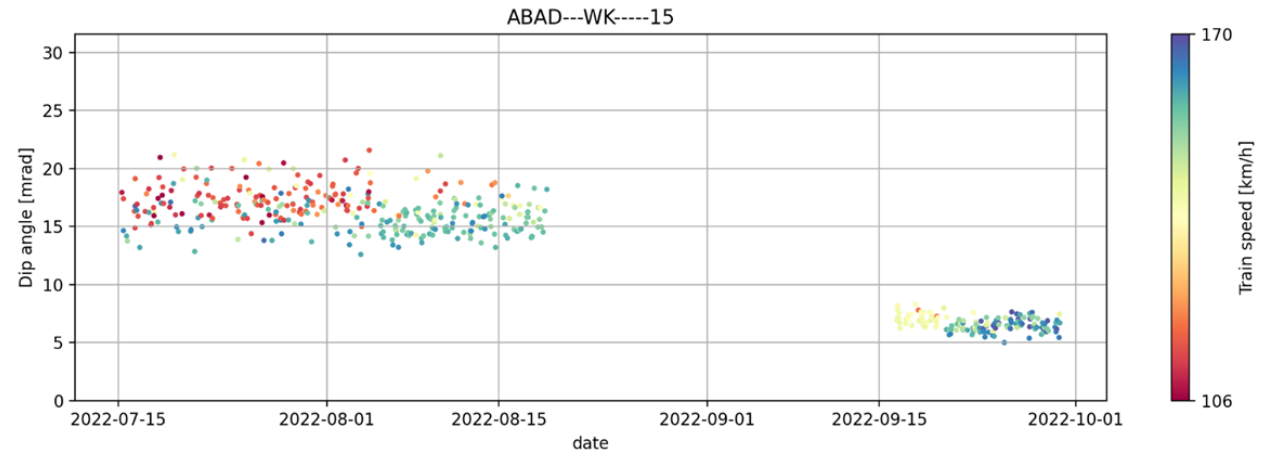


# The KONUX Crossing Health model

## WTR NEXT STEPS

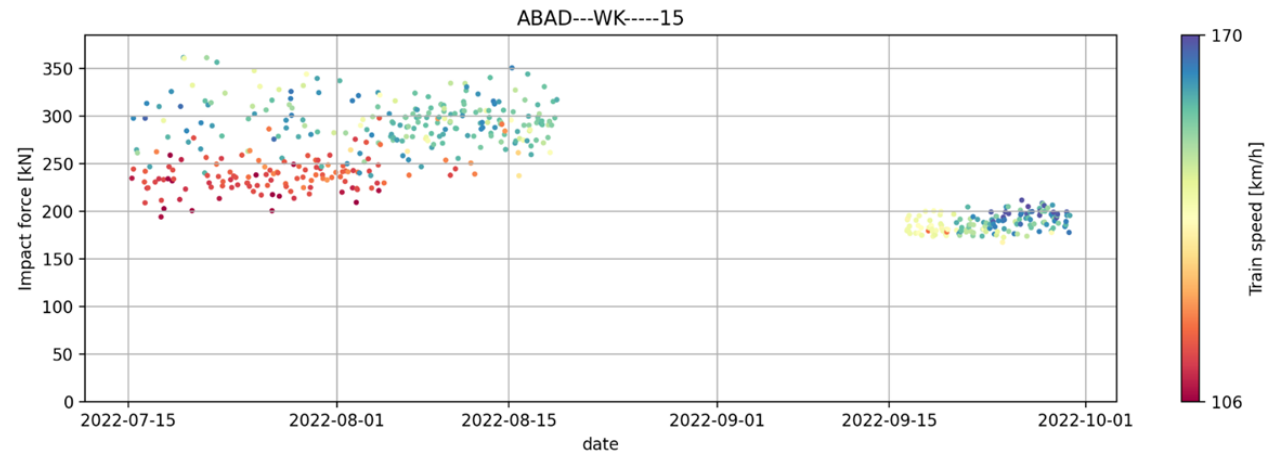
### Dip Angle

To align with existing standards and understanding of condition



### Impact Force

For use in future remaining useful life models



3rd party integration: One Big Circle

# VISUALISE OUR INSIGHTS WITH REAL TRACK IMAGERY

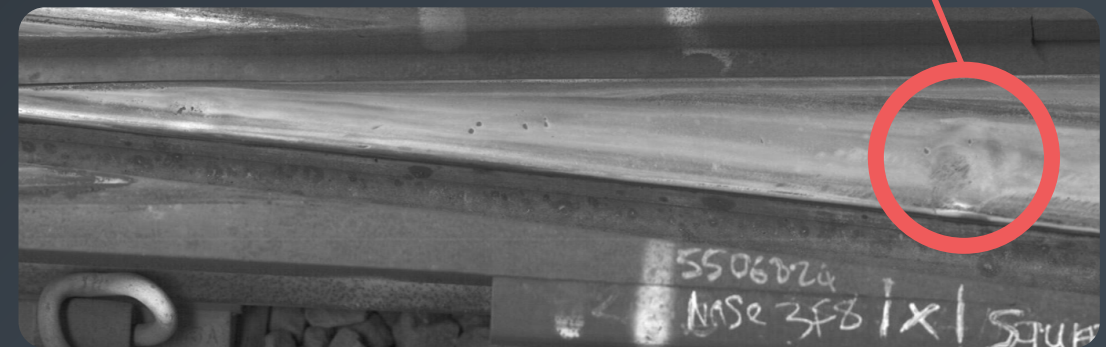
Visualise defects predicted by our models

Improved Decision Making

Reduced travel and operational costs

Streamline maintenance efforts

A step towards reliability centred track inspection



# Automated Reliability Centered Track Inspection Business Case | Vision

Rob Lacey: Principal Engineer, Eastern Region, Network Rail



“No boots on ballast for Track inspection

by the end of this control period”

## Why is this important:

- 1 Improve trackworker safety by removing requirement for physical inspections
- 2 Better utilisation of data to apply the correct intervention, reducing the risk of failures and therefore improving on safety & performance
- 3 Reduce the current costs incurred with track inspections, improve productivity and track monitoring by introducing affordable technology

*Having the right **digital tools** to **empower** people to make the **right decisions** before **asset failures***





# Automated Reliability Centered Track Inspection Business Case | How can we achieve this?



# Track Focus – Business case overview: inspection programme interface

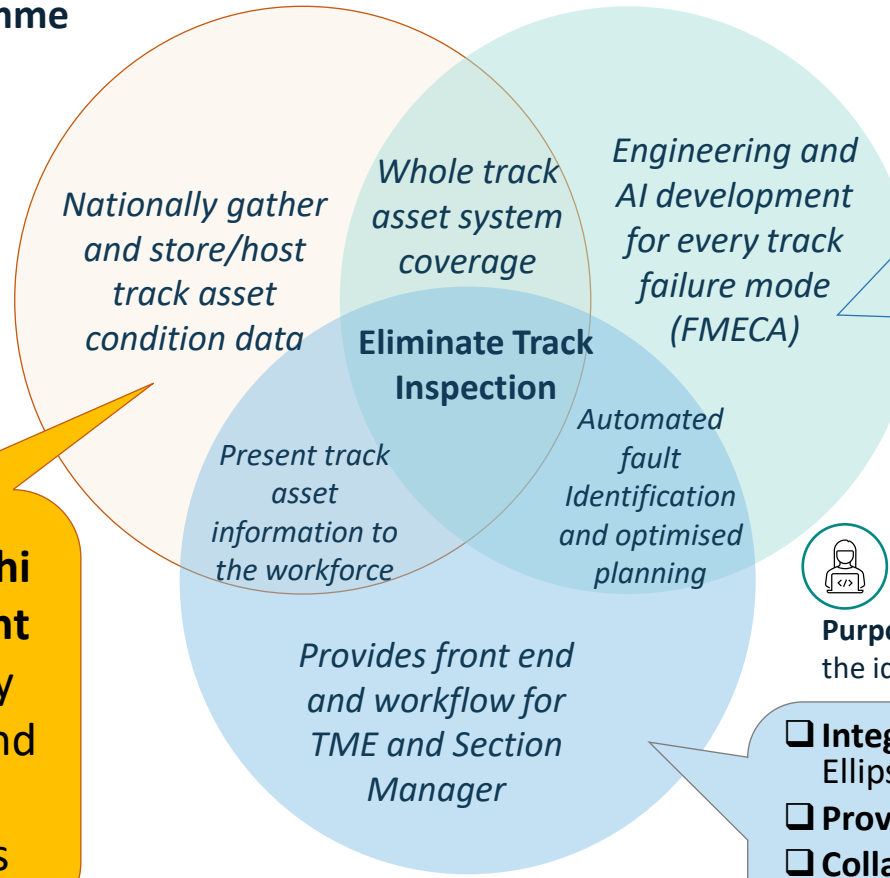
NR inspection programme interface with our Enterprise Asset Management system (EAMs) II Insight. This diagram shows how ARC will effectively drive enhanced inspection regimes and predictive maintenance in line with our existing business systems and the IM programme



## IM Programme

**Purpose:** Provide the right Track asset data at the right intervals to allow the business to make informed asset management decisions

**VIU and Hitachi camera fitment** provides early deployment and sandpit opportunities



## Automated Reliability Centered Track Inspection (Business Case)

**Purpose:** To provide a comprehensive way to identify pre-cursors to functional failure of the track system and remove boots from ballast

- ☐ Automatic identification of potential failures through updated standards to remove traditional action tables
- ☐ Defect specific failure prediction, enabling optimised planning and reduction in SAFs
- ☐ Applying analytics and data to establish RBM regimes
- ☐ AI predictive maintenance of degradation rates (predict & prevent)
- ☐ Automated root cause analysis

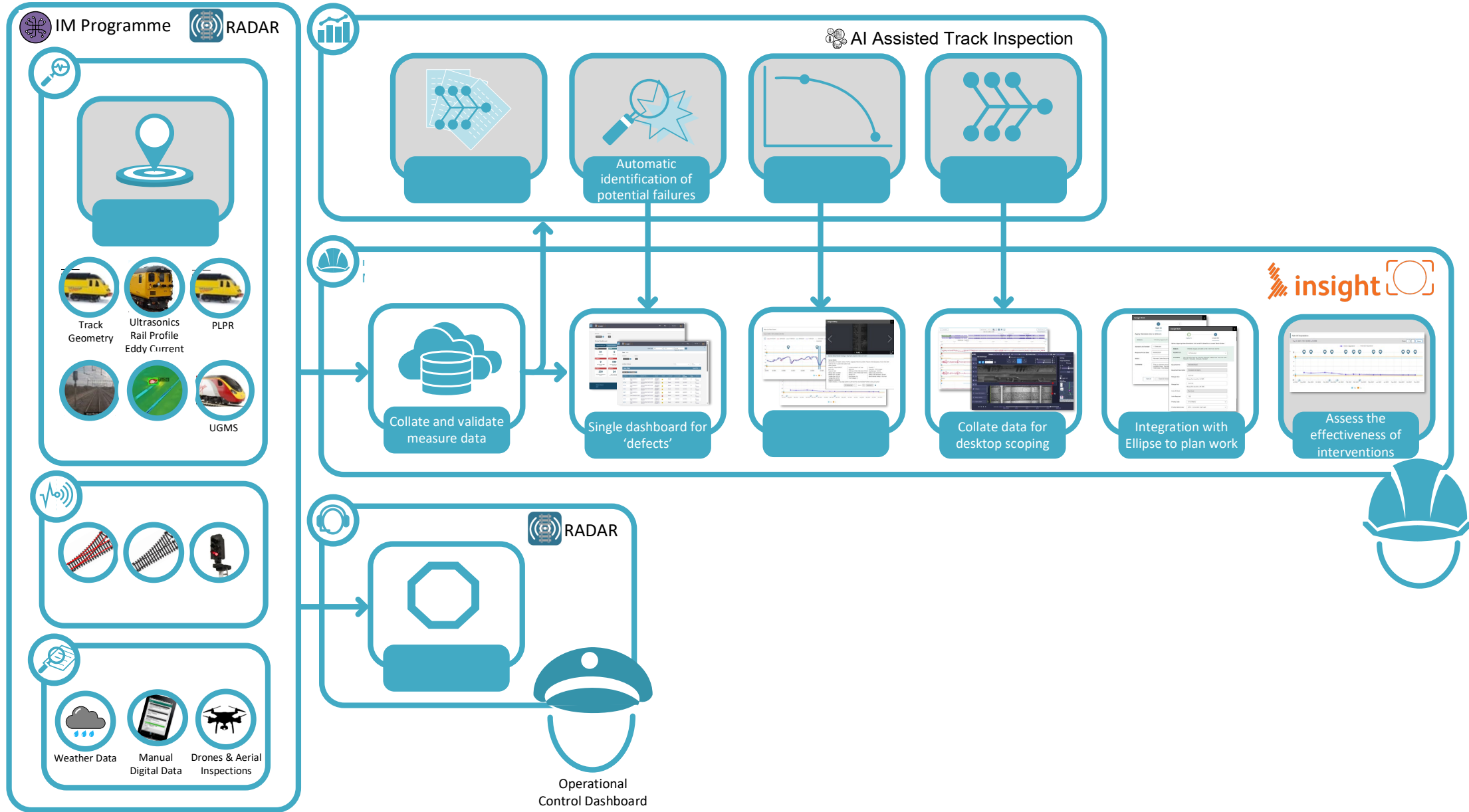


## Insight

**Purpose:** Provide the primary interface for TME and Section Mangers workflow, aiding the identification, planning and assessment of quality of interventions

- ☐ Integration of all required data streams and AI outputs with trusted interface with Ellipse and other NR systems
- ☐ Provides a workflow for standards processes & facilitates 'defect' reviews
- ☐ Collate and validate measure data for desktop scoping
- ☐ Single dashboard for 'defects' & additional modules to aid planning and intervention quality analysis
- ☐ Assess the effectiveness of interventions

# Automated Reliability Centered Track Inspection | Inspection Programme Interfaces





# Eastern digital asset inspection vision

Eastern is committed to revolutionising how we operate our railway of the future through **digitalising asset management**. The new **Automated Reliability-Centred Track Inspection ("ARC TI")** initiative will deliver on this while meeting our **standards** and **legal imperative (ALARP)**. Our priorities are delivering **risk-based, value for money asset interventions**, mitigating **safety risks, service affecting failures** and increasing the **resilience** and **performance** of our railway.

## Benefits

Productivity & Safety:



### 240,000hrs

Boots off Ballast for Inspection. Hrs p.a gained from **BVI & SVI** of Track for Maintenance activity

Benefits:

### £92M

Total cost **£44m**

Total CP7 & 8 Benefits & Costs (inc. cashable vs non-cashable)



Cost Avoidance:



### 95 SAFs (5%)

Reduction p.a in Service Affecting Failures ~1900 total in Eastern

Cost Avoidance (Passenger Safety):



### 1% FWI

Mitigating 1% p.a i.e Lambrigg, Colton J.

Cost Avoidance (Workforce Safety):



### 10%



Mitigating 10% p.a i.e Margam. (£1.3m average cost of fatality)

CO2 Emissions:



### 57kg CO2e

Total p.a emission reduction by removing use of section manager van need for inspection

## What we heard from leadership to influence our business case and support for change...

"Business change is required to digitise asset inspection and standardise work banks which will improve asset quality & assurance aligning with the Insight & IM Programme"

Eastern Route Directors



"This programme offers a solution to the red zone working ban policy to witness track in daylight & under traffic which we should see as a requirement to successfully assure our networks' assets".

Roger Griffiths - Chief Regional Engineer Eastern



"It is clear that new inspection practices and solutions are needed to address safety and standards that we are required to uphold"

Eastern Route Engineers & TA



# THANK YOU



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