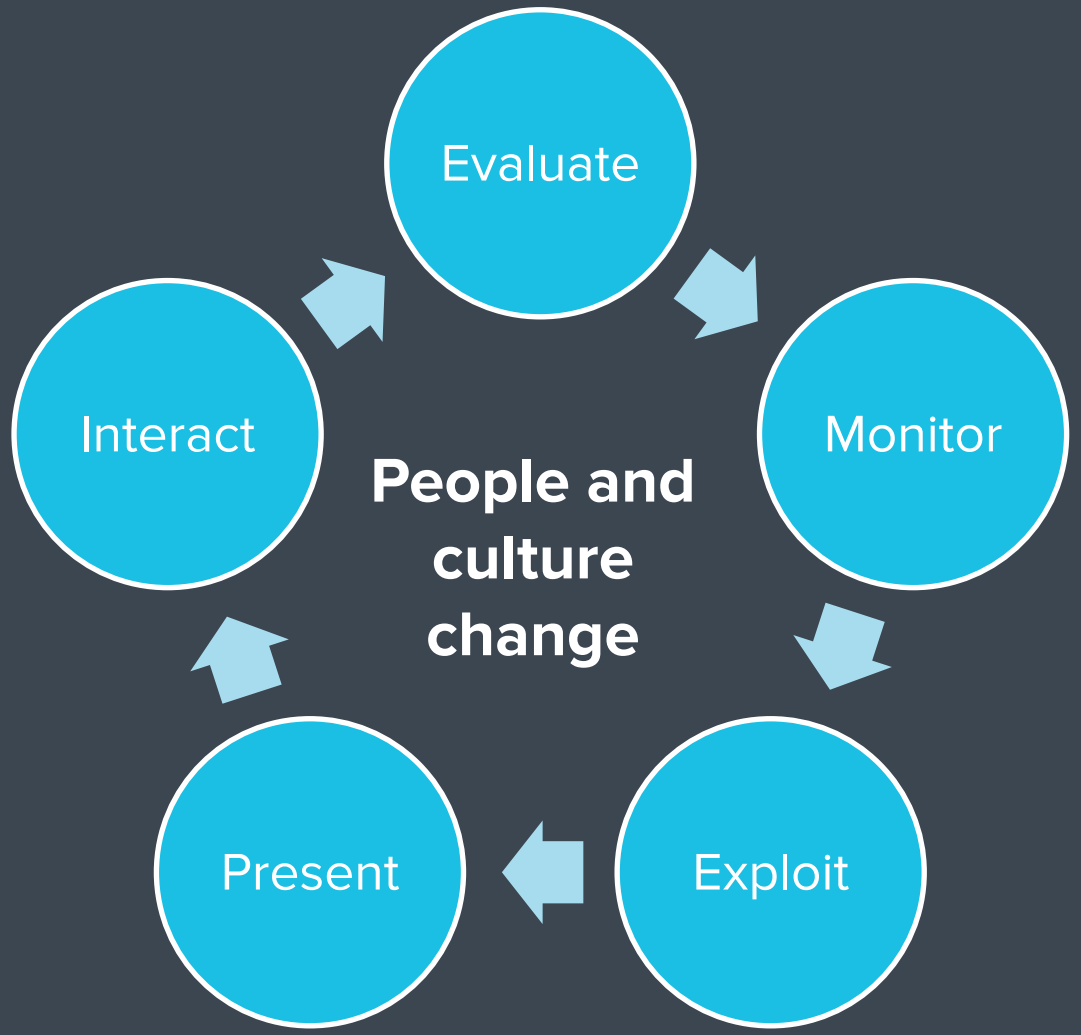
KONUX

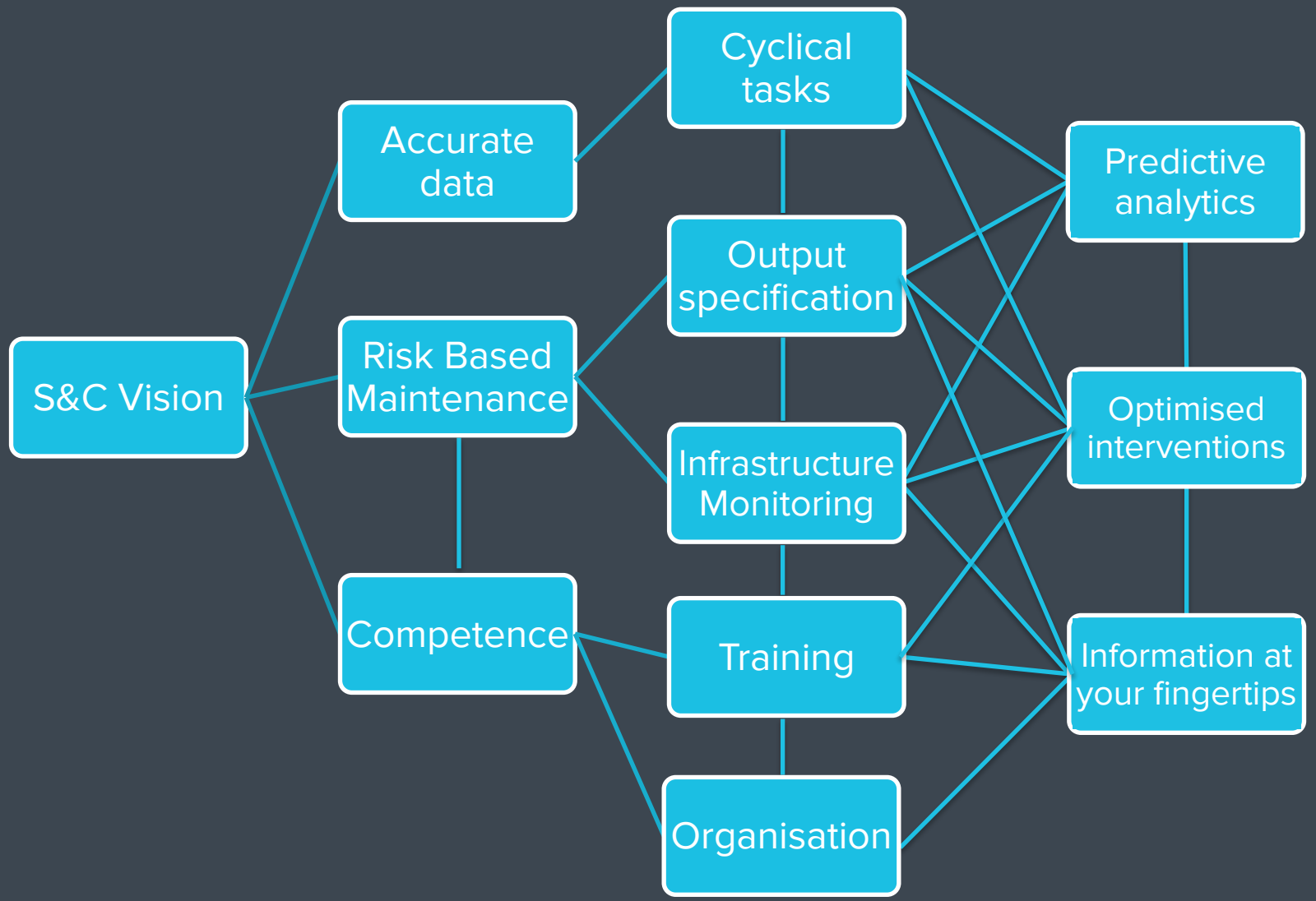
REALIZING THE VALUE OF S&C

PREDICTIVE MAINTENANCE IN REAL-LIFE OPERATIONS

Permanent Way Institute



How data can improve asset management and maintenance



S&C Management and Maintenance

Getting it right is complicated and difficult....

....but the benefits of doing so are huge

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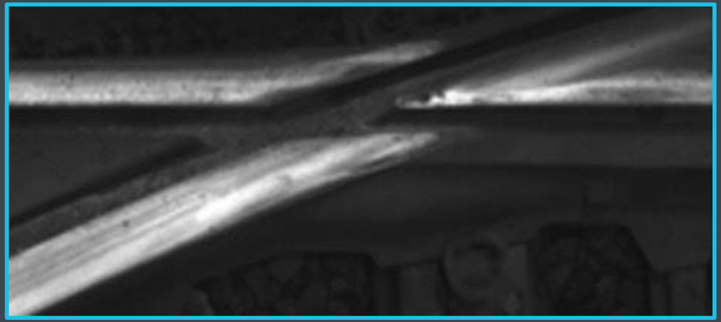
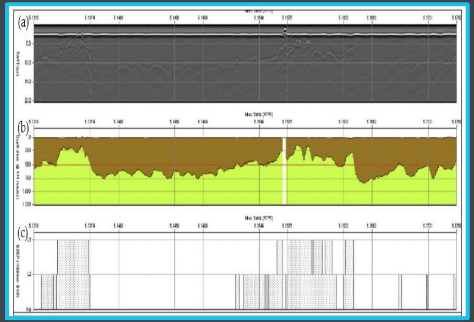

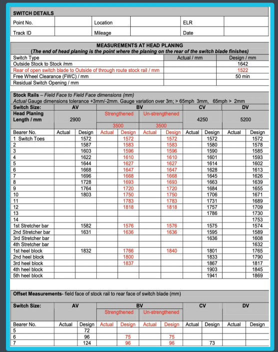

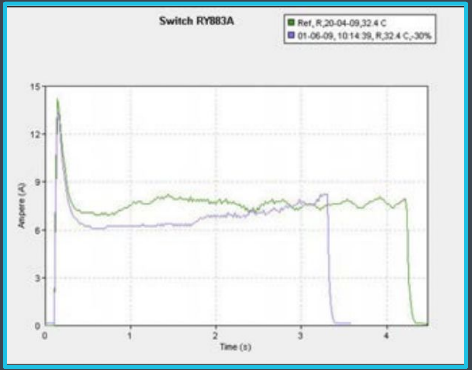


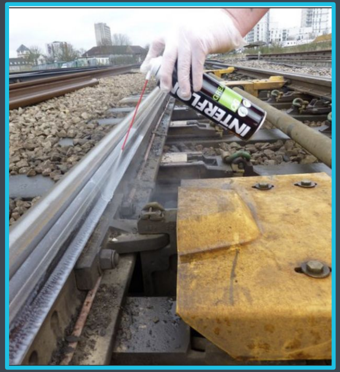
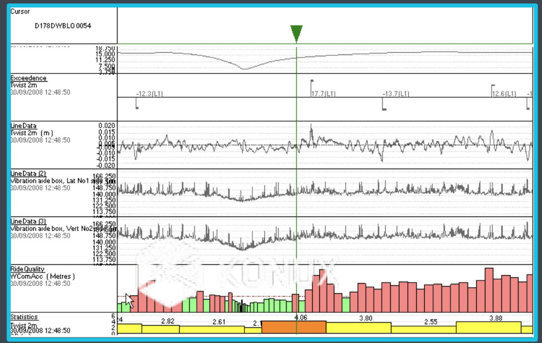
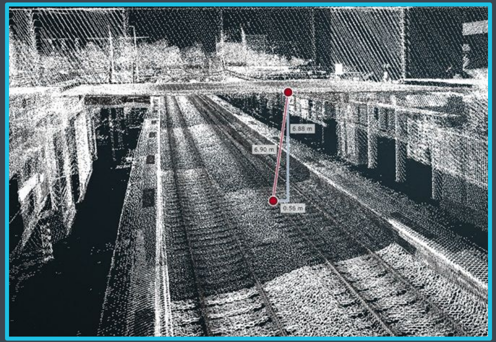


Right data?
Right place?
Right time?
Right information?
Right treatment?

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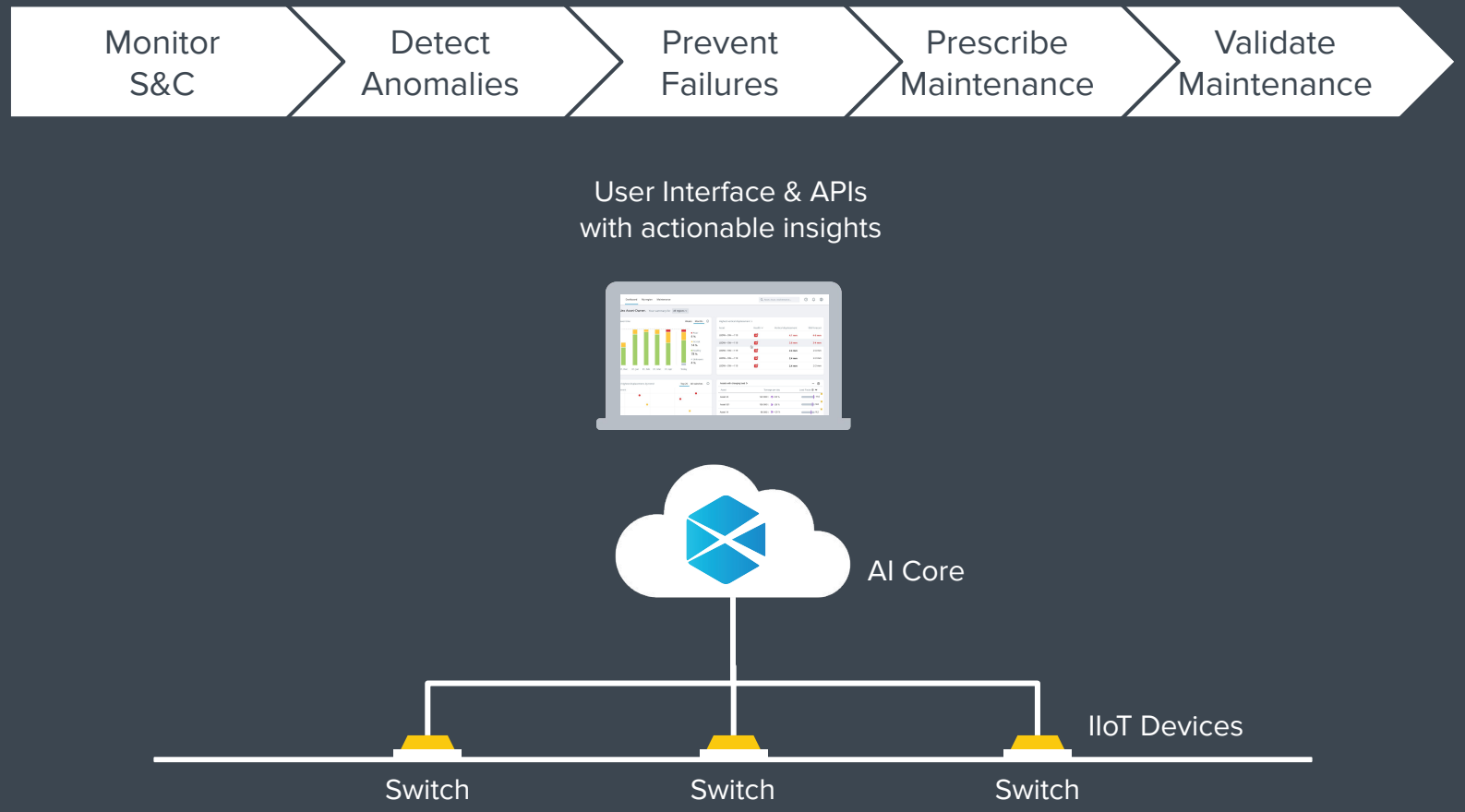
How can the supply chain and NR collaborate to create a holistic S&C maintenance and management solution?

	Trackbed	Crossing	Blades	Point Operating Equipment	Heating
Monitor	Trackbed health monitoring	Crossing health monitoring	Blade health monitoring	Point Operating Equipment health monitoring	Heating health monitoring
Inspect	Usage-based inspection planning				
Maintain	Trackbed maintenance optimization	Crossing maintenance optimization	Blades maintenance optimization	Point Operating Equipment maintenance optimization	Heating maintenance optimization
Renew	S&C component renewal planning				

Available from KONUX

In development / needs integration with Network Rail or supplier held data

KONUX combines artificial intelligence and the Internet of Things to deliver a Predictive S&C Maintenance Solution



Our device has proven itself in the field for over 4 years

1000 S&C currently monitored across 10+ railways

Network Rail full product acceptance certificate obtained August 2021

25mph to 215mph train speeds supported

Operates between -33°C to +70°C

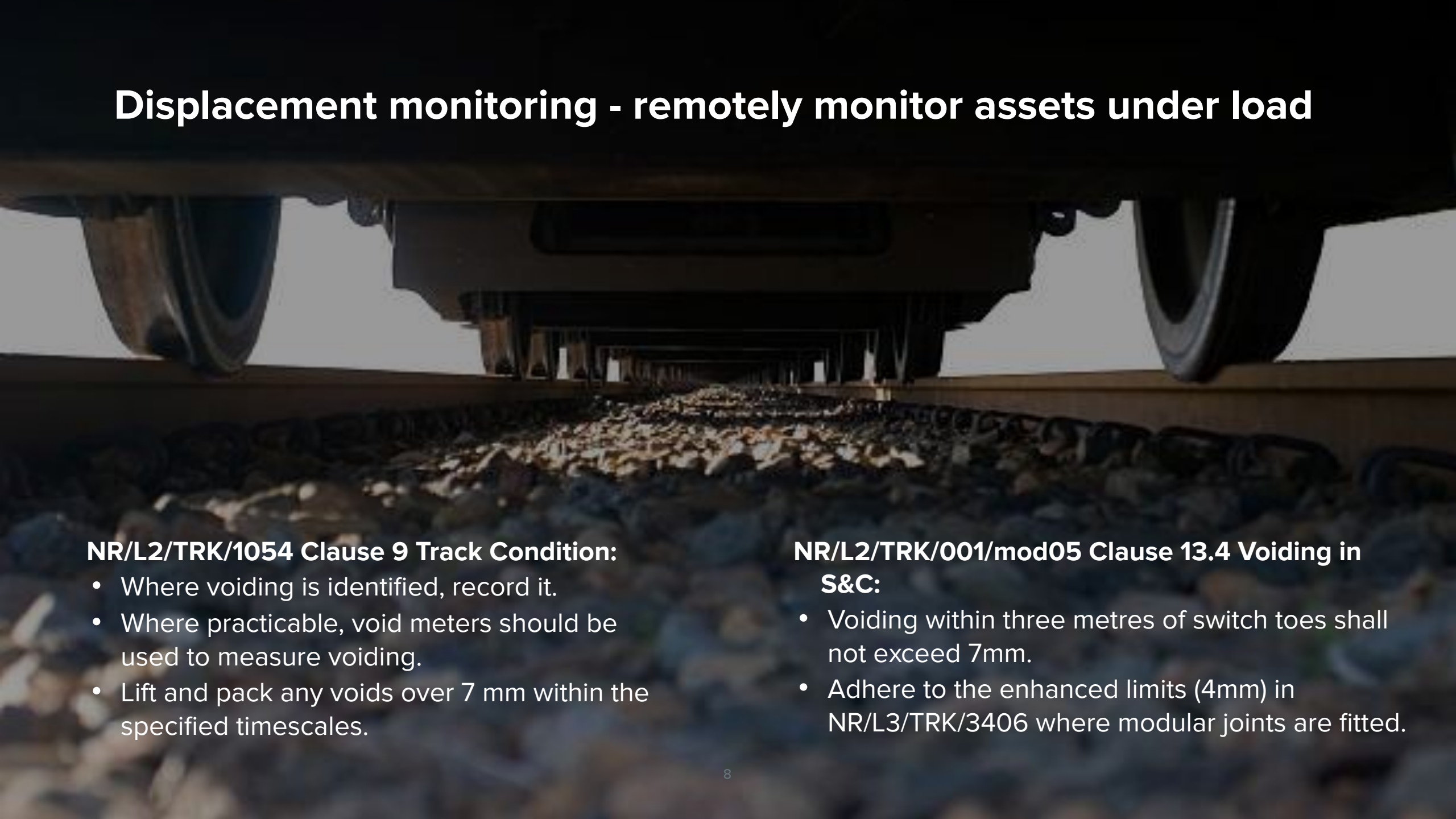
4+ year battery life (monitored and managed by KONUX)

Can be fitted to any S&C type - fully autonomous

Unique and mature feature set

Pipeline for delivery of new features each quarter

Displacement monitoring - remotely monitor assets under load



NR/L2/TRK/1054 Clause 9 Track Condition:

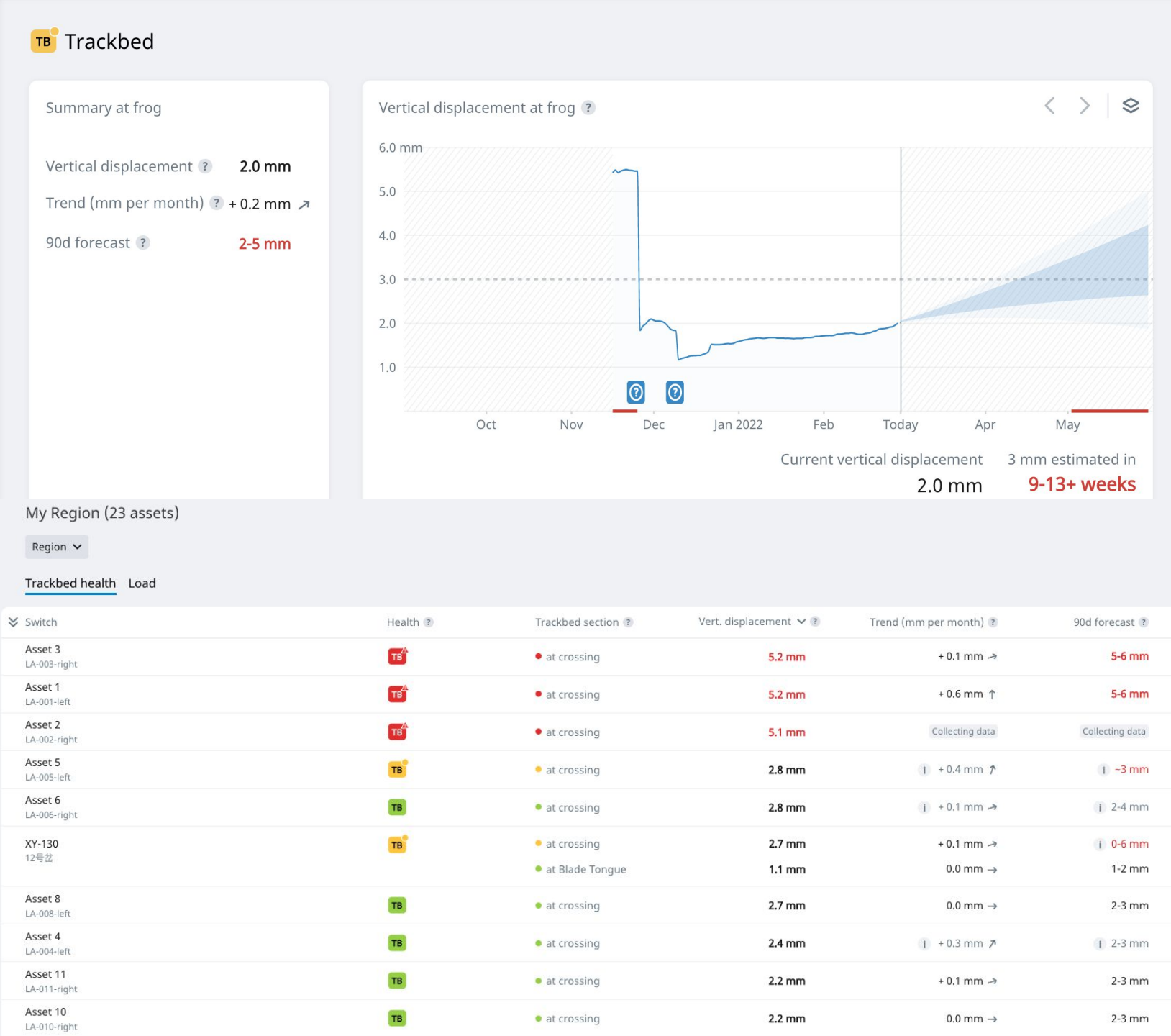
- Where voiding is identified, record it.
- Where practicable, void meters should be used to measure voiding.
- Lift and pack any voids over 7 mm within the specified timescales.

NR/L2/TRK/001/mod05 Clause 13.4 Voiding in S&C:

- Voiding within three metres of switch toes shall not exceed 7mm.
- Adhere to the enhanced limits (4mm) in NR/L3/TRK/3406 where modular joints are fitted.

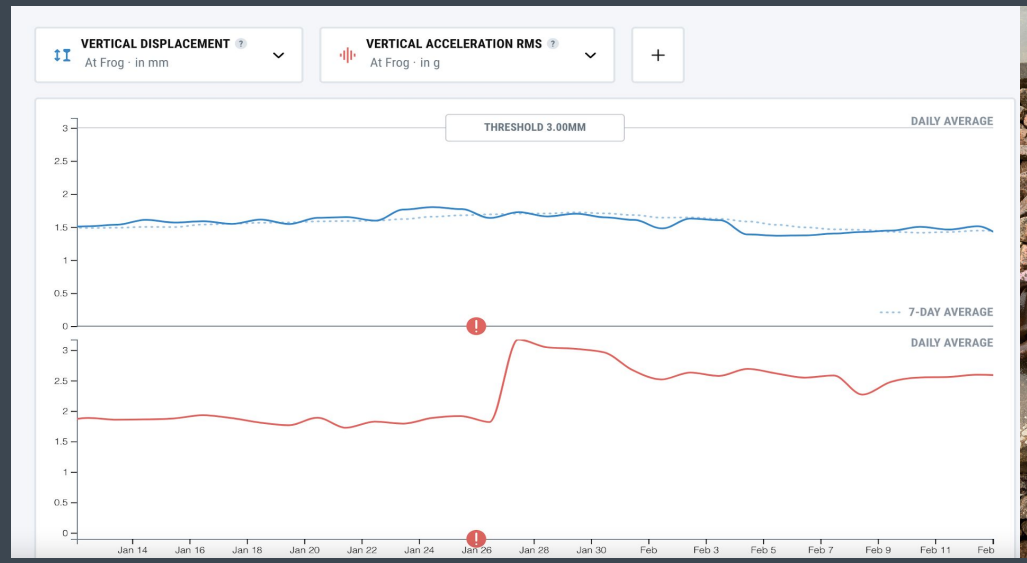
Trackbed Monitoring & Forecasting

- 90 day forecast to enable forward planning
- Optimize maintenance plans to maximise productivity
- Understand degradation rates and act accordingly



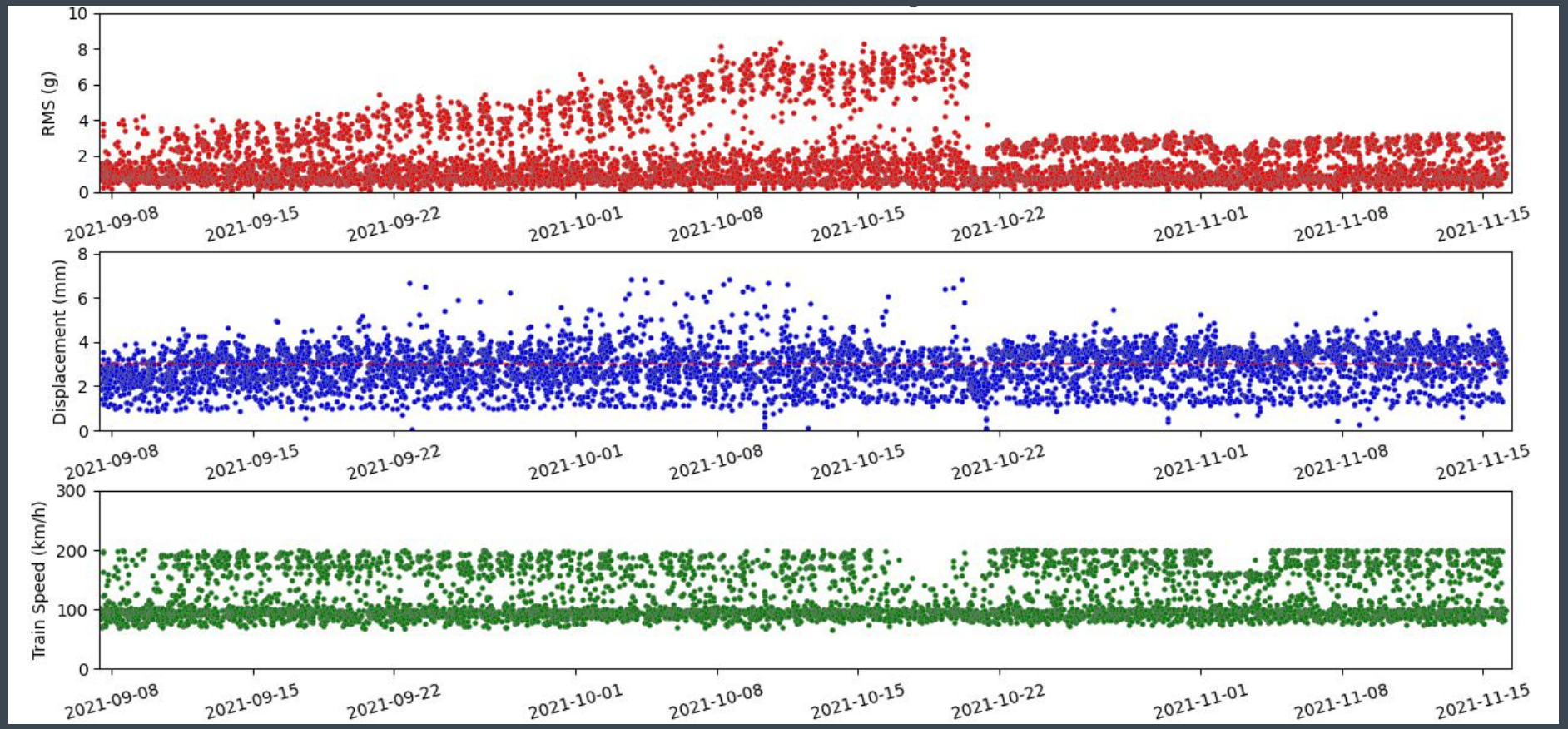
Vertical Acceleration Insights - Squat Identification

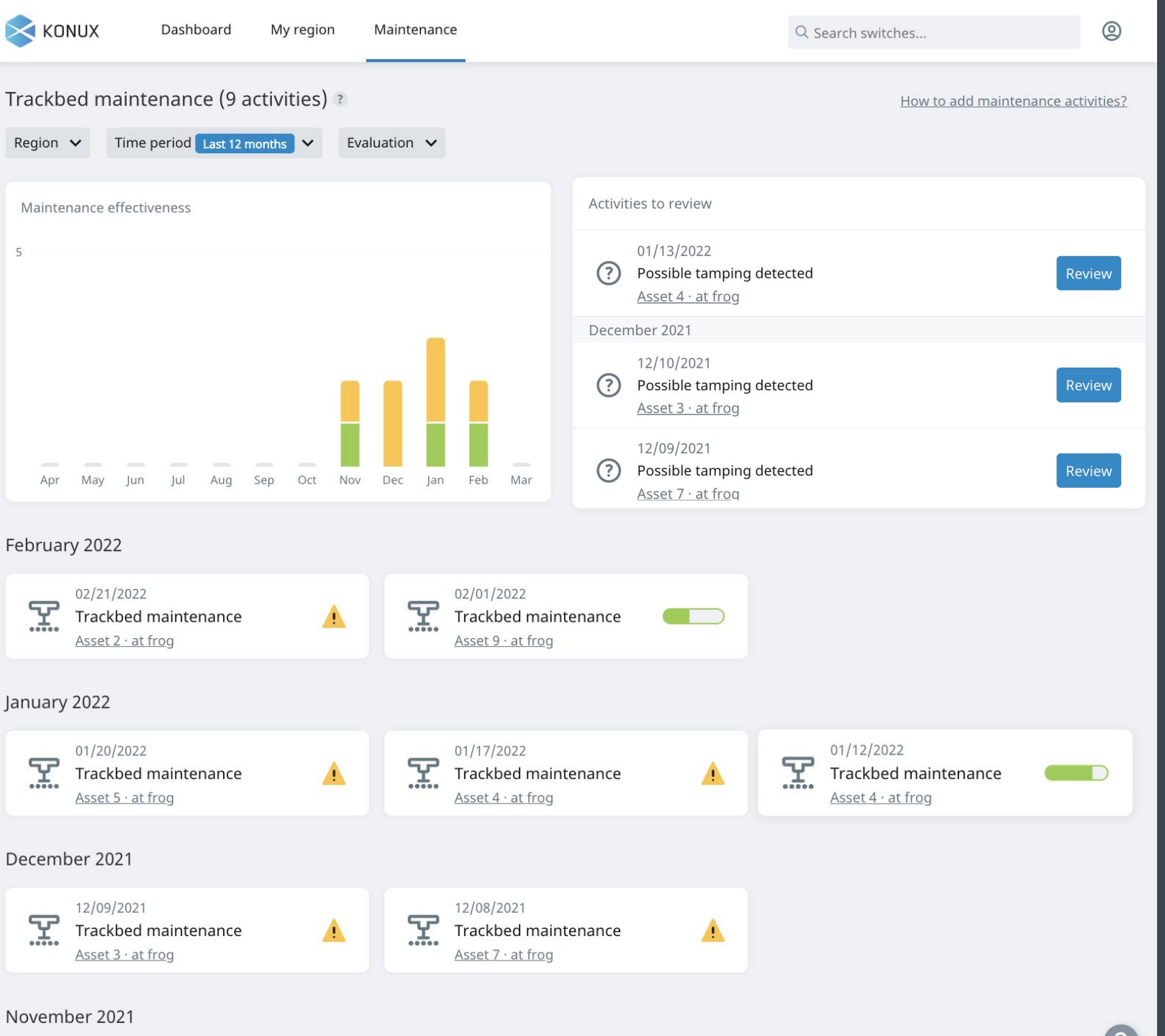
- The system can differentiate between trackbed displacement and switch and crossing deformation
- Site with history of costly delays (1 delay ~ £500k) mostly caused by voiding
- KONUX system identified increased acceleration values
- Detailed crossing inspection identified 2 squats along with poor quality weld resulting in high spots
- Squat too deep to repair so crossing planned for replacement



Crossing breakout (not in UK)

- Acceleration increasing over a period of 6 weeks but KONUX insights not acted upon
- Visual inspection confirmed there was a breakout at the crossing on 20th October
- Weld repair performed 21st October => Following intervention acceleration dramatically improved

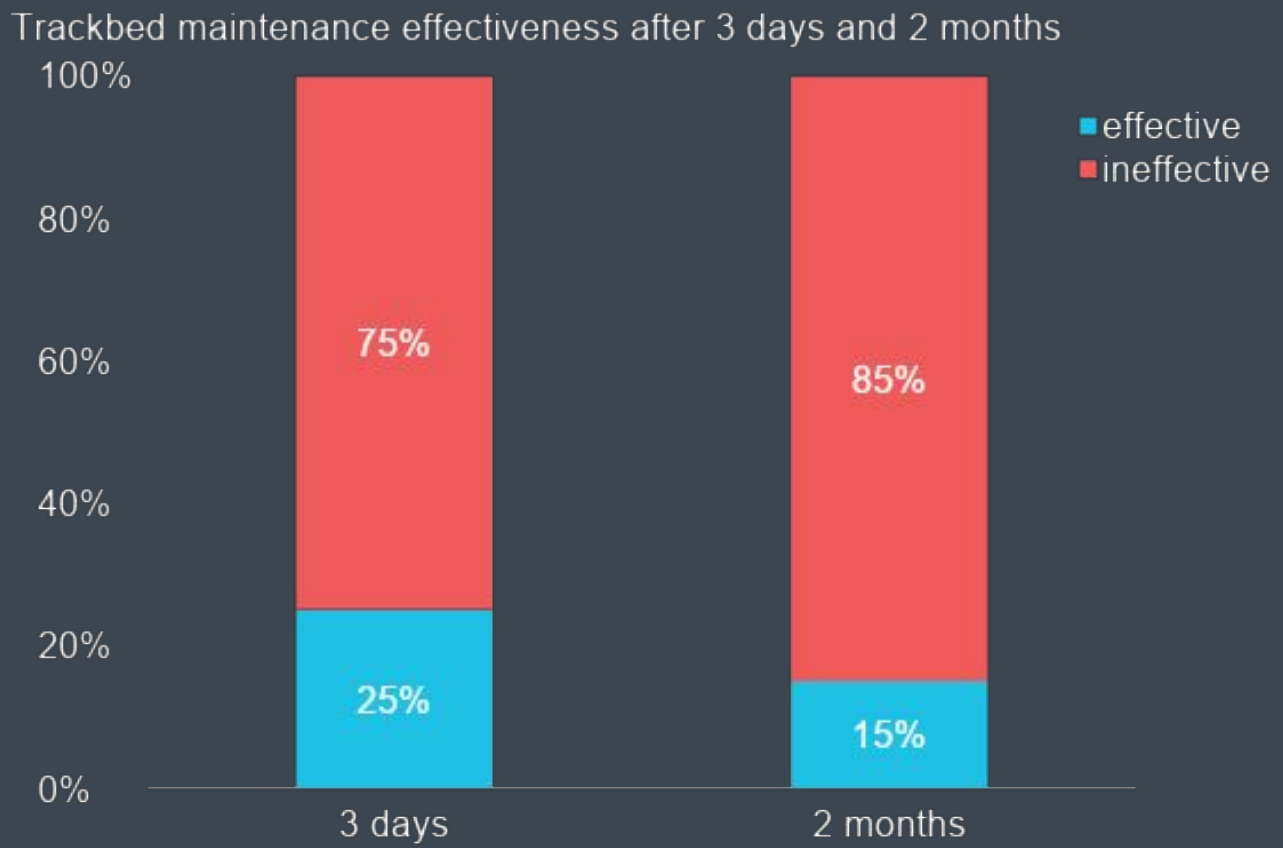




Maintenance Quality Check

- Evaluate the impact of different maintenance interventions
- Resolve the root cause and sustain the fix
- Identify training needs
- Understand the outcome of tamping at the crossing and switch toes

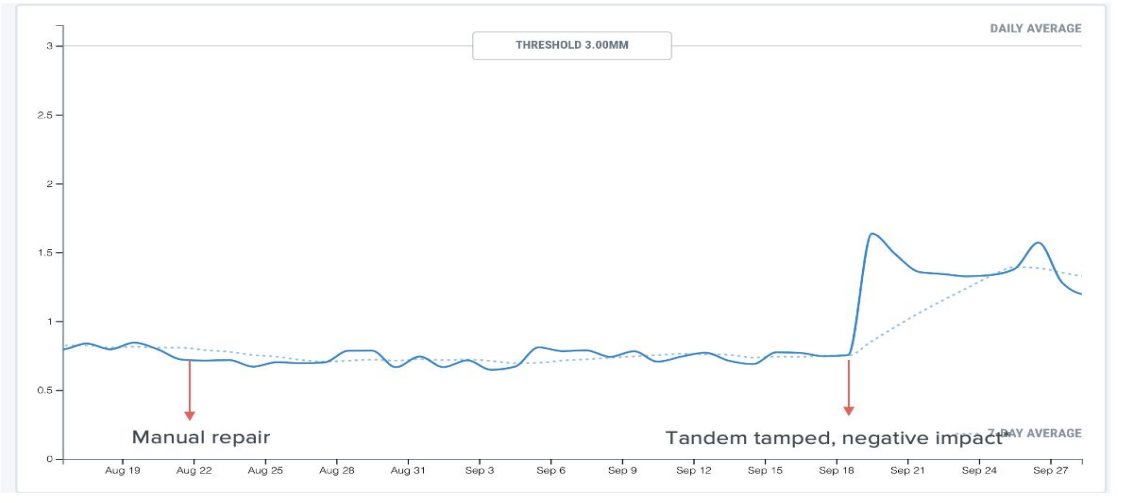
We analyzed the impact of 100+ crossing tamps



*Effective = at least 15% reduction of vertical displacement; vertical displacement below 3 mm; sustained for 60+ days

Marshgate, East Coast: Manual vs tandem tamping

- 22/08/21 Manual Tamping (using Cobra TT / Kango Ballast Packer x4 Duff Jacks)
- 19/09/21 Machine Tandem Tamping (completed with design)



2456B, crossing

2457B, crossing

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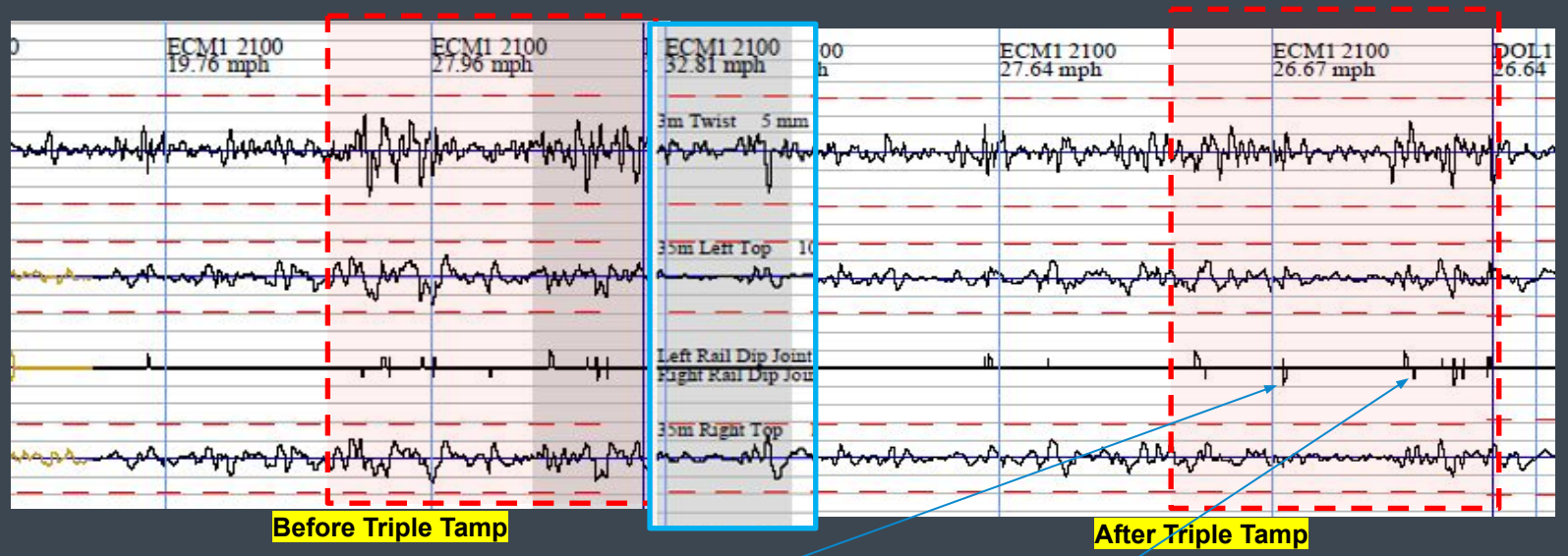
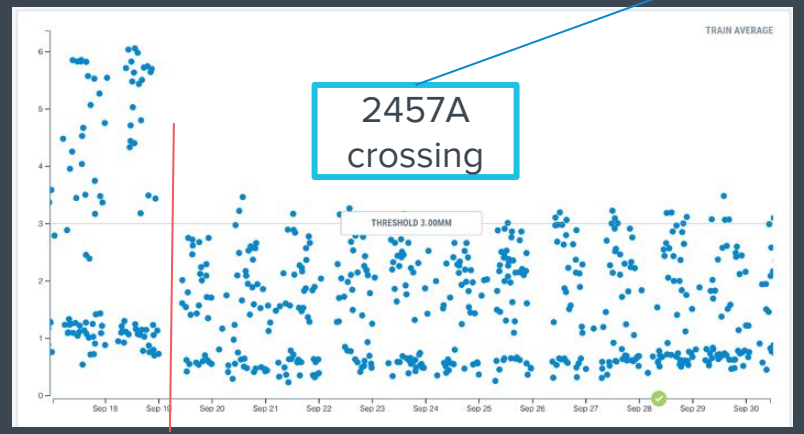
Doncaster - Marshgate Junction

Design triple tamp at difficult to access location

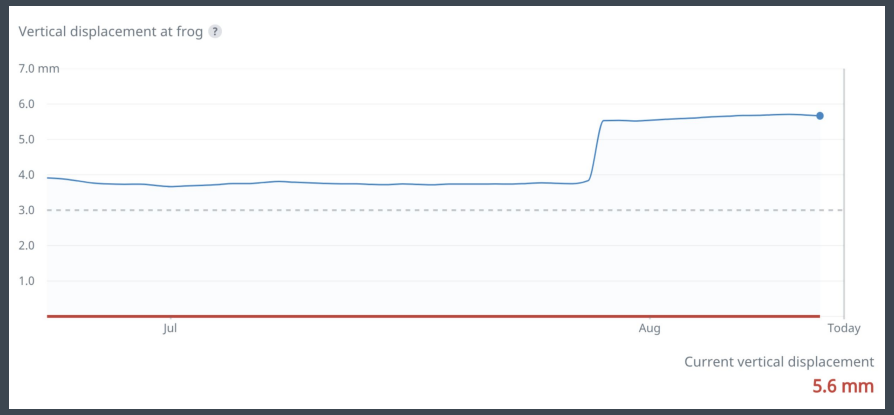
- Best SD at site for many years
- Some assets increased displacement, some reduced
- could the job have been planned differently to achieve the best possible outcome?



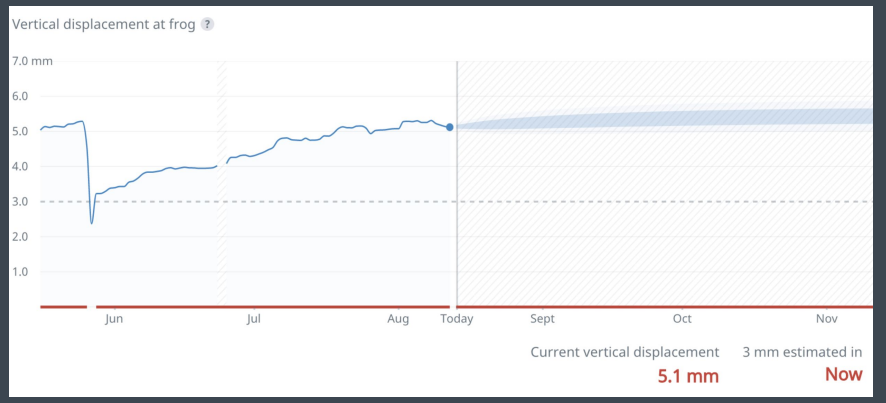


Examples of ineffective tamping

Increased displacement

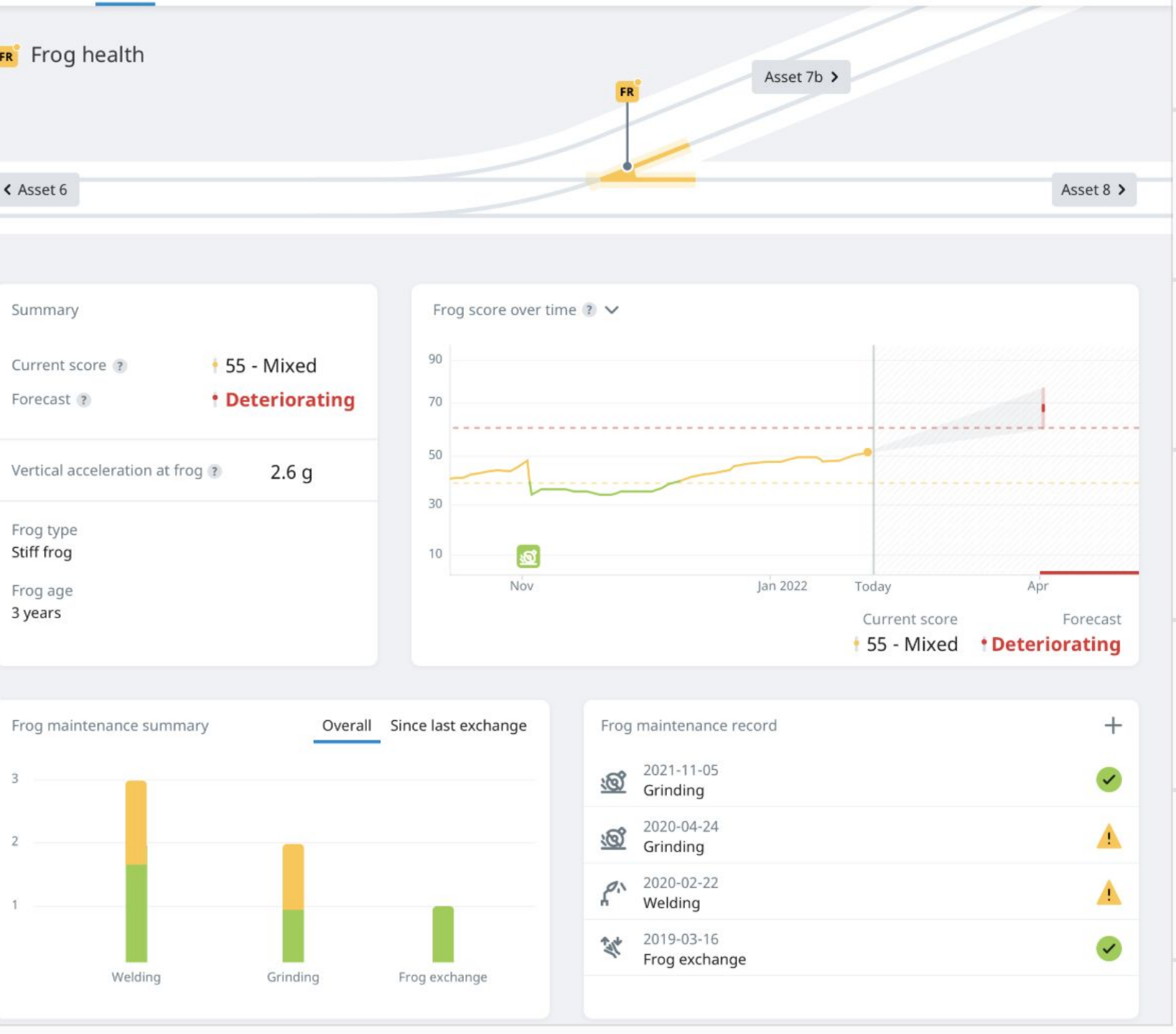


Fix is not sustainable



Unnecessary maintenance

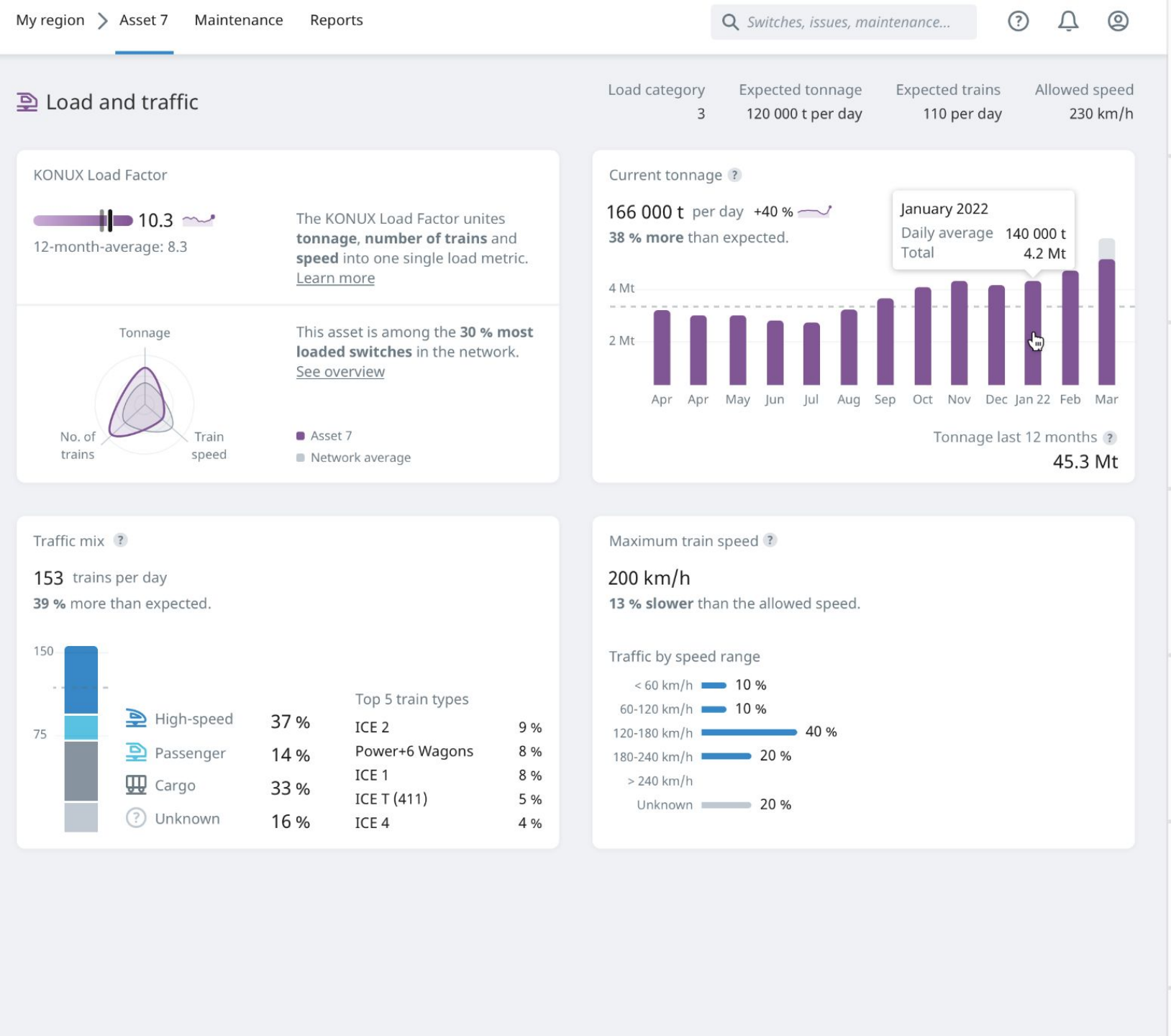
Multiple interventions



In Development

Crossing Health - New Model 3.0

- Artificial Intelligence model for recognition of deteriorated crossings (worn/deformed transition zone from crossing nose to wing rail, lipping, breakouts, flaking, spalling) and crossings with high risk of accelerated degradation
- Provides health state of a crossing daily (red/green or grey for unknown)
- Trained with large amount of data. The model output granularity and accuracy depends on amount and quality of training data

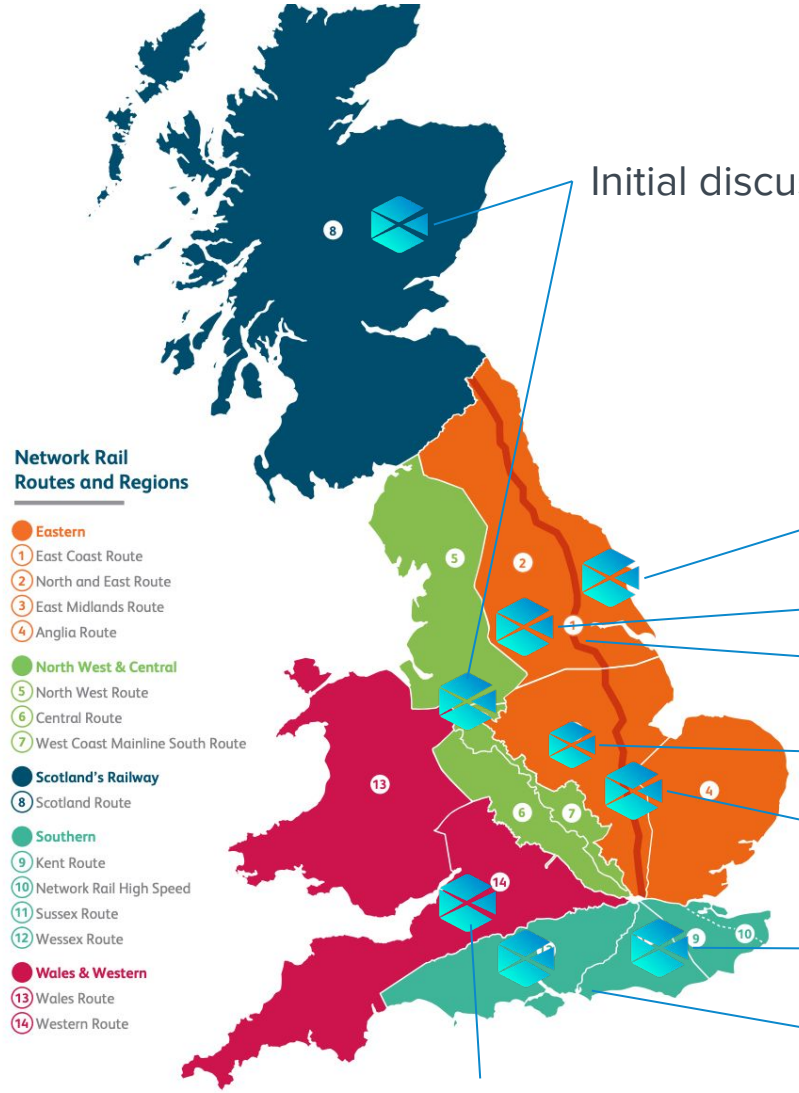


Train Classifier & Load-based insights

Optimize your inspection and maintenance plans twitch the knowledge about:

- Train number, type and speed
- Load Factor
- Load and speed trends over time

KONUX within Network Rail



Initial discussions held

16 IIoT devices installed, Doncaster pilot

8 devices due installation in June for Whitehall flat crossing

64 devices for North and East Route (May/June install)

4 IIoT devices, Luton pilot
+ 18 additional devices for East Mids (May/June install)

16 IIoT devices, East Coast (May/June install)

Further discussions with Sussex 25/04/22

29 IIoT devices, Wessex Route Pilot request

18 IIoT devices for Western Central DU (June install)

Benefits case

↓ 20% DELAY MINUTES

Estimated improvement on S&C failure minutes per annum

↑ 25 % CROSSING LIFETIME

Estimated a 25% improvement on half set and crossing replacements per annum

↑ 25 S&C LIFETIME

Estimated a 25% improvement in the extension of asset life

OPTIMIZED MAINTENANCE

We have reviewed and proposed a number of Maintenance volumes that could change as a result of this system. This could be achieved through changing the engineering approach or by having a greater understanding of actual traffic loading. We are keen to work with Network Rail to verify these savings.

The S&C Alliance

We want to support Section Managers and Engineers to:

- Understand failure modes and how they can be prevented
- Use best practice and best value solutions to maximise asset life
- Remotely monitor and inspect to understand asset condition
- Optimise maintenance regimes
- Removing recurring and long term failures

We believe that by working together we will generate much greater value for the industry than by working independently.

KONUX

S&C Alliance



150+ years S&C expertise

S&C Alliance




OneBigCircle

FAST PAT

SPIKE FA

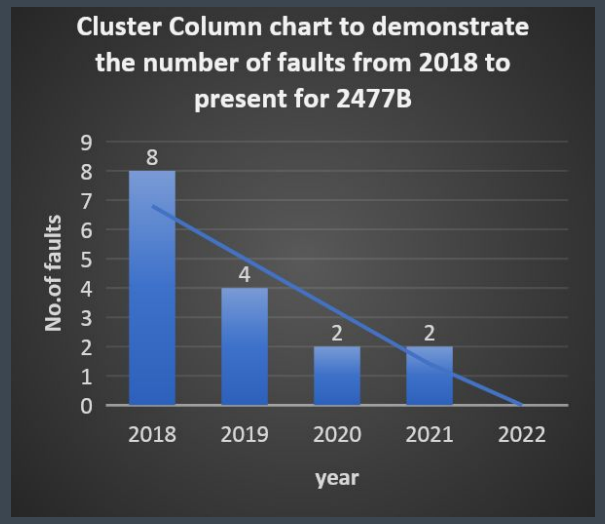
Staytite

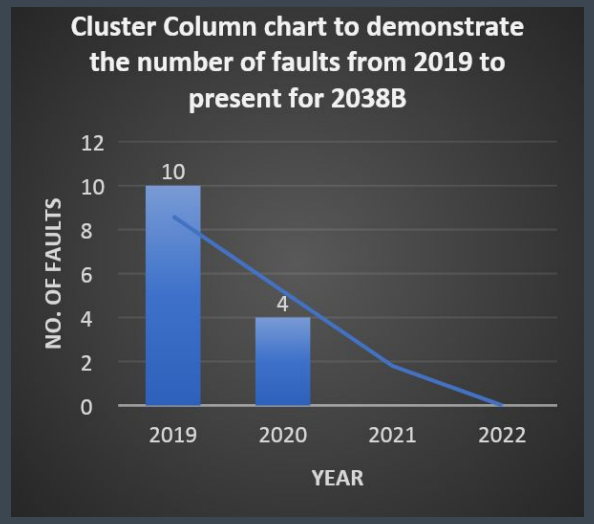
KONUX

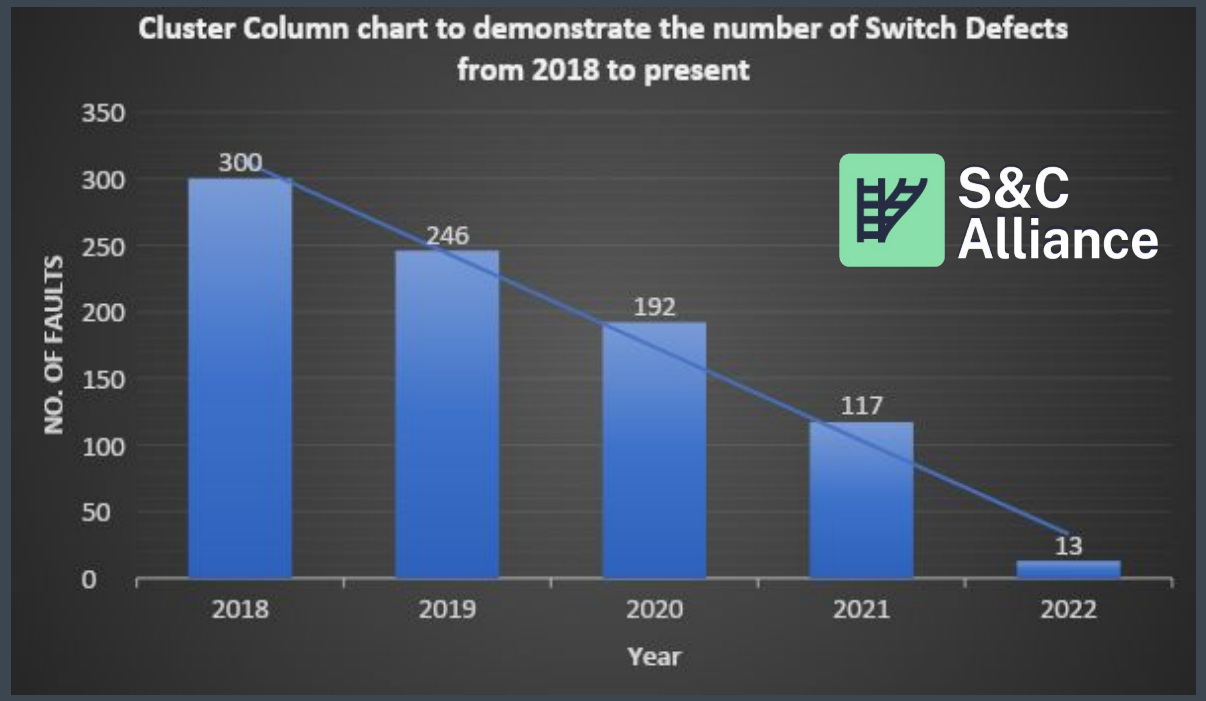
INTERFLON ®

flexilube smart lubrication

S&C Alliance







What happens when you get it right

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LET'S DEVELOP FURTHER TOGETHER!

Tim Flower, UK Account Director

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