Short Note:

The RASC® Pod - rethinking trackbed inspection

Part 2: Integration of inspection data for improved maintenance planning

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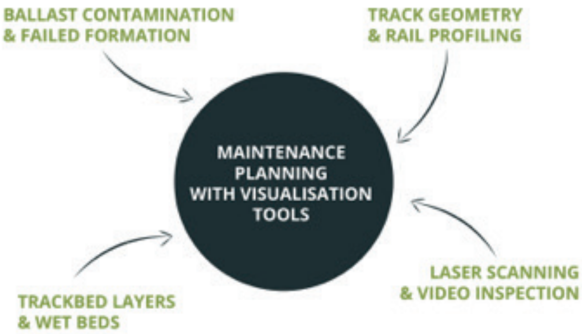
Summary

Part 1 of this series (Ref 1) introduced the RASC® Pod - an innovative trackbed inspection solution which has the potential to improve:

- the return on investment in data capture systems
- track safety, and
- the cost effectiveness of follow-on maintenance



The system is a versatile platform which can be mounted on a wagon in-consist with a revenue-earning train (above left) or on the chassis of a hy-rail (above right).

The RASC® Pod can simultaneously collect data from a wide variety of inspection systems including: track geometry, rail profiling, linescan camera surface imaging, 360o 2D laser, 3D laser, accelerometers, video, 2D and 3D ground penetrating radar (GPR), thermal imaging and catenary inspection.

The unified data stream allows integration of above- and below-ground information to:

- investigate the root cause of problem track flagged by track geometry exceptions
- investigate the cause of derailments, and
- reduce the cost of maintenance

Part 1 (Ref 1) summarised the case for an improved ROI for data capture and enhancing track safety.

This note covers integration of RASC® Pod data for more cost effective maintenance planning.

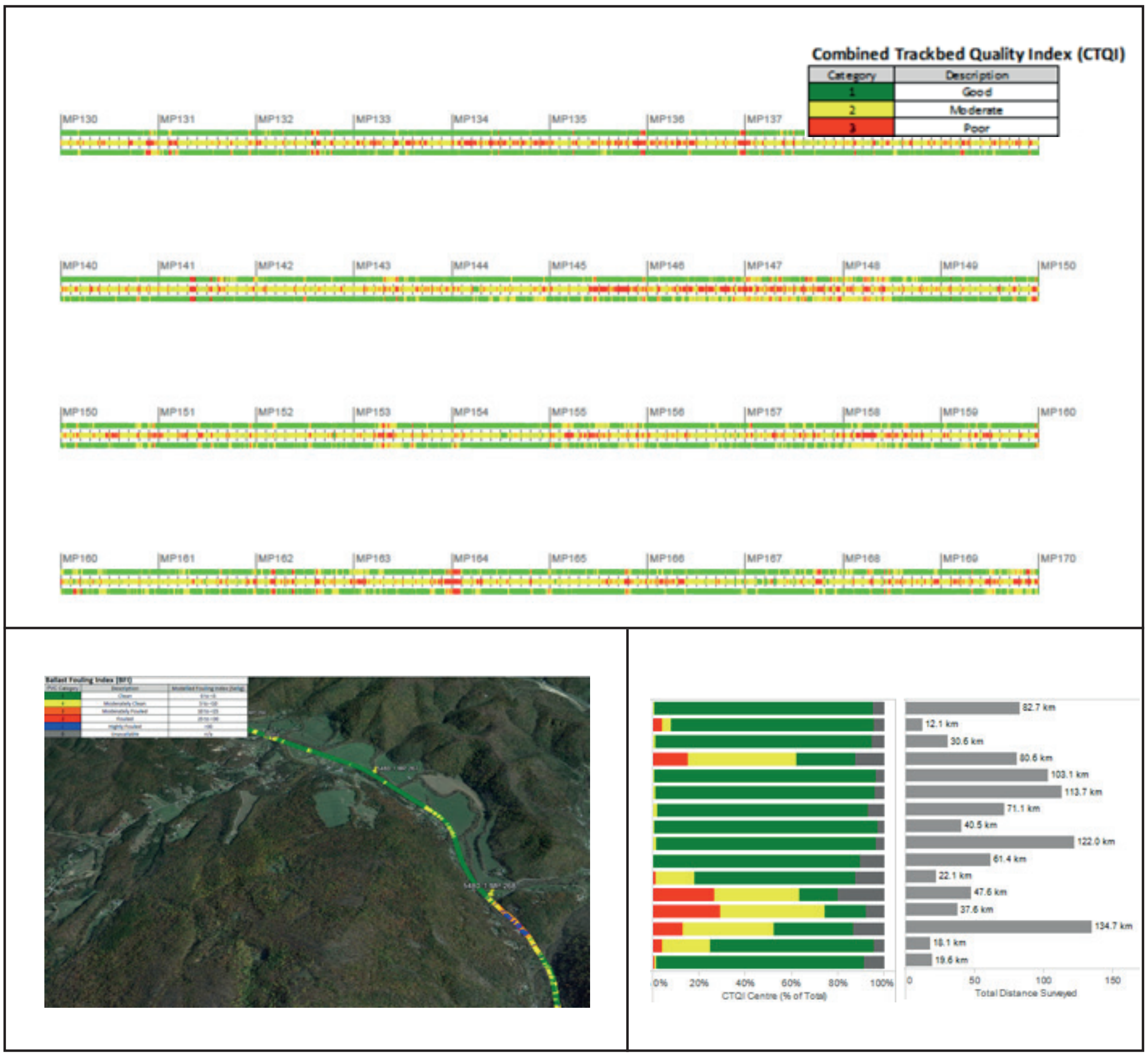
Data integration

The RASC® system streamlines the acquisition and processing of the multiple data streams used to map and characterise problem track.

The benefit of this approach is three-fold:

1. Immediate recognition of the location and extent of problem track without the necessity to invest in expensive data management solutions
2. Minimising the amount of data that needs to be stored in a live data management environment reducing costs
3. Precise colocation of the individual data streams improving the accuracy of data correlation

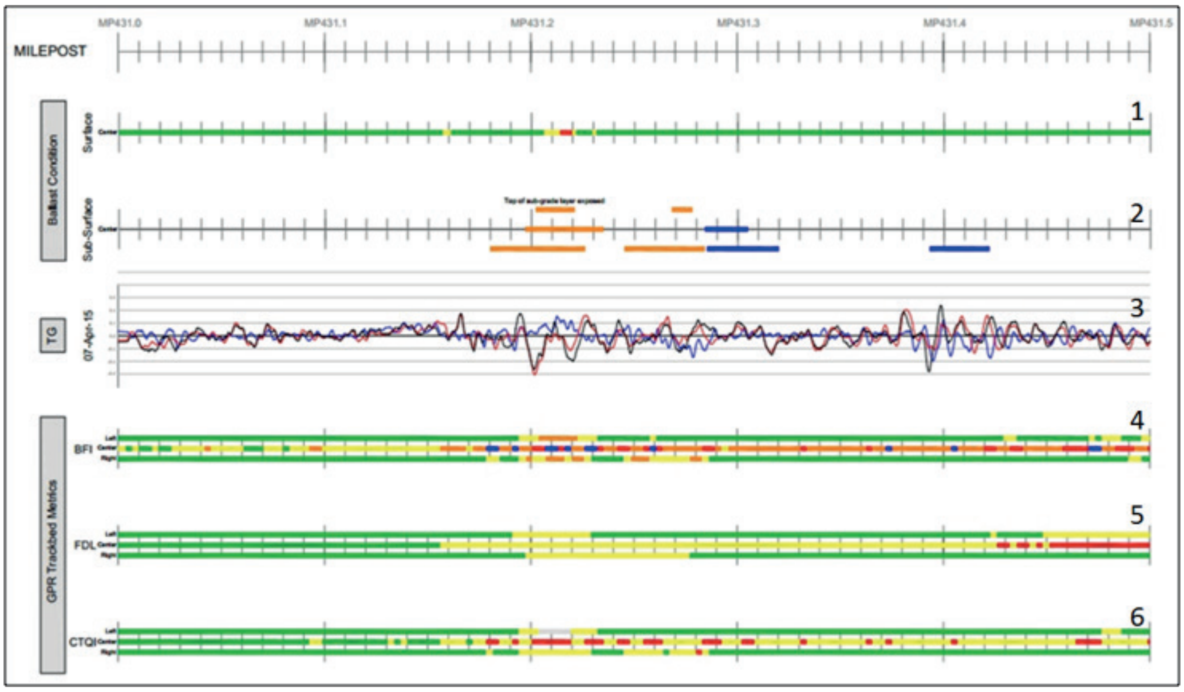
Zetica's proprietary Combined Trackbed Quality Index (CTQI) groups trackbed quality indicators, such as ballast fouling level, moisture concentration, surface and incipient mud spots and track geometry exceptions, to give a concise network-wide view of problem trackbed.



The CTQI and all of its component parameters are provide as track charts referenced to the customer’s mile post or kilometre post system, geo-linked spreadsheets, standard GIS file formats and statistical summaries.

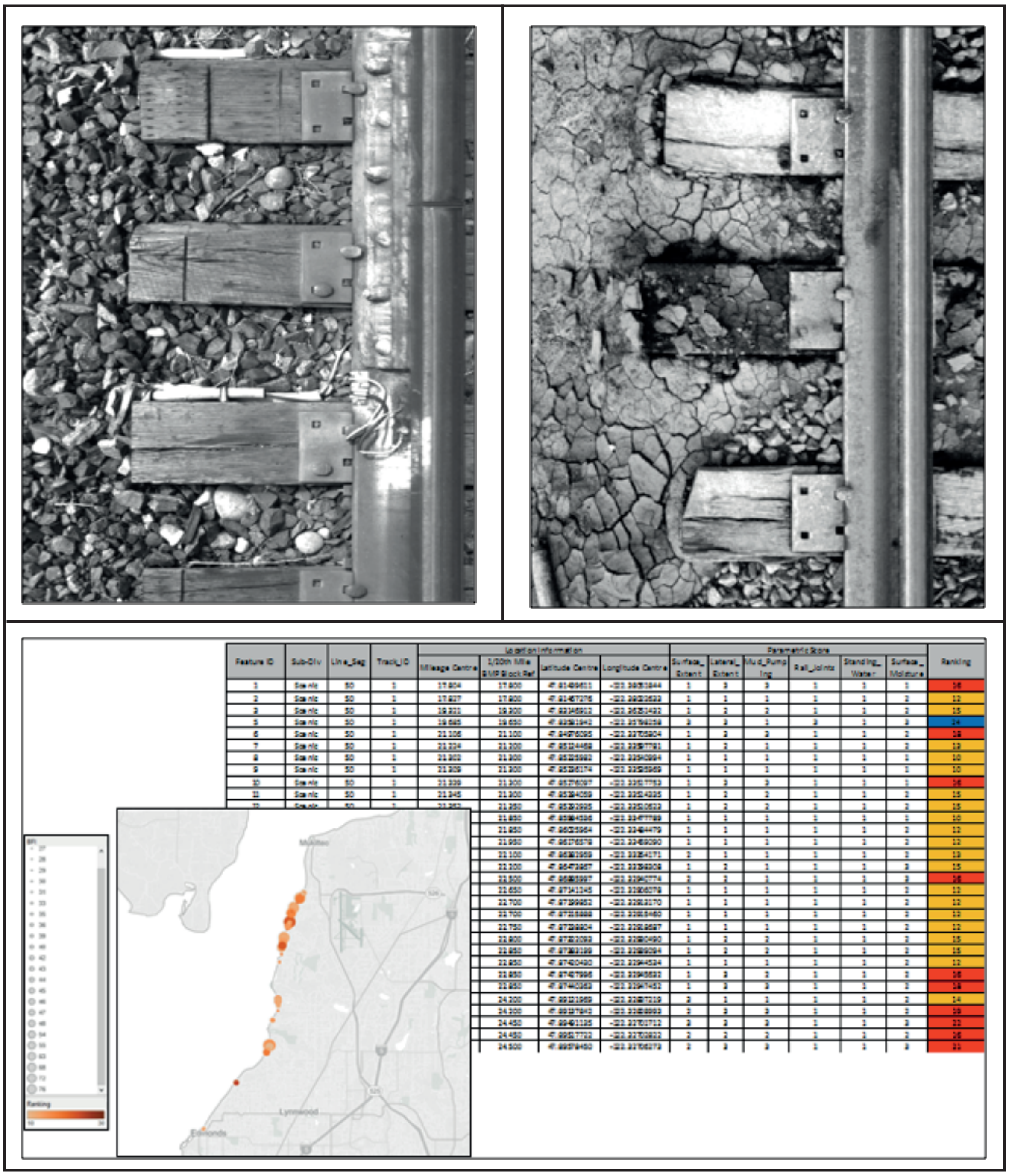
An example of data reduction from a recent RASC® survey, which collected 7Tb of raw data, was that just 20Mb of CTQI results were required for high-level characterisation of a 2,000km network.

Once problem track has been identified an assessment of the cause and potential remediation solutions can be aided by detailed trackbed condition reports.



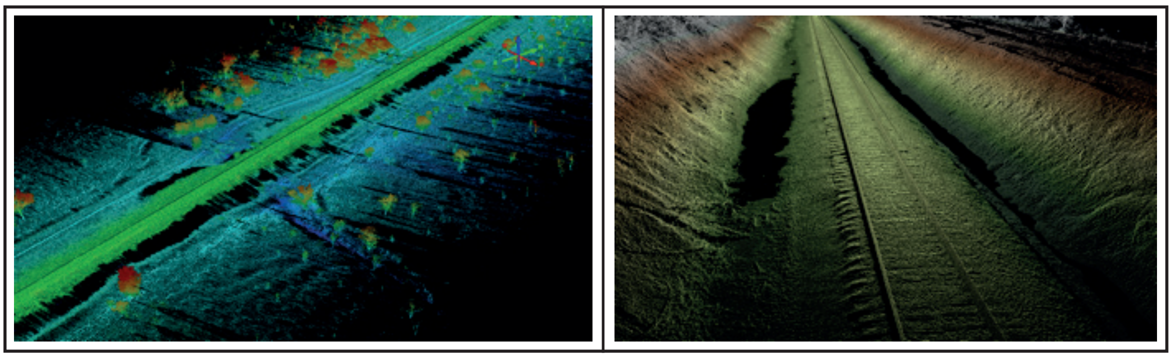
The above example shows an integrated track chart view for a 0.5mile section of track presenting mapped surface mud spots (1), below-ground extent of mud spots and ballast pockets (2), track geometry - left/right profile and twist (3), ballast fouling index (4), ballast fouling depth (5) and CTQI (6).

RASC® deliverables include categorisation of mud spots by extent as well as proximity to joint bars and transition structures. Example imagery from the linescan camera trackbed imaging system on which this mapping is based is shown below.



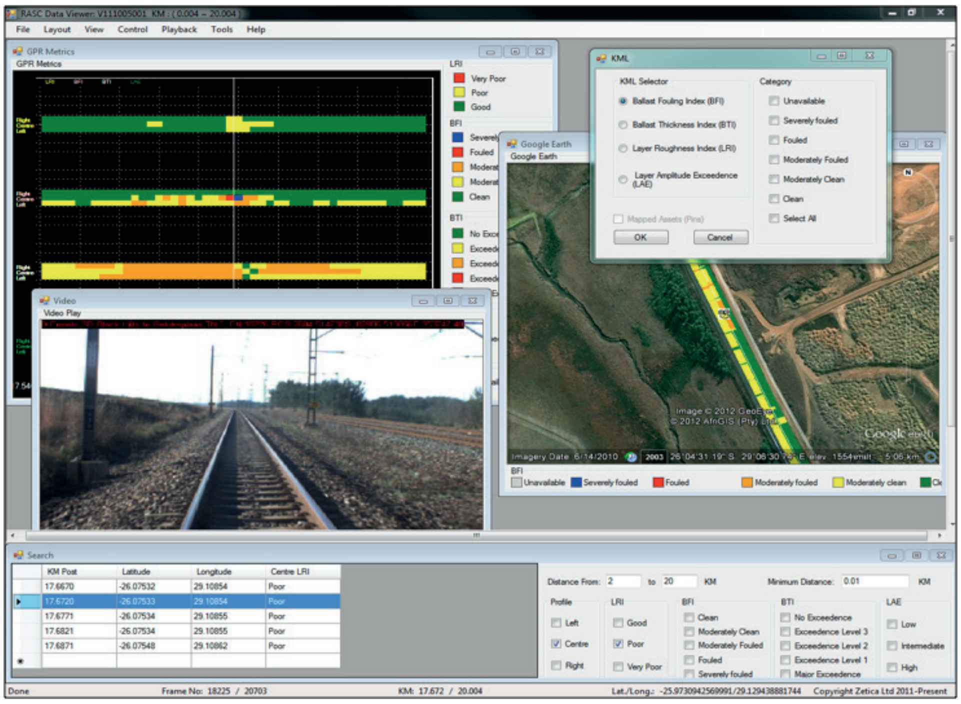
Mapped surface mud spots are linked to the subsurface fouling extent and combined in a ballast defect report as shown in the example above. Individual defect locations are ranked based on a range of parameters in order to help assess their severity in terms of track safety and to prioritise maintenance.

Subsurface fouling and moisture concentration can be combined with the 360° laser profiling system to highlight trackside drainage problems which may be contributing to poor track stability. The example point clouds below show a streambed crossing beneath track (left) and standing water adjacent to track (right).



Integrated data views are available through the RASC® Viewer desktop software solution. This links the CTQI metric (and all of its components), laser views, and track geometry, to on-track video data and Google Map overlays, referenced by milepost or kilometre post and latitude/longitude.

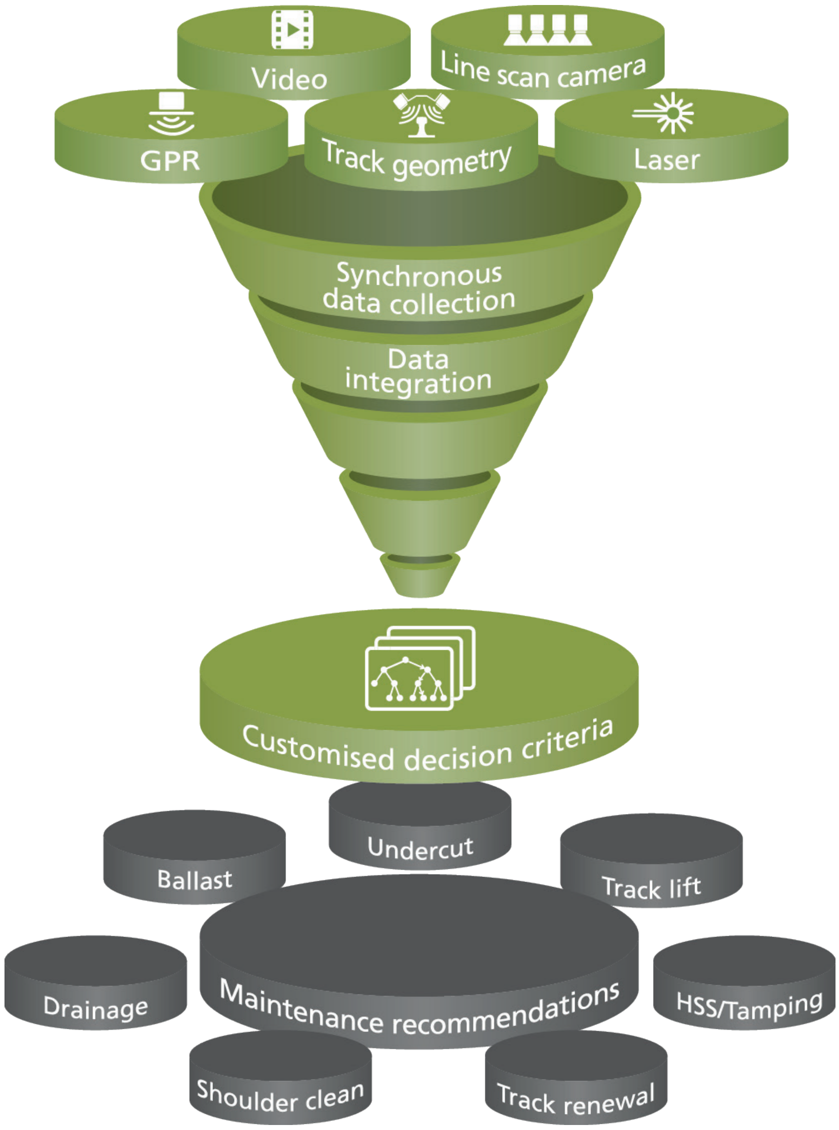
The software includes search functionality, which allows the location of specific trackbed issues to be quickly located across the dataset. Outputs from the RASC® survey are accessible through the RASC® Viewer.



Maintenance work order recommendations

The data integration tools enable evidence of trackbed quality to be easily aligned with field observations. The results can then be used to objectively prioritise maintenance based on available resource and budget.

Maintenance methods which are typically considered include ballast screening, tamping, shoulder cleaning, track lifting or rehabilitation. Rules for determining which activity is most appropriate are based on the RASC® deliverables as well as planning considerations such as minimum economic extent of track to maintain and the distribution and frequency of track assets such as crossings and transition structures.



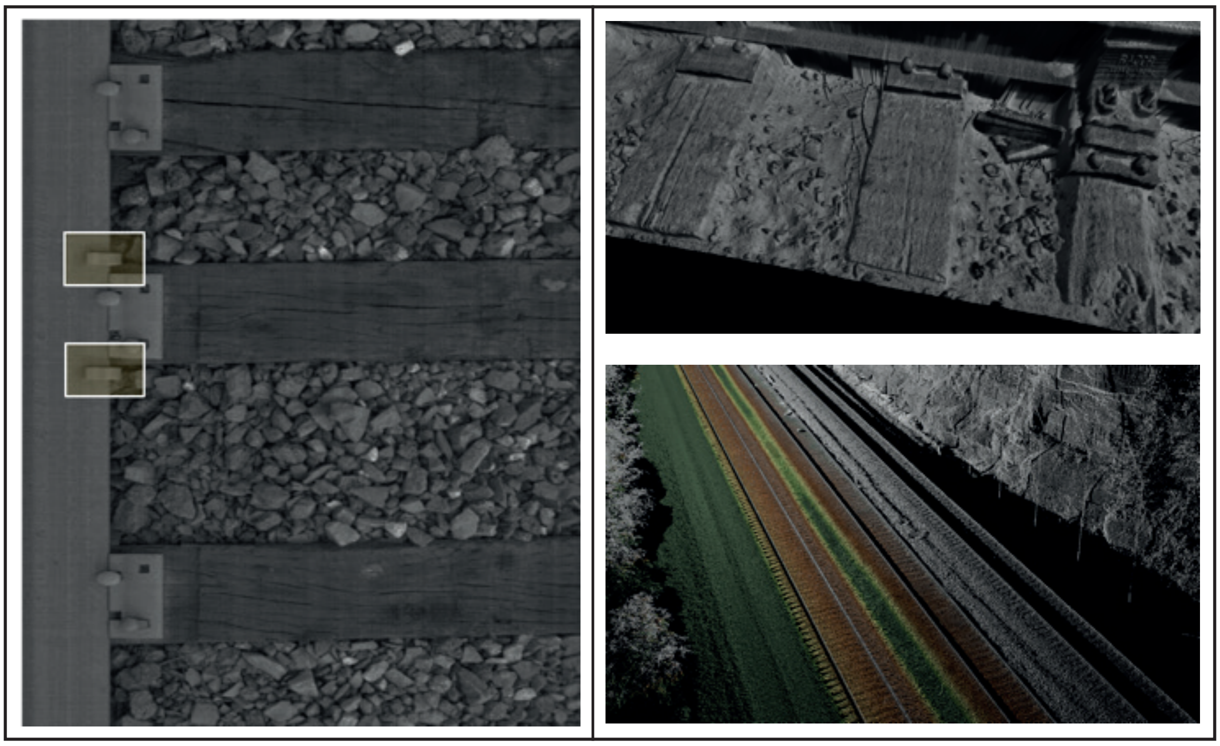
Quality control

Deploying the RASC® Pod on recently maintained or newly installed trackbed offers the potential for QC, benchmarking and the implementation of continuous improvement programs.

RASC® systems can be used for a variety of QC tasks such as:

- Baseline track geometry measurement
- Verification of rail profile, anchor and spiking patterns and clip replacement
- Confirmation of the lateral and depth extents of ballast cleaning
- Confirmation of as-built subgrade gradient (cross-fall) on newly-built track
- Conformance to design standards

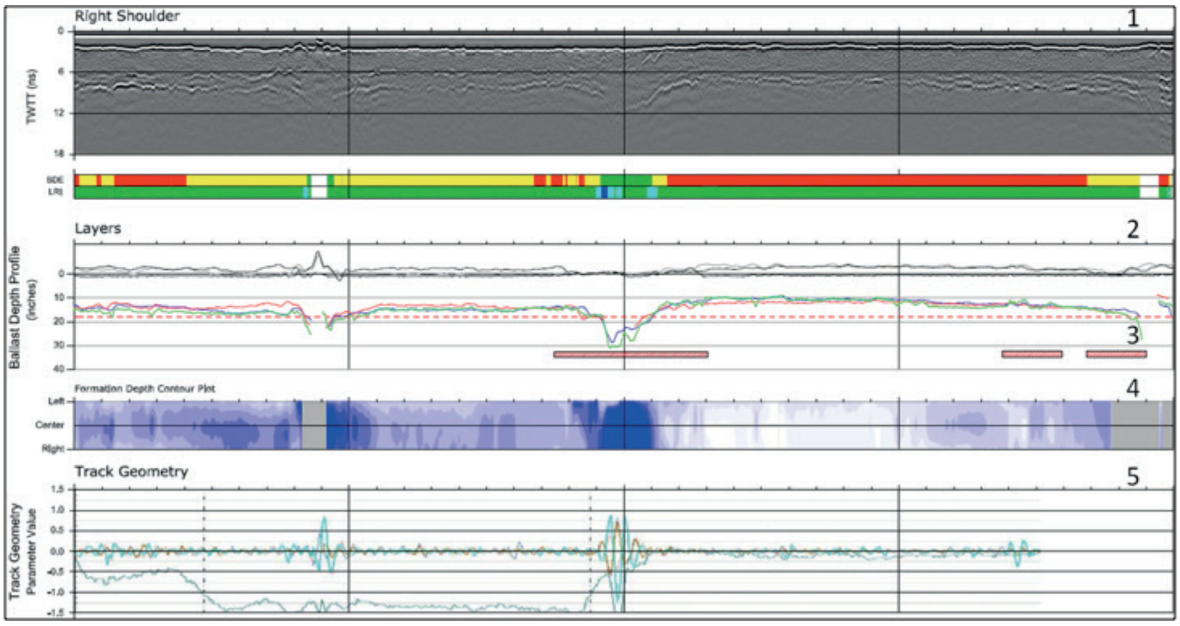
The following examples (clockwise from left) show the use of linescan camera trackbed imaging to verify anchor patterns, a 3D laser system to monitor fasteners and 2D laser point clouds to verify ballast surface profiles.



Forensic assessment of trackbed condition

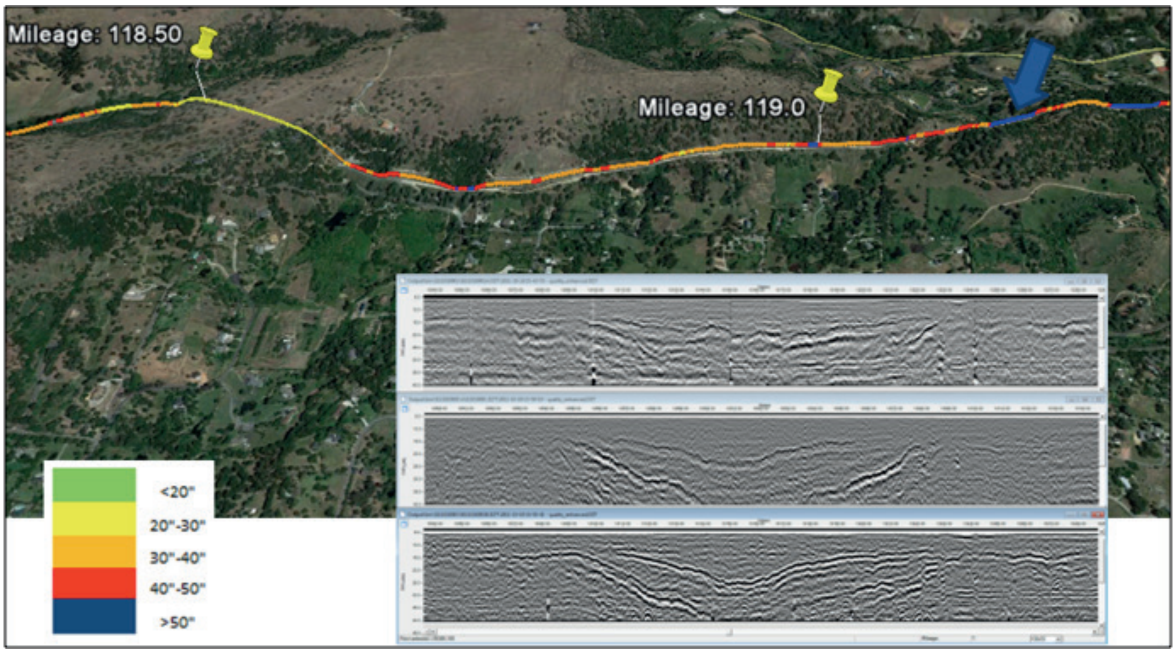
The RASC® data suite provides the information required to help investigate track geometry exceptions and in the forensic analysis of derailments, improving the understanding of root cause and helping reduce the risk of reoccurrence.

In the example chart below, data from a RASC® GPR survey is detailed for a section of track subject to a persistent slow order due to a recurring curvature exception. The track geometry data (5) is combined with trackbed layer information (2), recommended extents of formation rehabilitation (3), a contour map of the modelled depth of ballast (4), GPR layer metrics and an example GPR radargram (1).



RASC® data can also provide valuable input to monitor settlement of trackbed on embankments following heavy rainfall events and can be used to map sand ingress in and around ballasted track following sand storms in desert areas.

In the example below the existence of ballast pockets (>50” depth, some associated with undrained moisture) has been mapped for a critical section of track over elevated terrain.



Profile:

Zetica Ltd is an experienced service provider offering an integrated above- and below-ground measurement solution for trackbed inspection which offers the following benefits:

- Identification of subgrade erosion, drainage and ballast fouling issues which could affect track stability and explain track geometry exceptions
- Provision of a system to target trackbed maintenance effectively using evidence-based information thus reducing wasted time and resource unnecessarily maintaining track where this is not needed
- Reduction of material costs by optimising ballast cleaning and trackbed rehabilitation programmes
- Provision of an effective means of quality controlling new build trackbed or recently maintained trackbed to verify the work carried out
- Update of above-ground asset mapping information

In 2015 the RASC® Pod received vehicle acceptance certification for carrying out work on the UK rail network.

References:

(1) Zetica Ltd, January 2016. The RASC® Pod – rethinking trackbed inspection. Part 1: Improved ROI for trackbed inspection and enhanced track safety. www.zeticarail.com

Notes :

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More details are available at
www.zeticarail.com