TRANSFORMING TRANSPORT

MOBILITY MEETS BIG DATA

NEWSLETTER

005 | January 2018

BIG DATA IS REVOLUTIONISING HOW FAULTS AND WEAR ON RAIL ASSETS ARE IDENTIFIED

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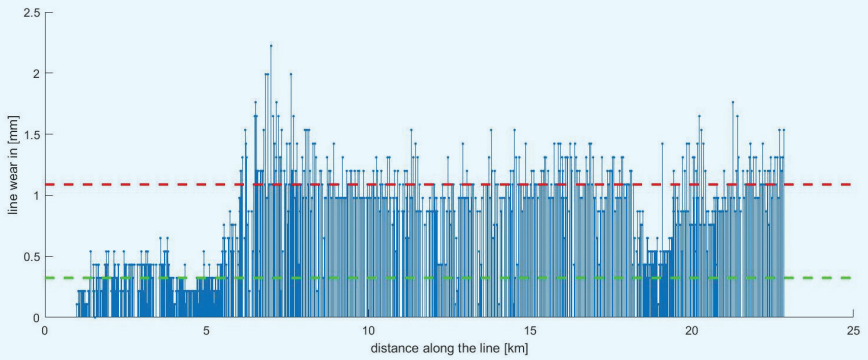
The Transforming Transport project, which is demonstrating how big data analytics can improve transport in a real-world setting, is progressing admirably across seven different transport sectors such as highways, air travel, sea travel, and rail. The project is demonstrating in two pilot subprojects how big data can improve safety, reliability, cost efficiency, and capacity on the main rail line in the UK and for a high-speed line in Spain. The project's intention is that the pilots' findings can eventually be replicated across and impact the whole of Europe.

The UK pilot project is looking at four types of rail infrastructure assets namely: overhead line equipment, point machines, track circuits, and track profile. The replication pilot on the other hand is focusing more closely on track profile and point machines, in addition to developing new predictive models to optimise railway operation based on the DaVinci rail traffic management planning system. Both pilots are developing and applying new big data techniques and algorithms to facilitate the maintenance improvements in order to provide timely, focused, and prioritised maintenance activities resulting in the ability to predict and prevent failures.

Already the pilots have started to produce valuable early insights based on analysis of the initial datasets provided. The results are radically improving the diagnosis and prognosis of two major rail assets: the point machine (or switch) and the overhead line equipment. This translates to big data helping to identify line wear and distribution of faults throughout the UK, as well as the location of problematic point machines within both the UK and Spanish networks.

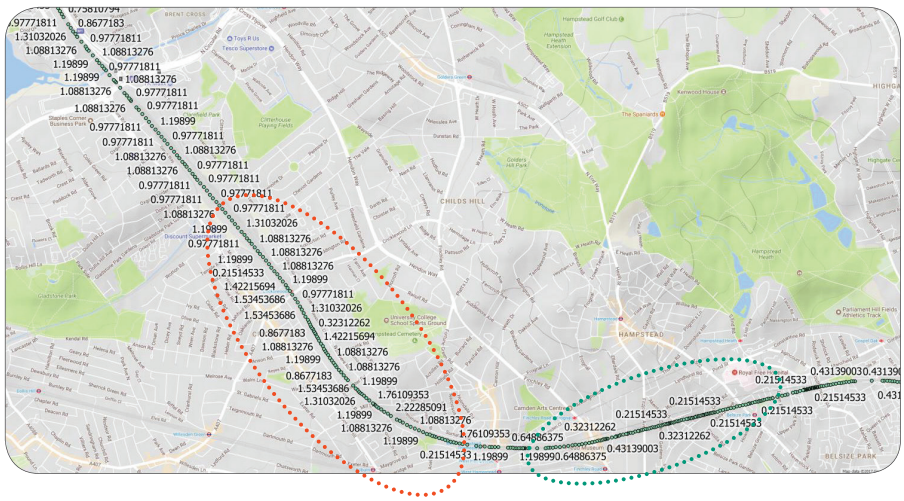
Importantly, each pilot is analysing each asset from two very different perspectives. For point machines, the initial pilot is employing 'Internet-of-Things'-type highly detailed telemetry data to predict future behaviour from historical data, whereas the replication pilot is using state machines which report true or false states e.g. 'is the point machine in motion?', 'is the point machine locked?', 'is the point machine over temperature?' etc. For the track profile measurements both pilots are utilising readings taken from highly specialised measurement trains at timed intervals. These measurements are both geometric (i.e. laser scanned measurements) and dynamic (i.e. accelerometer measurements). This similarity in measurement process is expected to lead to mutual gain and synergies between the two pilots. By June 2018, the pilots are expected to deliver the project domain's first functional prototypes and proof of concepts.

EARLY INSIGHTS FROM THE INITIAL PILOT IN THE UK



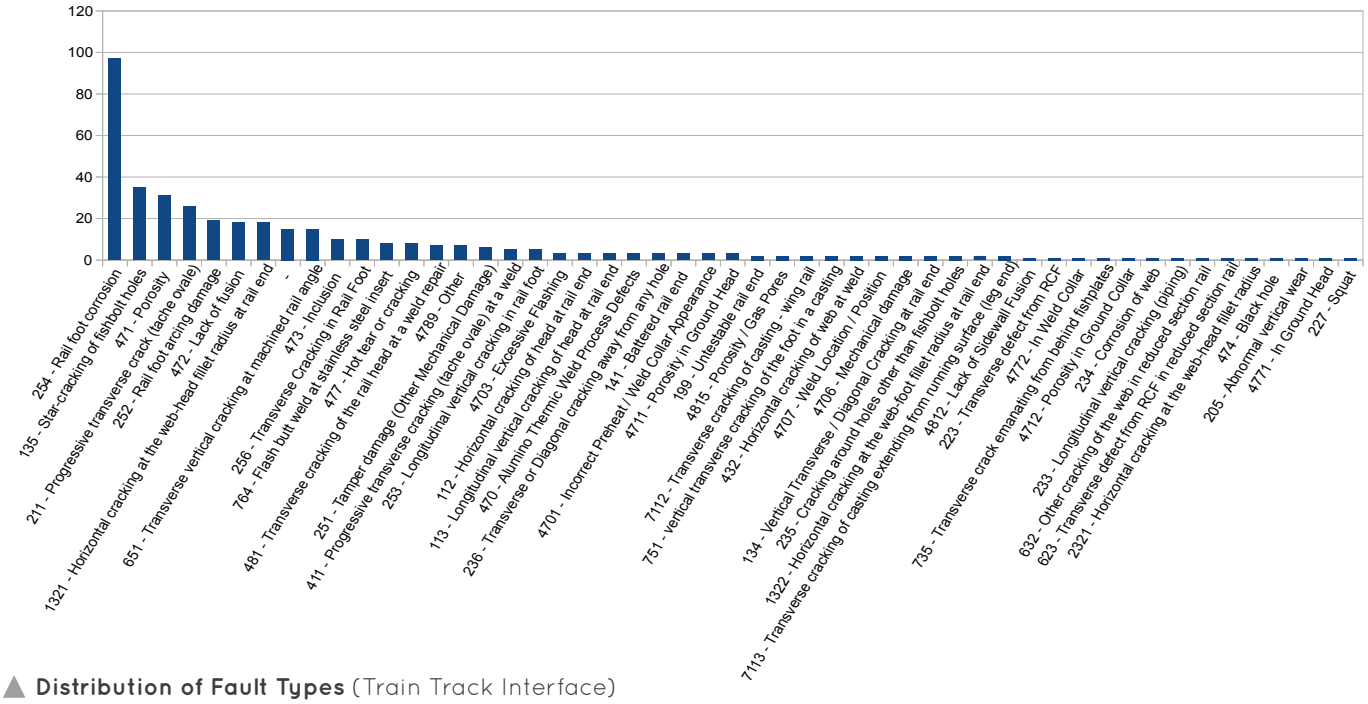
Line Wear (mm) along the line from Euston

Overhead wire thickness measurements (y axis) against the distance from Euston Station (x axis). The red and green lines indicate the upper and lower 25th percentiles in line wear. Further investigation will now be targeted at distances between 0 and 10km and 18 to 20km from Euston to identify the causes of these extremes.



Map of Line Wear along the Euston line

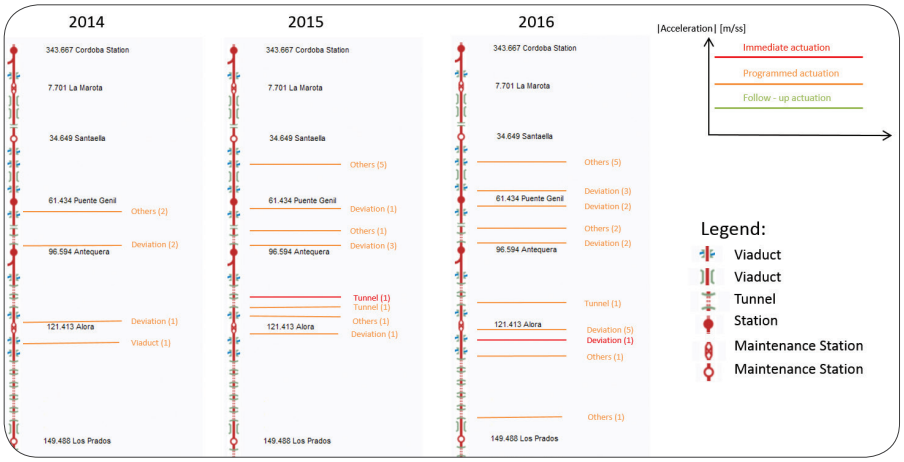
This chart shows the areas of high and low wire wear. The red circle indicates an area of high wire wear whilst the green indicates an area of particular low wire wear. Further investigation will now be targeted in these areas.



▲ **Distribution of Fault Types** (Train Track Interface)

The distribution of fault types in the data analysed clearly demonstrates that most faults are caused by 7 to 10 fault types which roughly belong to 3 groups: corrosion, cracking, and electrical damage.

EARLY INSIGHTS FROM THE REPLICATION PILOT IN SPAIN



◀ **Location of point machine faults along the line**

The chart shows the location of point machine faults per year along the high-speed line in Malaga from 2014-2016. The number of faults are increasing each year particularly around the central section of the line. Further investigation will now be targeting in this area.

◀ **Replication pilot initial dashboard design of error-detection software**

A preliminary view of the pilots' dashboard design linked to the newly developed big-data software to inspect tracks and identify switch errors.

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