

UNDERSTANDING ASSET LIFE: HOW CAN WE IMPROVE?

PWI TECHNICAL SEMINAR

LONDON SOUTH BANK UNIVERSITY

MAY 2019

AUTHOR: CHRIS PARKER, PWI CONFERENCE REPORTER

David Godley of Network Rail (NR) introduced the seminar, welcoming everyone to the London Southbank University. He reminded us of how human life expectancy has changed between the mid nineteenth century and now. The increase has been enormous, but he pointed out, much of the longer lifespan is likely to be spent in ill health. Statistics suggest that people may spend 30 years in poor health at the ends of their lives.

What matters is healthy lifespan, and this is just as true of our assets as it is to humans. In the rail industry more people are travelling on our trains than ever before, and whilst asset reliability has improved significantly, (incidents affecting failures have halved since the early 2000s), it has not been enough to prevent the total delays from rising unacceptably. Each incident potentially affects more trains.

This is a system wide issue, not just a track problem, and it requires us to make sure that the assets we control remain healthier for longer under greater pressure of use.

With this, David introduced the keynote speaker, who would begin the day's consideration of this challenge.

MORNING SESSION

CHAIR

MONA SIHOTA
PROFESSIONAL HEAD OF
OFF-TRACK, DRAINAGE & ASSET
PROTECTION
NETWORK RAIL

Mona's theme was asset data, and she began by speaking about the need for the right data at the right time. Data is critical to asset management; how can you manage without it? For example, if you don't know where your drainage is, how can it be managed? Hindsight is no use, the data must be there in time to facilitate correct, informed decisions and actions.

She looked at the concept of asset life, from the identification of a need for an asset and its acquisition, to its disposal and the management of residual liabilities. In between these extremes we utilise and maintain the asset, and we may modify or improve it.

The Institution of Asset Management has an Asset Excellence Model that Mona recommended, and this describes asset life and asset information very well. She recommended studying this Model as a good way of improving understanding of the whole of asset management.

Included in the Model is a discussion of the factors affecting data in lifecycle decisions, and Mona discussed these. Timing has already been mentioned; the correct perspective is equally vital, ensuring that root causes are found and fixed. A system wide view is essential, and so is competence to understand data correctly. Experience is useful but we must not allow our history to blind us to new concepts.

Finally, she spoke about the value of data and the costs that must be set against this. It is costly to collect, analyse and store data and it has a shelf life, needing to be kept up to date, so that too is a cost to be reckoned with.

So, asset data is essential for good asset management, but it is costly, and so needs to be managed appropriately in itself in order to deliver best value.



PRESENTATION 1

TRACKBED ASSET MANAGEMENT - IMPROVEMENTS IN DATA DRIVEN DECISION MAKING

MAT BROUGH
AECOM

Mat began by considering the trackbed asset, what it is and why it's important. In case of doubt, he said that research in the USA found that 7.5% of derailments had a trackbed root cause.

The principal trackbed related failure mechanisms are subgrade related, ballast related or system failures. Track quality data can be used to give warning of incipient

failures in these and also in the earthworks that support the trackbed.

Other considerations also need to be taken into account in seeking to understand the trackbed assets; such things as historic maintenance/renewal data, for example. Looking at what worked or did not work can be highly informative.

Mat then looked at the history of trackbed renewal decision making. Pre-Hatfield (2000), decision making was highly dependent upon local knowledge and the Hatfield crash resulted in the recognition of the need for a comprehensive asset database.

Mat took the seminar through the history of the introduction of technologies now in use every day; automatic ballast sampling, ground probing radar and track stiffness measurements, for example. By 2005/10 total route evaluation and a more scientific approach generally became accepted, and new solutions too were coming into common use, geo grids and geo-composites, for example.

From 2010, CP5 policy was to use better condition information to improve the understanding of degradation. Industry wide work took place such as that of TSWG, (track subgrade working group), on measurement and understanding and data analysis. There were leaps forward in the collection of linear asset data and its visualisation and yet more work on solutions to problems.

In future, Mat sees the use of rolling wheel track stiffness measurement, the application of instrumented service trains to replace dedicated measurement trains that occupy valuable train paths, the use of machine learning and "big data" and the improved use of the data we already have.

As always, decision making comes down to ensuring the best balance between cost, risk and performance.

Mat summed up saying that we have come a long way, but more improvement is always possible. He stressed the benefits of analytics and emphasised the need for an organisational asset strategy and the need for that to be understood throughout the organisation.

PRESENTATION 2

IS WEAR A BAD THING? INCREASING RAIL LIFE ON LONDON UNDERGROUND

ANDY VICKERSTAFF
SENIOR WHEEL/RAIL INTERFACE ENGINEER
TFL

Andy considered why LU used to be a (rail) wear dominated railway, why it no longer is and why that is important.

LU has a lot of tight curves, particularly on the older lines, and by tight, Andy means less than 400m in radius. Early rolling stock had very stiff bogies and jointed BH track used to be universal. Even today about 30% of LU track is BH. All of this meant that rail wear and deformation were extremely common, and dominated track matters. As with NR, changes in track and rolling stock mean that things have changed so that today rail wear is much less significant and other things are more important. Squat type defects, corrugations and rolling contact fatigue (RCF) are now major factors, as is wheel damage in certain circumstances.

Andy described in detail how the inter-running of C and D stock on certain routes led to wheel flat problems on the C stock. This was due to the different curving behaviour of the two train types, so that wheelsets on the one come into flange contact sooner on a curve than those on the other type of train. The positioning of rail lubricators was inappropriate for the C stock, causing the problem.

Squat type defects have become a real problem and are thought to be caused by the heating of the rail surface as a result of the behaviour of the trains' wheelslip prevention systems. The heating results in martensite forming in the rail head, a hard form of steel that cracks. Done early enough and correctly, rail grinding is effective in controlling this before rail breaks result. Otherwise weld repairs or re-railing are required.

Corrugations are an issue in the deep tubes, especially on NTF415 sleepers. They are a major cause of noise & vibration complaints from neighbours, Vanguard baseplates can isolate the track from the ground, reducing complaints, but the other problems caused remain. Grinding can eliminate the corrugations, but they may return if the root cause remains. This is "pin-pin" corrugation, speed sensitive as it is caused by a common frequency of vibration of the wheelsets and the track. The frequencies are determined, inter alia, by sleeper spacing and train speed. The issue is complicated by the fact that not all trains through a given track section run at the same speed, despite automatic train operation.

Andy spoke about how LU is predicting RCF using the whole-life rail model and measuring it using the MRX device. They have been testing for RCF for 5 years now so have good historic data to aid decisions. Rail grinding, once again is a possible solution, but the constraints of the infrastructure limit the size of grinding trains to 8 stone machines and short engineering hours severely limit what can be achieved. However, LU is now developing a model for determining grinding frequency based upon traffic and available engineering hours. The use of HP335 rail has been tried and has worked in some cases, though not universally. Poor track support conditions have been the problem, it seems.

Andy talked about rail wear today, which still happens but is not quite the dominating factor it was. Rail lubricators are used, but there are risks to braking performance, and maintenance of the devices themselves is awkward due to access issues. The trend is towards fitting wheel flange lubricators onto trains instead.

In future, there is expected to be a shift to rail milling instead of grinding, as more rail can be removed in one pass, increasing production in tight engineering access. The new deep tube trains are more track friendly and will do less damage. There is still a question as to whether rail wear is better than RCF as it's more predictable and manageable.

Finally, for LU, 80% of the cost of rail is in the cost of installation and recovery, so once it is in the track it's important to look after it and get the most out of it.

PRESENTATION 3

COLLECTING ASSET DATA & GENERATING INTELLIGENCE FROM IT

KEVIN HOPE
NETWORK RAIL STE

Kevin commenced by asking why we collect asset data, citing incidents like Hatfield & Greyrigg as the evidence for its necessity. He also showed a video of a dewirement that destroyed the pantograph of MENTOR, the only instrumented pantograph in the country at the time.

All these occurrences, arguably, could have been avoided if the appropriate information had been available to the right people at the right time. Asset data is the beginning of asset information.

Next, he considered what data is collected at present. The majority of NR's assets are covered, mostly by automated systems.

Such technology includes GPR, ultrasonics, PLPR (plain line pattern recognition) and more. Recent developments include eddy current rail crack detection & measurement, rail deflection (to monitor track stiffness) and wheel/rail forces. The NR dedicated train fleet covers over 750,000 km/year.

Benefits of this technology include safety, accuracy, speed and repeatability. The well-known success story of rail breaks, reduced from around 1,000pa to about 100, is testament to the effectiveness that can be achieved.

However, whilst such successes have cut the rate of service affecting failures, as we heard earlier, the increase in traffic has meant that total delays are not reducing sufficiently. Delays per failure have gone up due to the increased number of trains.

Embedded monitoring is being implemented so 60,000 assets are now monitored thus, for example, point heaters, S&C and more. In-service monitoring platforms are being introduced, on service trains, for example. Innovative systems being utilised include drones and train mounted laser scanning systems.

Work is going on to better manage "rough riding" reports from train crew. It is becoming clear that there is not a good correlation between such reports and actual track

geometry defects. Effort is being made to understand why this is and how it can be managed to avoid unnecessary performance impacts.

Effort is being put into generating real intelligence from asset data, maximising the value of the investment in its collection and storage. Kevin described the use of P-F curves that plot asset condition against time. The object is to predict asset failure and allow planned intervention before failure occurs.

He described how his company is using health assessment analysis for track, dividing it into red, yellow and green categories, and how the track decision support tool is used similarly, in order to anticipate faults and avoid them.

Other techniques include the combination of different datasets, as in LADS, to help understanding of root causes, and the use of total route evaluation to understand the residual life of assets, the best actions to take and drive the planning of renewals and their budgets.

Finally, Kevin mentioned a few of the future challenges he foresees, such as the incompatibilities between some measuring systems, the thorny problem of longitudinal accuracy, and the growing problem of track access.

PRESENTATION 4

EXPLOITING THE VALUE IN DATA

JONATHAN JARRETT
AMEY CONSULTING

Jonathan referred again to the ideal whereby data generates value through better decisions. High speed, quality decisions must be the objective, he said.

He described how there is potentially a gap in decision making between the tactical, immediate, daily things and the strategic, life cycle, big value long term ones. In order to meet the current intensity of demand, that gap needs closing.

He explained how in 2016 SE train performance became a big problem, and no amount of tactical work seemed able to improve matters. Amey Consulting was engaged to assist in resolving the problem.

It was discovered that the tools to manage this issue did not really exist. Train performance data was focussed upon the 5-minute delay

threshold and delays less than 3 minutes weren't even recorded by the delay attribution system in use.

Fortunately, the native railway systems did rather better, with trains being monitored to the second by the signalling system TRUST and Train Descriptor. Using the data from these systems it was possible to pick up and pinpoint delays as soon as they began to develop.

Jonathan went on to describe some of the tools developed based on this data, which were successfully used to improve matters.

Thank you to the speakers, organisers, exhibitors and sponsors.

AECOM

ASPIN
QUALITY AND INNOVATION FROM THE GROUND UP

AQUA

BANCE

Staytite

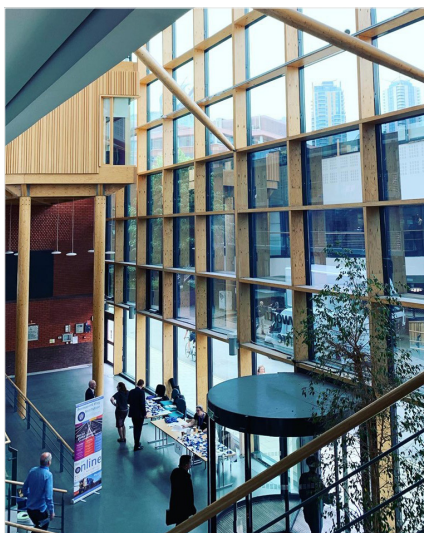
Excalibur
SCREWBOLTS

CONCLUSION

DAVID GODLEY NETWORK RAIL

David spoke briefly about the impending reorganisation of Network Rail, and the intention thereby to bring the infrastructure and train operators much closer to each other. The professional heads in NR will devolve many of their current responsibilities to appropriate Regional posts, giving the Routes more power, but also more responsibility. This will make the competence of those in the Regions significantly more importance.

Following this, he gave his, and the Institution's thanks to the organisers, sponsors and exhibitors who made the event possible and successful.



Presentations from this seminar can be viewed in the PWI Technical Hub.

www.thepwi.org/technical_hub/presentations

“

Feedback from our delegates

Excellent thought-provoking presentations which generated good discussion and gave me things to take back to my role.

Having been to the last five of these seminars, I thought the speakers this time were the best yet, and the content valuable too. Well done!

Data issues in the industry are not new and it was refreshing to see that some effort is being made to improve the situation.

The speakers all had different styles and presented different aspects on the same subject. Good to keep to half hour presentation time. Really enjoyed the key note speech.

”

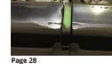


The Repoint Project

TIM HARRISON

PAGE 32

TECHNICAL JUSTIFICATION FOR
GAM T PIECES



Page 28

TRACK WATER: OPTIMISING
RAILWAY DRAINAGE
MAINTENANCE USING IoT
SENSORS



Page 37

THE INFLUENCE OF SLEEPER
MATERIAL CHARACTERISTICS
ON TRACK BEHAVIOUR



Page 41

TECHNICAL ARTICLE

AS PUBLISHED IN

The Journal July 2019 Volume 137 Part 3



If you would like to reproduce this article,
please contact:

Kerrie Illsley
JOURNAL PRODUCTION EDITOR
Permanent Way Institution
kerrie.illsley@thepwi.org

PLEASE NOTE THE OPINIONS EXPRESSED IN THIS JOURNAL
ARE NOT NECESSARILY THOSE OF THE EDITOR OR OF THE
INSTITUTION AS A BODY.