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MAGAZINE

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The New Silk Road

PLUS... *The Role of Academia in the Rail Industry* **&** *Altrom: From Digitalisation to Train System Availability*

ISSUE ONE 2017

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Letter from the Editor

First of all, I hope you've all had a great start to 2017.

We've certainly been incredibly busy with the launch of our new website, which you've hopefully had the chance to explore! I obviously speak from a place of bias but I'm very happy about the inclusion of a special magazine section so you can find all our past issues.

And so of course a warm welcome to our first magazine of 2017. We have some exciting features lined up for you.

Last month the first train from China arrived in the UK, an extension of the existing freight route between the Asian superpower and the German city of Duisburg, the world's largest inland port. We take an in-depth look at the journey.

In the piece 'From Digitisation to Train System Availability', Thorsten Bomke discusses Alstom's new HealthHub.

Parker Hannifin discuss 'how innovative current collection solutions can help train manufacturers'.

We also take a look at high-speed rail in Spain, from the Almonte Viaduct to other projects the FCC construction company are involved in.

Neil Barry from Space-Time Insight tells us how we can use data to manage the logistics of big sporting events like the rugby world cup that took place in England. Harnessing the vast volumes of data we generate to produce the smartest solutions for society is a subject matter that's only going to grow in importance in years to come.

We have chatted with academics in the UK, Sweden, India and the United States to learn more about the interaction between academia and the rail industry.

All in all a diverse issue to get us going nicely for 2017.

Our next issue is due to be published in the run-up to Railtex, which takes place in Birmingham, U.K., 9–11 May. Please email al@railway-news.com if you wish your company to be one of our advertising partners in that issue; if you wish to discuss editorial content, please get in touch with me at jcs@railway-news.com.

Please do follow us on Twitter (@Railway_News). We also have a Facebook page (@railwaynews2015) as well as a LinkedIn presence (Railway News) so you can keep in touch with us there too.

May the China-London train serve us a reminder of what we're capable of when shared interests, goals and technology come together. Here's to a prosperous and stimulating 2017!

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If you would like to submit editorial content, or you are interested in giving an interview for the magazine, please contact **Josephine Cordero Sapién**. If you would like your company to join Railway-News's online platform, please contact **Andrew Lush**.

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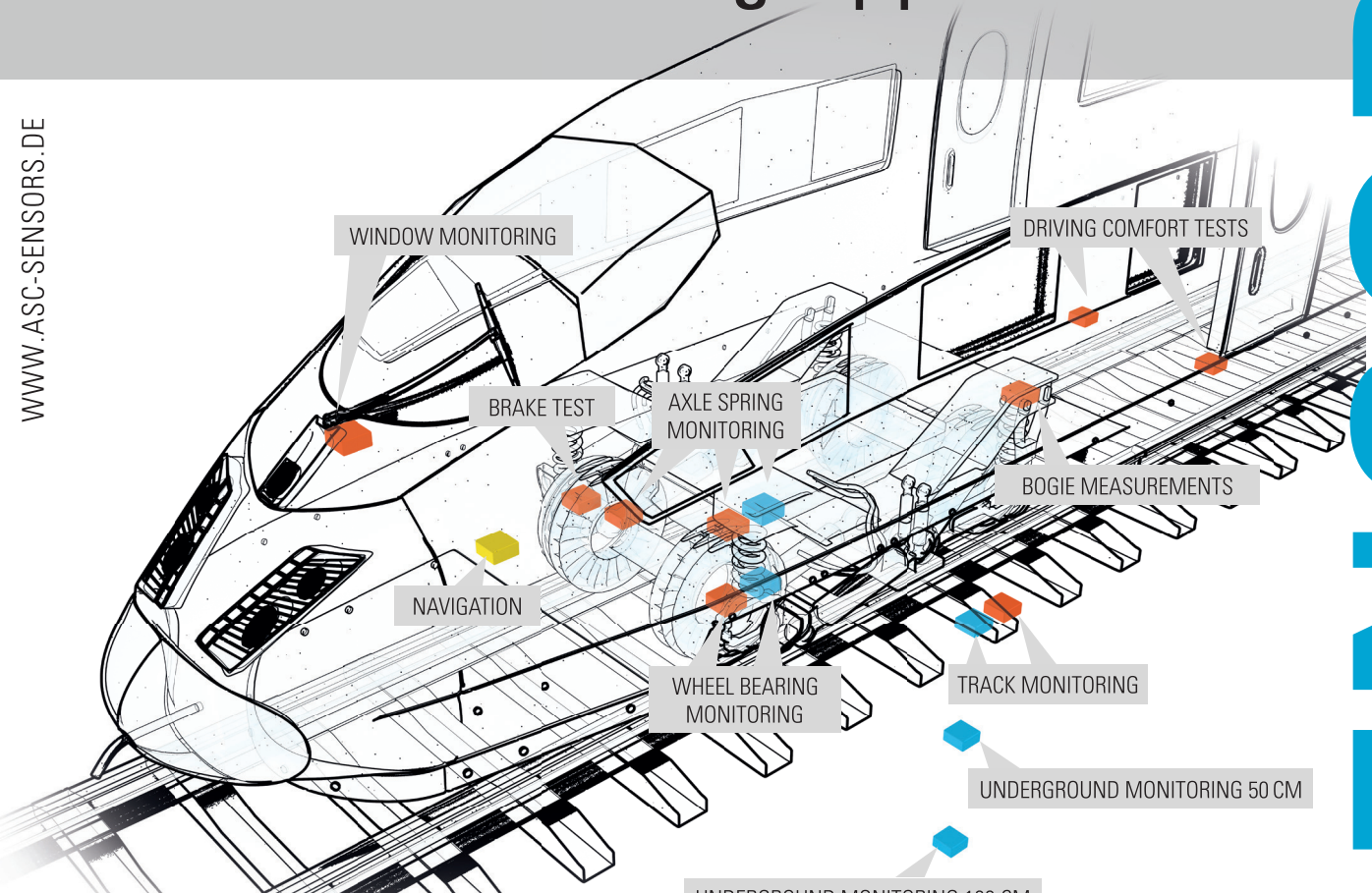

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TESTING & COMMISSIONING APPLICATIONS

- Passenger Comfort & Ride Quality
- Brake & Crash Testing
- Modal Analysis
- Commissioning Tests in Laboratories

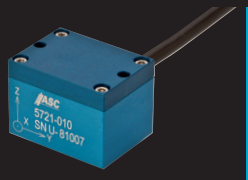
CONDITION MONITORING APPLICATIONS

- Bogie Monitoring
- Wheelset Monitoring
- Axle Box Bearing Monitoring
- Gearbox Monitoring

MISCELLANEOUS APPLICATIONS

- Track Condition Monitoring
- Ground-borne Vibration Monitoring
- Soil Quality Determination

CAPACITIVE ACCELEROMETERS



OFFSHORE ACCELEROMETERS

IEPE ACCELEROMETERS

Contents

FEATURES

INTERVIEW

SUPPLIER NEWS

The New Silk Road

A Look at the East Wind Freight Train that Travelled from China to London

By Josephine Cordero Sapién

As was widely reported to much fanfare on 18 January of this year, the first freight train travelling between China and the UK arrived in London, at DB Cargo UK's Eurohub Centre in Barking, having departed Yiwu, in the eastern province of Zhejiang on 1 January.

We wanted to take a closer look at the journey as the train dealt with a whole host of issues, from technical aspects such as interoperability to political and economic ones, such as customs checks. The 'Study on Corridors' by OTIF, the Intergovernmental Organisation for International Carriage by Rail, which has 50 Member States, stated that the key issues for international rail transport "include the harmonisation of transport documents and technical standards, use of electronic records and the simplification of customs procedures etc." (http://www.otif.org/fileadmin/user_upload/otif_verlinkte_files/07_veroeff/Studien/STUDY_ON_CORRIDORS_-_Final.pdf)

Background

The Silk Road is the oldest overland trade route in the world, running between China in the east and Europe in the west. Goods such as gunpowder and spices were transported, and of course the eponymous silk, the most lucrative of all the commodities traded.

Now, the president of China, Xi Jinping, launched a revival of the Silk Road, an undertaking he calls One Road, One Belt, designed to link the east and west again with both an overland trade route, this time by train, and a maritime route. Unveiled in 2013, the first train to run on this network reached Iran from China in February 2016.

The One Road, One Belt policy is an enormous economic undertaking, intended to increase China's influence on global trade. In fact, China's president said he hoped this new Silk Road would bring in an extra $2.5 trillion to China in ten years. With China excluded from the US's TPP, China wants to assert its own economic dominance in Eurasia. With more than 60 countries involved in the entire network, such a partnership can enhance economic and therefore political stability in regions and benefit everyone through mutual access and exchange.

Route Description

The One Belt One Road overland route is not one linear route from east to west, it is instead a whole network of routes linking 16 Chinese cities to 12 European ones.

- **Total length of 11,000 kilometres (7456 miles)**
- **Travelled through 9 countries (China, Kazakhstan, Russia, Belarus, Poland, Germany, Belgium, France, UK)**
- **Carried 34 containers**
- **Cheaper than air freight and faster than maritime freight**

China

The East Wind freight train began its long journey in Yiwu, in the far east of China, south of Shanghai, at the Yiwu West Railway Station. It then travelled the width of the country, on standard gauge lines (1,435mm), heading northwest to the border of Kazakhstan.

Kazakstan – Russia – Belarus

Crossing the border into Kazakhstan at Alashankou/Dostyk, on the Dzungarian Gate, an important mountain pass along the Eurasian Land Bridge, the containers had to be unloaded and the rolling stock (platform wagons and locomotive) replaced to accommodate the 1,520mm 'Russian' gauge in place in Kazakhstan, Russia and Belarus.

There are customs checks

between China and Kazakhstan. However, inspired by the European Union, Kazakhstan, Russia and Belarus entered a customs union in 2010, which became the Eurasian Customs Union in 2015. This allows for smooth border crossings between Kazakhstan and Russia and Russia and Belarus on this front.

The freight train continued northwest, to Astana, the country's capital. The 839km from Dostyk to Monty is not yet electrified though these works are planned to be completed in 2018. The 1071km from Monty via Astana to Petropavlovsk on the Russian border is already electrified.

After leaving Kazakhstan shortly after Petropavlovsk, the East Wind continued its westward journey in Russia, travelling 2448km to Moscow. Incidentally, one of the reasons China is interested in developing its freight rail route through Russia is the devaluation of the rouble, making it a cheaper choice.

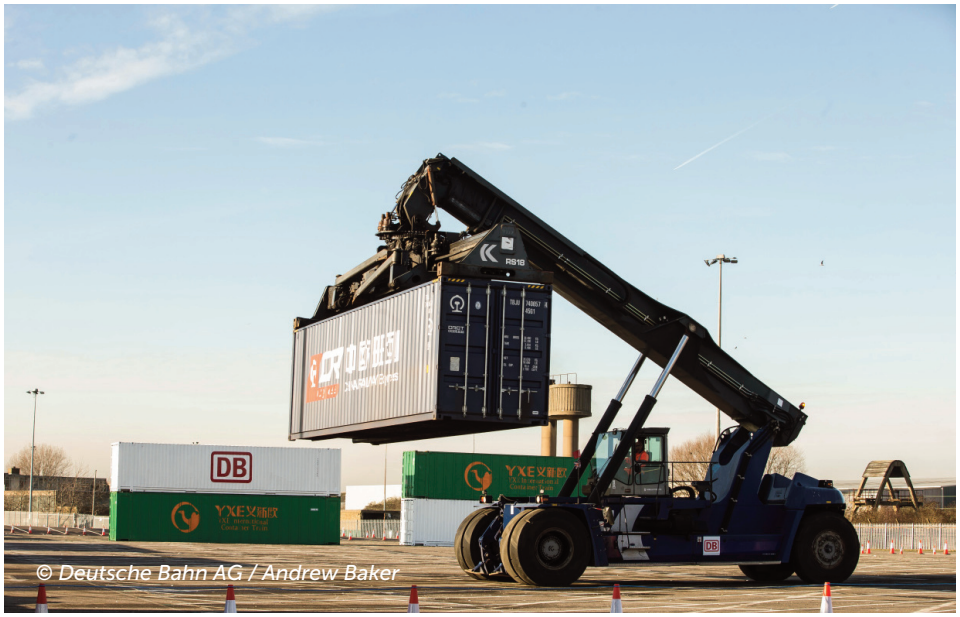
The stretch between Moscow and the Kazakh border is also electrified. However, the two countries have different electrification systems. This means that either the train at the Sino-Kazakh border had to be a two-system locomotive or the locomotive had to be changed at the Kazakh-Russian border, despite the gauge remaining the same.

Having reached its northernmost point in Russia, the train now headed southwest, on Pan-European Corridor II, towards the border with Belarus. The train made its way through Orsha (Belarus), through the country's capital of Minsk and onwards to Brest on the Belarusian-Polish border.

Here once again the train was confronted with customs checks as it left the Eurasian Customs Union and Entered the European Union. Another factor was the second break-of-gauge, with the whole of the EU operating, like China, under the standard 1,435mm gauge.

Poland – Germany – Belgium – France

Once in Poland, the freight train traversed the country east-west via its capital of Warsaw before heading straight into Germany at Frankfurt-an-der Oder, without customs or gauge issues.



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The train continued through Berlin and headed to Duisburg, at which point DB Cargo UK took over with an electrified Class 92 locomotive, a dual voltage locomotive that can use both overhead wires or a third rail and that was designed especially to run services through the Fixed Link between France and the UK.

The East Wind steadily continued through both Belgium and France before making its way through the Channel Tunnel and entering the UK. Six of the containers had to be transported by ferry instead for safety reasons.

UK

The UK also operates on standard gauge lines and is currently a member of the European Union. However, given last year's Leave decision on the UK's referendum on EU membership, Prime Minister Theresa May has given a speech stating that it is the UK's goal to leave both the Single Market and the Customs Union. Politically the UK seeks to brand itself as 'global' and 'open for business'. The arrival or the cargo train from China is a positive for a Government wishing to emphasize trade links to major economies outside of the European Union.

However, this train (to serve as an example) clearly benefitted from a lack of customs checks at the French-British border and from the European Union's continued effort to create a Single European Railway Area, with technical interoperability – from everything from signalling to fire safety standards – and a huge reduction in red tape.

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How the UK will choose to proceed from hereon in with regards to railway harmonisation remains to be seen. However, less than 1% of EU-Asia trade is currently conducted overland. (http://www.otif.org/fileadmin/user_upload/otif_verlinkte_files/07_veroeff/Studien/STUDY_ON_CORRIDORS_-_Final.pdf) Most is still done by sea. Although this option takes longer, overland rail transport is more expensive. It should also be noted that although rail transport is responsible for a much lower carbon output than air transport, shipping is, surprisingly, still the most carbon-friendly option.

After almost 12,000 kilometres the East Wind switched to being powered from the rear by a Class 66 diesel-electric locomotive as the DB Cargo UK's Eurohub in Barking is not electrified. It arrived with its cargo of 34 40-foot containers, filled with goods such as clothes and other high street goods.

The current plan is to run a weekly service to gauge (excuse the pun) demand. However, with increased harmonisation, with the further roll-out of ERTMS signalling and the reduction in other barriers, China's One Belt, One Road policy is set to access and integrate markets, continuing the legacy of the original Silk Road, which started in around 120BCE, fuelling the exchange not just in goods, but also culture and technology.

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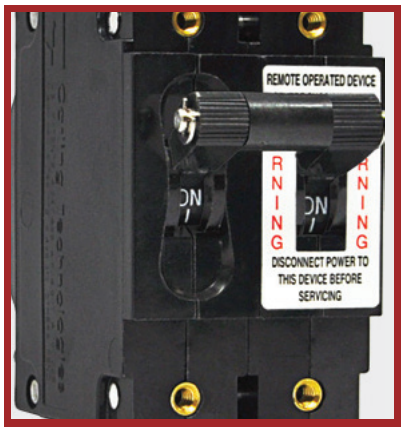

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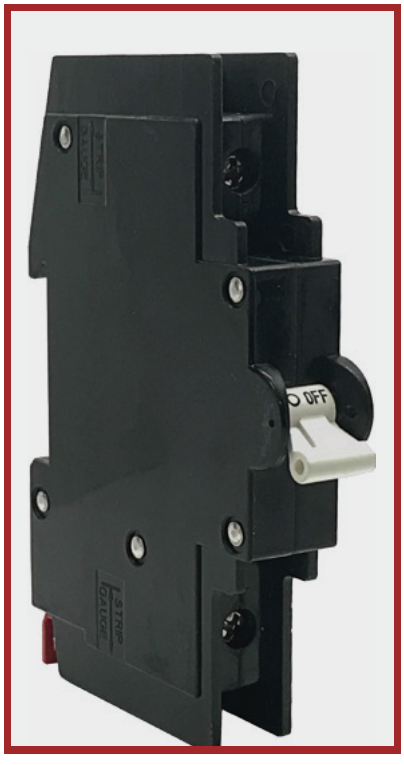

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- 1-3 Poles
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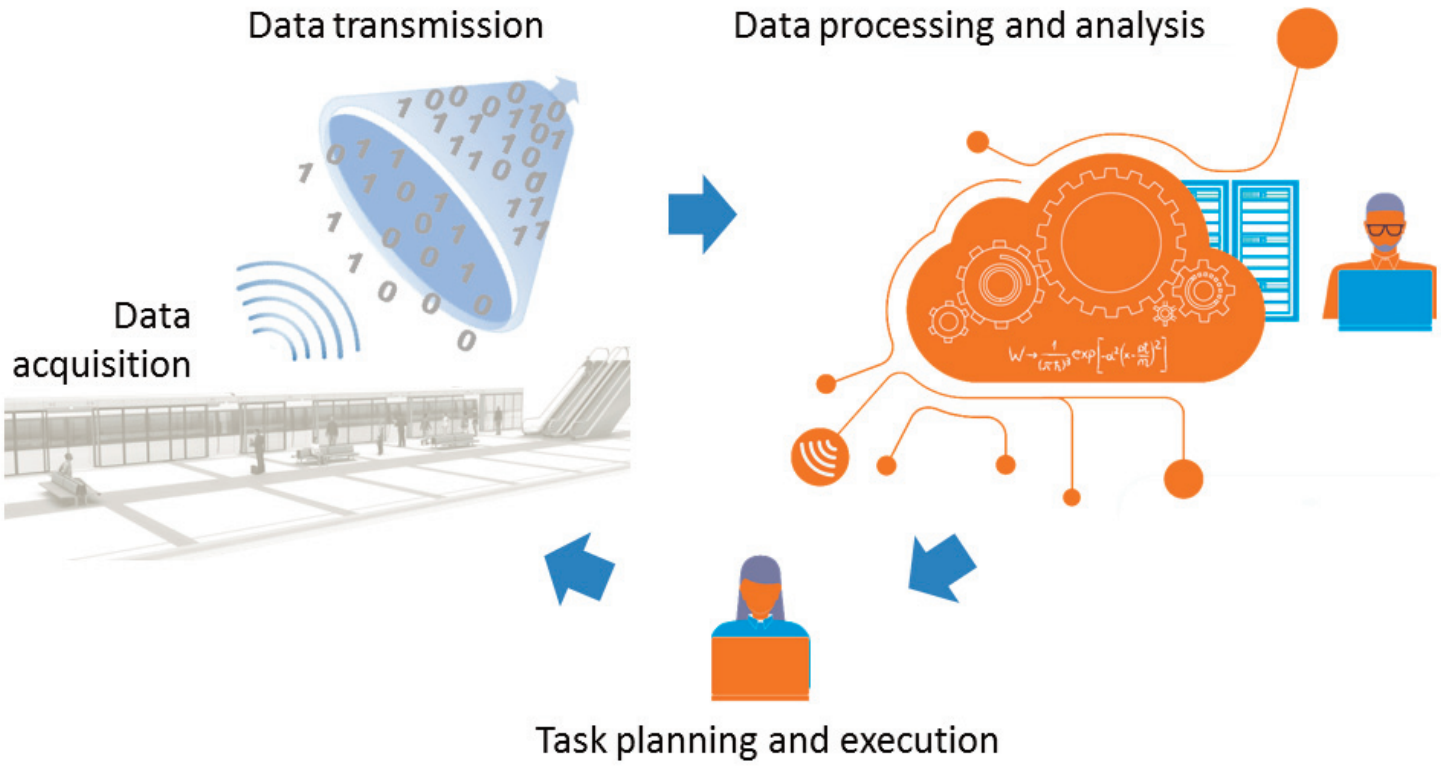
- UL489, CUL Certified & TUV

From Digitalisation to Train System Availability

By Thorsten Bomke, Market Portfolio Director Services, Alstom

'Digitalisation' was one of the most frequently-used words at InnoTrans 2016. The number of announcements or articles published relating to 'digital' products has continued to grow ever since. Many of these publications focus on the new technical solutions available today; some focus on the cultural and organisational changes that digitalisation represents for a company such as Alstom; but not enough focus on what this is all about: providing the highest possible train system availability with the most efficient use of resources. Using data to improve a technical system of any kind represents nothing new for the rail industry. Train systems have been collecting data enabling operators and maintainers to understand and improve these systems for many years. The novelty lies in the quantity of data that can now be made available and managed in real time, and in the correlation of datasets that can be used to create new information and even predict the evolution of system parameters. Technical and cultural challenges need to be carefully addressed to fully benefit from these new developments and to achieve the highest possible train system availability at reduced costs.

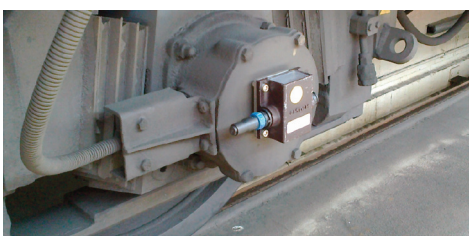


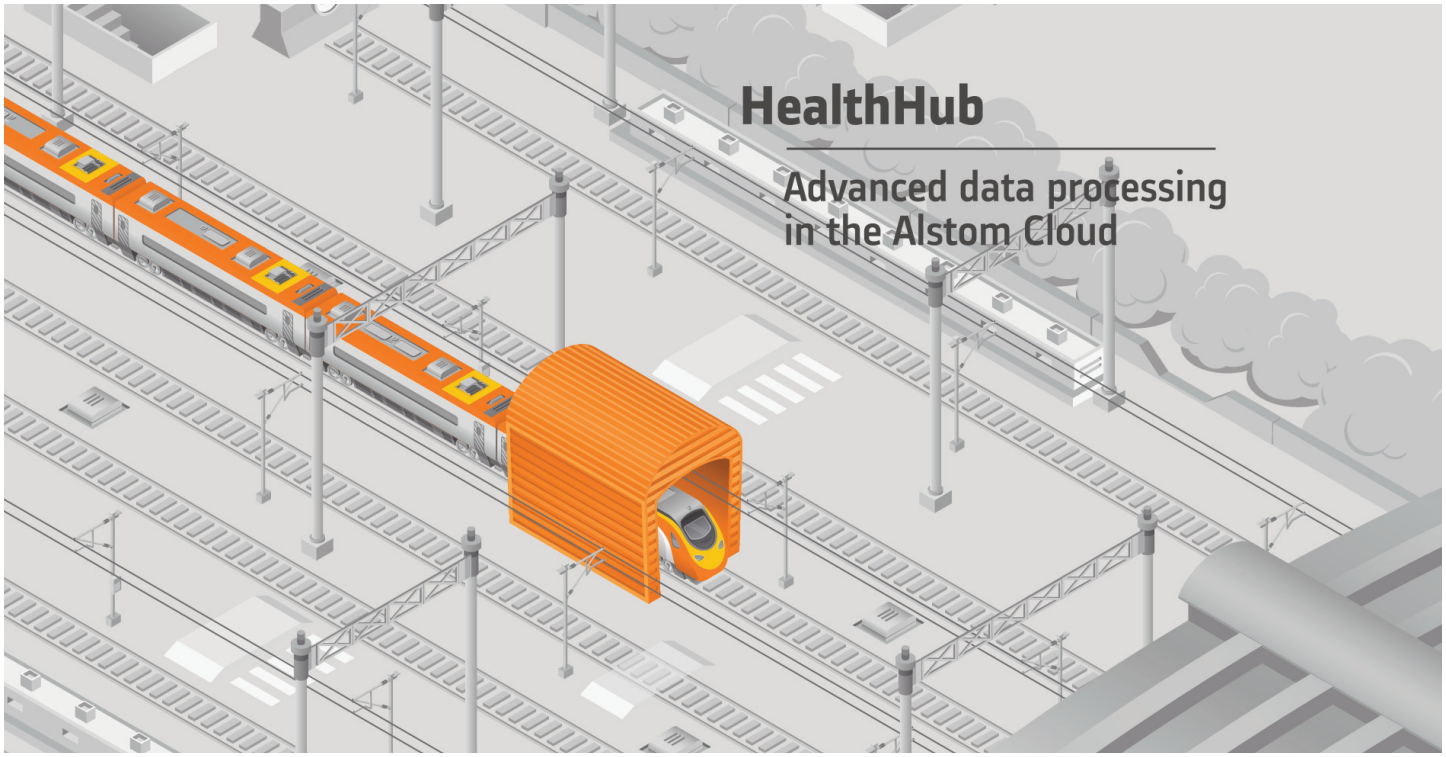
Market Drivers for Digitalisation

So why have the concepts of 'Digital Rail', 'Rail 4.0' and 'IoT' (Internet of Things) become such buzzwords in today's rail industry? The rail market is facing strong intra-segment competition, discrediting the predictions of a few years ago, which foresaw a strong concentration of the rail market and a reduction of suppliers; we continue to enjoy a large variety of market actors in terms of geography and technology. Inter-segment competition is also growing: Maglev trains, electric buses, automatic driving trucks and shared individual modes of transport such as Uber are competing with the traditional rail sector. This growing competition in passenger or freight services has an impact on operators. The frame conditions of the rail market can increasingly be compared with other infrastructure markets such as the telecoms or energy sector: markets today are often open to competition, with various actors, both public and private, competing over new franchises for passenger or freight services. Growing competition at all levels of the rail market has placed greater pressure on costs, but it is also stimulating innovation.

Energy is a major cost factor for train operators, representing up to a third of the total operating cost of passenger services, and even more for freight services. Visibility over energy costs and the ability to control energy consumption is a prerequisite to optimize an operator's cost position. Collecting energy consumption data and monitoring it over a long period of time is therefore essential to identify areas of optimization and cost reduction.

Other important cost elements are all related to train availability. Train availability targets are achieved when a pre-defined number of trains are ready for service at a given time and location. This objective can be met either with the aid of very large resources (as is still the case on some networks) or by using minimum resources with maximum system availability. Train service availability is ensured through the proper maintenance of trains and infrastructure, requiring permanent investment over the lifetime of the train system. Here as well, knowledge not only of train status, but of the systems and subsystems makes it possible to optimise maintenance efforts: how can maintenance cycles be enlarged, how can downtime for maintenance activities be reduced, how can train system availability be maximised? Data thus needs to be collected from trains and infrastructure, then worked with to allow reductions in the life-cycle cost of a train system.





The Technological Push for Digitalisation

We are seeing a growing number of 'intelligent' products capable of collecting, analysing and transmitting status data. Additional information can be collected through sensors that measure temperatures, pressures, vibrations or emissions, to name but a few examples here. This makes it possible to add context data to status data. Easily collectable data includes the time and location of a measurement. A wide variety of specialised or combined sensors exist today, and the rail industry stands to benefit from developments observed in other competitive industries. More complex measurement tools such as Motes integrate several types of sensors, thus increasing the quantity of data collected. Motes are networks of wireless sensors specified for the railway environment, enabling predictive maintenance on critical rolling stock components. Motes consist of lightweight versatile components that are connected without cabling and can be configured in various topologies. Data is collected via an array of sensors, then transmitted to neighbouring nodes in order to relay and route all the information to a site maintainer's tablet computer or to a web-based service.

Most digital services rely on fixed or wireless telecom networks that transmit the collected data in real time. Although the quantity of

data per measurement is low, the permanent measuring of a large number of pieces of equipment on trains or at infrastructure level makes it a real challenge to provide sufficiently dimensioned data transmission capacities. Depending on the type of equipment (moving versus fixed assets), various transmission technologies can be of interest. For urban areas, wifi networks represent a cheap transmission mode as wifi chipsets are mass products, meaning costs are low, and wifi coverage can easily be established and the data then sent to fixed networks. In rural areas or when connecting moving objects, radio technologies often rely on 3G or 4G networks to provide cost-efficient coverage over large distances or very high train speeds. The introduction of 5G networks, already begun in some markets, will significantly increase data capacities (maximum data rates: 3G: 2Mbps, 4G: 100Mbps, 5G: 1 Gbps).

Deploying sensors and communication equipment in areas where additional power supply was not initially foreseen can be a challenge. More and more solutions exist to overcome these challenges, some adapted to rail, and others less suitable. The easiest solution is of course to use an existing power supply, for example one that is used to power trackside products such as point machines, track circuits or level crossings. Installing a power source where no power source has been foreseen, e.g. at bogie level on a train, can be costly. On all moving objects, energy harvesting represents an interesting option; battery solutions have also made great progress with regards to lifetime duration and temperature resistance.

Last but not least, data storage and data analytics have evolved dramatically. Data storage centres are either physically deployed in rail projects, or available as a cloud-based service. The processing of huge amounts of data collected in train systems represents a real challenge. Data has to be stored, filtered, analysed, correlated and then turned into actionable information. This is by no means trivial: in the context of rail, the information must make it possible to sound the alert if a measured status is outside a predefined range, as well as predict the status evolution based on historical data so that the ultimate objective, highest train system availability at a controlled and reduced cost, can be achieved.

Prognostics and Health Management with HealthHub

The Alstom HealthHub consists of a series of innovative solutions for remote condition-monitoring and predictive maintenance of rolling stock, infrastructure and signalling systems. HealthHub includes tools for data capturing, transmission and analytics. The ultimate goal of HealthHub is to optimise operational management using a 'pit stop' approach: the task chain for maintenance tasks is optimised as events can now be predicted, making it possible to plan interventions. Unplanned downtime for trains or infrastructure can thus be avoided. This means not only having the right parts available for maintenance or repairs; it affects people planning too: which skills need to be available at a given time, and where? What kind of external specialist support may be required? As a result, the train system can improve availability KPIs.

Alstom's HealthHub™ is built on four pillars:

- **The Motes are a network of intelligent wireless sensors defined by a group of nodes. This network first acquires data, mainly related to vibration and temperature, before transmitting it to neighbouring nodes in order to relay and route the information to on-site technicians through tablet computers or directly to the cloud-based server.**

- **The TrainTracer is an on-board real-time train condition-monitoring tool, which could decrease train downtime by up to 30% and recurring faults by up to 50%.**

- **The TrainScanner takes between 45 and 90 seconds to carry out an x-ray check on a train, and automatically and accurately detects potential maintenance needs for various components and fixed parts.**

- **The TrackTracer and CatenaryTracer are designed to capture data on track and catenary conditions during operation in order to predict and plan any maintenance.**

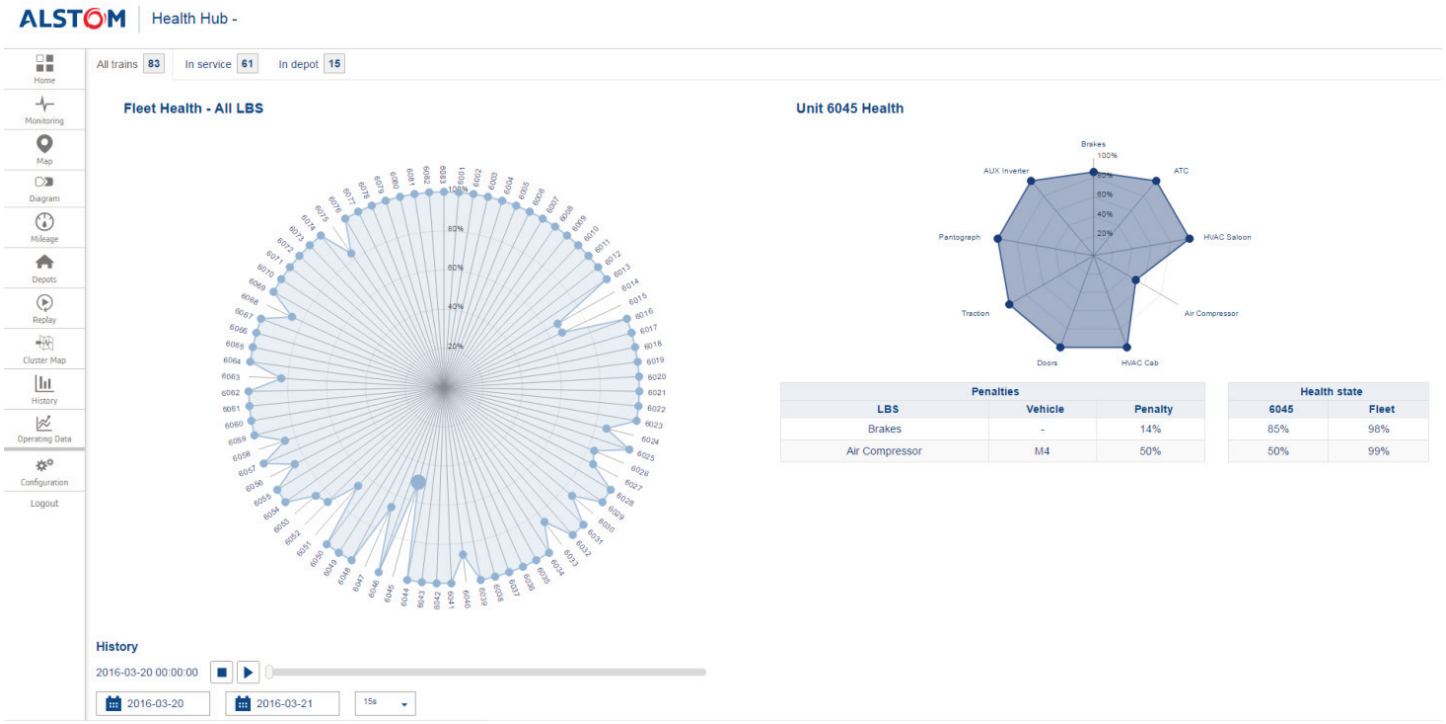
After the data acquisition, data scientists work on analysing the raw data. This step will become more and more automated as time goes on, but the creation of data models still requires human intervention, especially for new systems where PHM methods are applied. The HealthHub algorithms help to predict the future status of a given component, i.e. its remaining useful lifetime. To achieve this, the algorithms use time-series data concerning the asset condition combined with other data such as

maintenance history, track profile or even weather data. Maintenance tasks for each asset are anticipated and optimised.

Finally, information needs to be made accessible to the different levels of experts involved: data scientists, maintainers, team leaders, product managers, quality experts, and so on. HealthHub calculates a Health Index for each asset. The current status of an asset (fleet, train or component) is displayed in an 'at-a-glance' format to various parties through an ergonomic user interface. The information displayed is customised for each user. The example below shows the fleet view for West Coast Main Line Pendolino trains. The radar view, also displayed below, makes it possible to determine the train's health on a more detailed level.

Lessons Learned on the Way from Condition-based to Predictive Maintenance

Digitalisation is not an objective in itself. It is nothing more than a tool designed to facilitate, in the context of the rail industry, higher train system availability. However, it is a tool with a significant impact on our way of working. As with any of these changes, it requires all the people involved, at every level, to successfully carry out the project and make it a common success. This requires a clear definition of objectives, information for the participating teams or those affected, and long-term project management. Digitalisation is not a product; it is not a service; it is a cultural change, and has to be managed as such. The journey has just begun – and there is no final destination.



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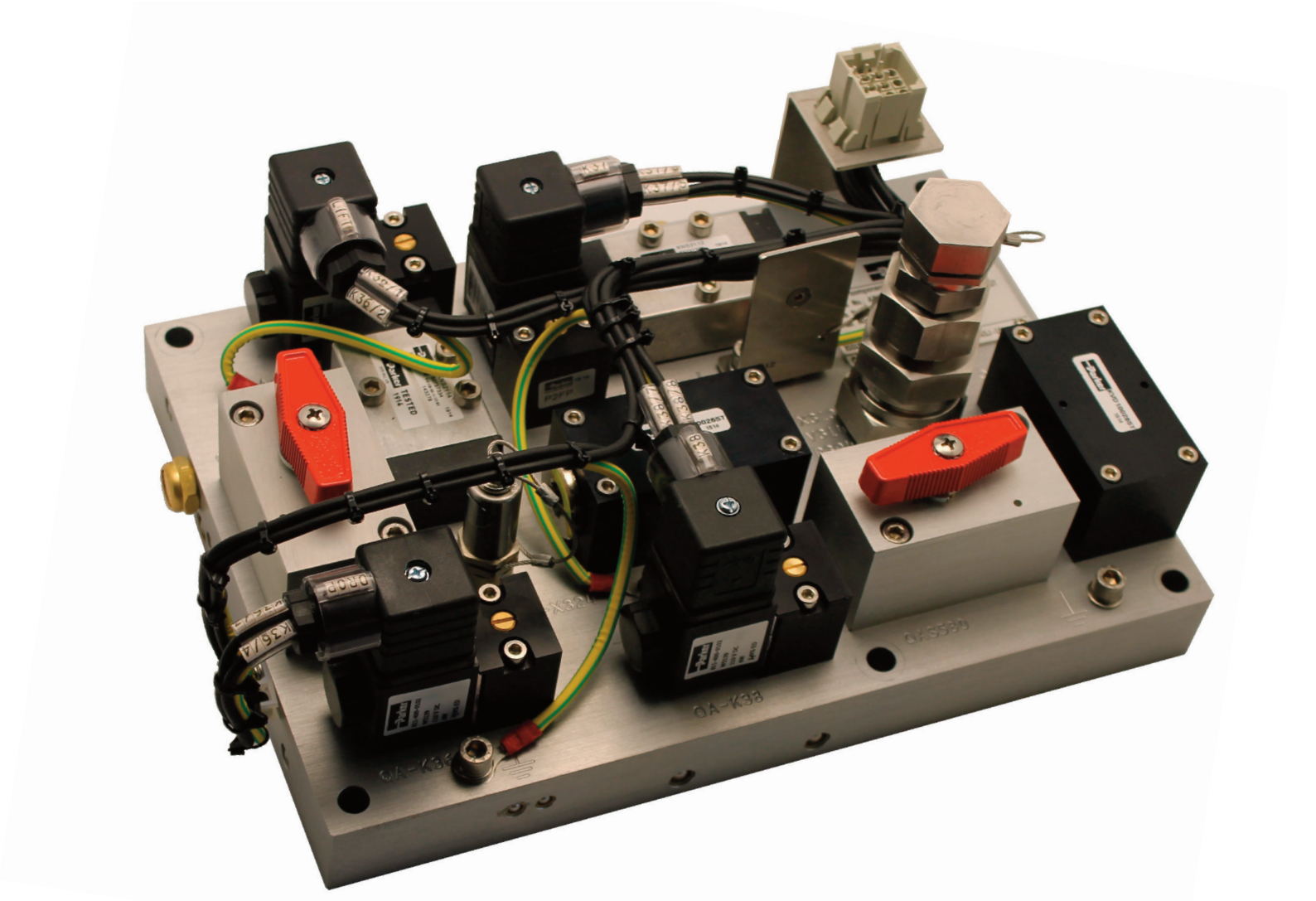
How Innovative 'Current Collection' Solutions Can Help Train Manufacturers

By Dave Walker, Market Development Manager for Rail, Parker Hannifin



Over the last 40 years the rail industry has seen significant changes in structure, operation and technology. One of the biggest changes has been the move away from dependence on diesel as the main motive fuel and the increasing electrification of railway networks, leading to train manufacturers looking for innovative solutions in the area of 'current collection'.

Today, the pantograph, a familiar sight on top of rail vehicles, is designed to allow travel at high speeds without losing contact with the overhead catenary lines. The pantograph arm pushes a contact shoe up against the underside of the power cable drawing the electricity required to power the train. Typically, compressed air is used to control the basic raise, hold, lower and fast-drop functions of the arm. However, demand for additional vehicle or end user-specific functions, such as contact strip wear monitoring, is increasing, meaning it is essential for any OEM designing and manufacturing pantographs to partner with a company that delivers in-depth experience and knowledge, especially of pneumatics.

So what has our experience shown us? It's been highlighted to us that the following needs are critical to the rail market:

See boxes on right

- **Overall reduction in vehicle weight**
- **Increase in available passenger space**
- **Initial acquisition and whole-life cost reductions**

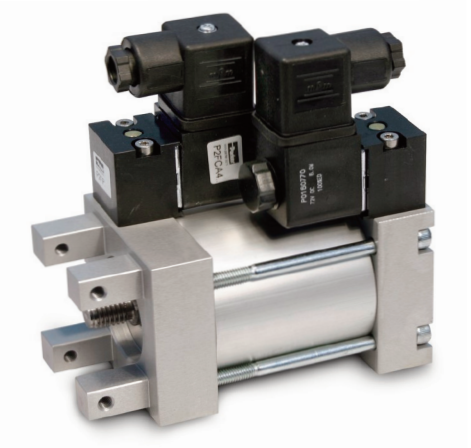
Development of new 'current collection' solutions can make a significant contribution to meeting these identified needs.

But where do we begin? Well, the majority of pantograph systems require the availability of a compressed air supply for the first lift after a vehicle outage period. Why? Because the vehicle's main compressors are usually not powered up until the pantograph has an established electrical connection to provide system power. This is normally solved by the use of an auxiliary compressor to deliver this supply. However, this approach has its drawbacks; the main ones being cost of procurement, the amount of physical space required to install the compressor, installation times and the ongoing whole-life costs associated with servicing and maintenance.

How is this problem solved? Simple; eliminate the need for the auxiliary compressor by designing a compact, fully-integrated 'plug and play' control system, containing all the pneumatic functions and incorporating a reservoir.

The newly redesigned main control module system is linked to a 25-litre reservoir, charged during normal operation via a 2/2 solenoid valve contained within the module. The pantograph system draws compressed air for its initial operation from this reservoir. The integrated 2/2 valve is vital for overall system performance. In its de-energised state it retains the reservoir's air charge for up to 5 days, ensuring reliable pantograph operation after moderate outage periods. Cleverly, the provision of a separate external air supply connection allows the system to operate even after extended outages.

As a result, this innovative approach addresses some of the key market needs whilst enhancing whole system performance.



Overall reduction in vehicle weight – there is now a single plug and play module, designed to achieve all required functionality with a minimum space envelope and weight. The weight of the auxiliary compressor and its associated installation components such as mounts, connectors and tubing are removed.

Increase in available passenger space – the module is now small enough to fit in a reduced space envelope making its installation location more flexible to suit carriage layout. The space required for the ancillary compressor has been eliminated, increasing available space in the carriage.

Initial acquisition and whole-life cost reductions – the initial acquisition costs are now lower and the vehicle initial installation costs are reduced due to elimination of the auxiliary compressor. A side benefit is process simplification, demonstrated by a reduction in the number of component suppliers, orders raised and managed, as well as assembly and testing work because the control unit is supplied fully function tested, ready to just 'plug and play'. All of these factors have a positive impact on the total lifetime cost.

The benefits of a single module approach don't stop at installation and procurement. It's essential in today's modern rail environment that service and maintenance times are kept to a minimum, optimising vehicle operational time and profit. Having only one module that can simply be replaced as a whole unit (rather than individual parts) is tremendously beneficial in terms of servicing and maintenance. Due to its plug and play qualities the system can quickly be decommissioned, serviced, repaired and re-commissioned with ease, resulting in less downtime.

Of course it is important to work with a partner that has experience developing proven solutions to address complicated engineering challenges and has an understanding and long standing reputation in the rail sector. Expertise in pneumatics helps in interpreting customer requirements, enabling creation of solutions across multiple applications that are not only technically advanced but go beyond simply meeting specifications, adding real customer value.

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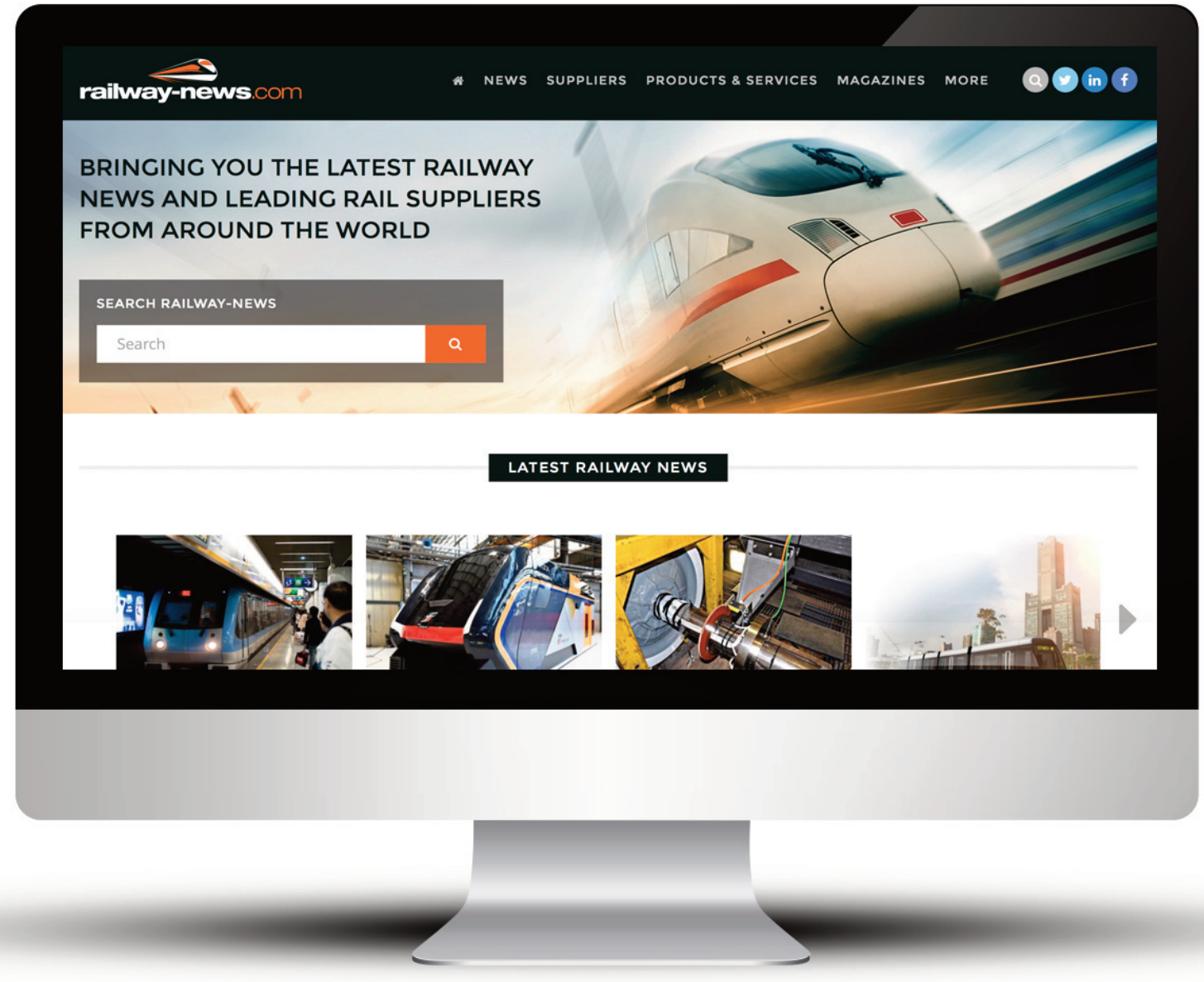

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The Role of Academia in the Rail Industry

As populations grow and become more urbanised, with increasing pressure to make transportation more ecologically friendly, and with society moving further and further towards digitalisation, the rail industry is called upon to evolve to meet demand.

By Josephine Cordero Sapién

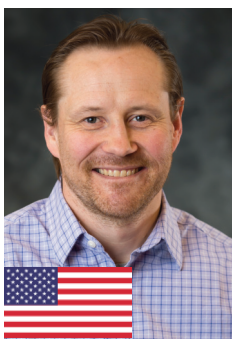
The industry is one of the fastest-developing industries in the world, while electric and self-driving cars are still being tested, automated trains with self-regenerative braking systems are already in use all over the world.

Technology is evolving, and for this to occur it must happen not just at an industry level. The role of academia in the development of rail transportation has never been more important. With that in mind, Railway-News spoke to four leading academics from railway institutes around the world find out more.

We spoke to Assistant Professor Pasi Lautala, PhD, P.E., the Director of the Rail Transportation Program at Michigan Tech University in the United States, Prof. Uday Kumar, PhD, Director of the Luleå Railway Research Center at Luleå University of Technology in Sweden, Professor Simon Iwnicki, Director of the Institute of Railway Research at the University of Huddersfield in the UK, Dr Coen van Gulijk, Reader in Rail Safety and Risk, also at the Institute of Railway Research, and Professor Shri Prakash, the Indian Railways Chair Professor at the TERI University in India.

Should academia be more involved in the industry?

Professor Pasi Lautala, USA:



We started ten years ago, as one of a handful of universities in the US who focused on the railway industry. Since then a large number has grown, with student chapters of The American Railway Engineering and Maintenance-of-Way Association springing up around the country, of which Michigan Tech was the first. Universities struggle to find industry partners, just as the industry is still figuring out how to use academia in the best way. We have a long way to go, but we've made some progress.

Professor Uday Kumar, Sweden:

I strongly believe that the level of engagement of academia with industry is much poorer in most parts of the world. Notable exceptions are North European universities.

Professor Simon Iwnicki, UK:

Yes, I think there can be a perceived barrier between academic and industry priorities but in my experience

this has been reducing in recent years as industry has become more innovative and as academic research has become more focused on impact.
Actually in the UK we have an organisation called the Rail Research UK Association (RRUKA), which exists to bridge the gap between universities and industry. RRUKA has around 50 university members and organises networking events to allow academics and industry colleagues to meet and inform each other on key problems and priorities of the industry and on new research developments and findings. RRUKA also stimulates research activity in areas relevant to the railway industry by funding feasibility studies on key topics and organising briefing sessions for university teams prior to inviting collaborative bids. Examples of projects that have resulted from these initiatives include research into the problem of low wheel-rail adhesion, light-weighting of rolling stock and the use of smart materials for condition monitoring.

Professor Shri Prakash, India:

Certainly. Without any effective involvement the research becomes abstract and an end to itself. Although it is also necessary to explore the new frontiers in knowledge and what looks today abstract may become an essential part of applied science tomorrow.

At the moment, where a policy making exercise has to be knowledge-based, the industry and the government should involve academia to enrich their professional capability. In fact, they are complementary to each other. With inputs from industry and the government largely in form of information and data the academia can help them in providing solutions to many of the key issues.

Could you tell me a little bit about the Institute of Railway Research and your role within it?

Dr Coen Gulijk, UK:

The Institute of Railway Research (IRR) is a world-leading team of academic and research staff carrying out research and consultancy related to railway vehicle dynamics and the complex interaction between vehicles and the track. For over 18 years the group has contributed to improving understanding of railway vehicle dynamics and wheel-rail interaction and has developed a number of analysis tools and techniques which are being used by railway engineers to control and optimise the vehicle-track interface. The IRR supports its core work with expertise in laboratory testing, on-vehicle instrumentation and data collection, and advanced computing techniques. This work is helping the railway industry to reduce track maintenance costs, to increase safety levels and resistance to derailment and to put in place the conditions which will allow a modal shift from road to rail.

I think that the focus on industry is the IRR's strongest point. Our research programme is inspired by industry concerns. We strive to support the GB railways to be the best in the world.

I am a safety researcher and my role is to support the GB railways in their efforts to deliver effective and efficient safety in a time of rapid technological change. I work with a team of five railway safety researchers with a background on research and practice on safety management systems, human factors, RAMS, data analytics, security and signalling. These experts also bring experience from other high-risk industries together.

We work in strategic partnership with RSSB to develop safety management technologies for the 21st century. RSSB is taking a major step forward by the IT transformation project SMIS+ [Safety Management Information System+]. I think the industry will recognize the added value of such systems quite quickly after its launch in November this year. Our part is to investigate additional business intelligence tools for SMIS+ and the GB railway industry at large.

How would you describe the collaboration between academic bodies such as yours and the rail industry, particularly with regard to implementation?

Dr Coen Gulijk, UK:

For the IRR, industry collaboration comes naturally. With railway organizations returning with practical concerns and implementation problems I think we are living proof that collaboration between universities and businesses is of mutual

benefit. But direct collaboration aside, I believe that universities should play their part in technology-horizon scanning for the railways.

Collaboration requires a level of mutual understanding which does not necessarily come naturally. Trust and taking the time to listen, I believe, are the most important ingredients for successful information transfer. Also, both academia and industry have to be aware of their natural pit-falls. I believe that the new rules for franchising, where part of the franchise has to be dedicated to innovation, provides platforms for building such trust.

With the RSSB-Huddersfield strategic partnership we have gone through the process of building trust and sharing ideas. I think the benefits are great for RSSB and IRR alike. Speaking for myself, we are tied in to SMIS+ developments and we can align our research alongside direct interests for SMIS+. Examples include semi-automate text-analysis to extract safety lessons from close calls and analysing OTMR [On Train Monitoring Recorder] files to gain insight in operations performance. These projects yield academic kudos and added value to the industry at the same time. For RSSB, I believe, there are two benefits. Firstly, it allows for the negotiation of an efficient research pipeline where several project ideas are debated before deciding which is the most opportune or timely to perform. It is also easier to change the direction of the project without complicated contract negotiations. Secondly, through the partnership we can be seconded almost immediately in whatever direct need RSSB has such as reviews, contributions to workshops and public events without the need for contract negotiations.

Professor Pasi Lautala, USA:

We are looking at gate crossing safety - using driver simulators to see how people behave and react to different warnings, and we are expecting to start a project with the Federal Railroad Administration very soon to validate these results. We are also looking at in-vehicle warnings for drivers approaching gate crossings which we hope will translate into the industry in the future.

We are also undertaking a project to look at the haulage of biofuels, carrying out statistical modelling to work out the optimum solution to haul timber by rail, which of course does not originate from a fixed plant but rather large areas. That's really challenging.

Professor Uday Kumar, Sweden:

Our education programme, research priorities and projects are all aligned to the need of present day Swedish railway sector with special focus on operation and maintenance of railway systems so as to make it more attractive and competitive.

We are closely working with Swedish transport administration TRAFIKVERKET to develop maintenance solutions relevant for current and future railway systems in close co-operation with TRAFIKVERKET.

In Sweden we are involved in many national projects mainly funded by TRAFIKVERKET and others with Swedish railway companies, apart from EU Horizons 2020 projects such as Shift2Rail, IN2RAIL, Infralert, etc.

Professor Shri Prakash, India:

Currently I have a research project that looks into the causes of the decline in the railway's market share in freight transport and suggest measures that increases the railway's share particularly for transport of cement, automobiles and containers. We will extend this study further to non-bulk commodities. We are also looking into the environmental impact of high-speed rail as well as of road highways and expressways. We have already completed life-cycle analysis of energy consumption of passenger transport modes and now intend to do a similar analysis for freight transport.

What strengths does academia have that the industry lacks?

Professor Pasi Lautala

Academia has a different approach when it comes to research and development. The industry approaches issues based on experience and empirical research, it doesn't use a lot of science in the US. It experiments with what works but doesn't look into why it works. Academia looks deeper into the challenges and conflicts the industry faces and counters them differently. We look at things with a fresh eye.

Professor Simon Iwnicki, UK:

I think that the academic environment can allow innovative ideas to be explored in a relatively unconstrained way. This can lead to radical developments which have the potential to become step changes in the way that things are done. Of course it doesn't always work out like this and research projects do run the risk of failure but even failure can lead to new

knowledge and failure in a safe academic context rather than on the railway is clearly the better option!

Academic networks and conferences can also be good at taking a broader view of a problem and bringing in knowledge from different disciplines. This is an area that has been receiving more attention recently and funding is sometimes available specifically for cross-disciplinary projects. The railway industry can be quite narrow in its outlook and stepping outside the industry environment can allow ideas which might be commonplace in other modes or industries to be considered and potentially adopted to improve performance.

Universities are generally good at disseminating knowledge although this does need to be aligned with the potential beneficiaries. The best arrangement is for industry-academic partnerships where each side can bring its own strengths.

Professor Shri Prakash, India:

The academia has analytical ability and access to the knowledge that has become universal with the advent of internet and IT tools. The industry has the data and information, however, most of the time they are suspicious of sharing with the academic world.
I wanted to talk with you about the idea of big data and its potential for the rail industry. Could you say a little bit about this?

Dr Coen Gulijk, UK:

We have called our research programme Big Data Risk Analysis for the GB railways. This research is set against the background of the global trend that transforms the way that business itself changes. The IT transformation of business entails the modelling in business processes and design of software solutions to support the business model. This is partly enabled by breakthroughs in IT (e.g. a broader accessibility of software to make infinitely scalable databases which contain mixed information) and IT business intelligence systems (e.g. real-time business intelligence). Businesses that embrace this way of doing business, broadly termed Business 4.0, face a tough transformation but tend to make their businesses more transparent, efficient and responsive to customers' needs. Crossrail and Network Rail are involved in such transformations and the Digital Railway follows this trend.

If management changes, safety management has to change alongside. RSSB's SMIS+ paves the way and HUDD's safety research considers the opportunities and consequences of such transformations. We cannot be sure exactly where Business 4.0 will bring us and how fast it will go but it is sure to deliver efficient, effective real-time safety to the GB railway. GB is ready to lead in this relevant and exciting domain!

What kind of funding can academic institutions expect from industry?

Professor Pasi Lautala, USA:

There is some funding from private rail companies, but it is very limited, the association of American Railroads University Affiliates Group has a set group of three or four universities that get dedicated funding for doing small scanning projects, but these grants are limited. Some companies work with universities on small, short-term projects focusing on specific topics.

We try to have an industry partner in every project we undertake, either to supply supplement funding or active participation in terms the provision of data or experience. We have worked with CN Railway, Union Pacific Railroad and Norfolk Southern, but we also work heavily with the Michigan Department of Transportation.

Professor Uday Kumar, Sweden:

Industry-sponsored projects with a focus on finding solutions to both short-term and long-term problems. Industry funding can make university research more relevant and useful for society.

Professor Simon Iwnicki, UK:

Academic institutions with a good track record of implementing solutions can receive significant levels of funding directly from industry. Usually this is in connection with the solution of specific problems or improvements in efficiency or safety or reduction of costs. These projects tend to be shorter-term but there are also some very effective long-term strategic partnerships between UK universities and industry.
Research funding to universities often depends on evidence of impact or potential impact and industry support can unlock research funding even for longer term, more 'blue skies' projects. In the UK and Europe much of the available research funding is awarded to joint projects between industry and academia. This is

often very effective as industry plays a useful role in defining the research direction and in implementing the findings.

Professor Shri Prakash, India:

The biggest problem academic institutions face is the inadequacy of funds for pursuing research. The industry generally spends money for their own commercial research for furthering business interests. There should be appropriate mechanisms for a closer interaction among industry, government and academic institutions with mutual sharing of knowledge and funds. The establishment of a dedicated national research fund by the government from contributions from both the government and the industry may go a long way in financing research projects in academic and research organisations.

What are some of the success stories and notable projects for your institute?

Dr Coen Gulijk, UK:

The Institute of Railway Research is a highly successful research institute. Not only has it been very successful in attracting research funds from EPSRC [Engineering and Physical Sciences Research Council] and the EU but it has been extremely successful in supporting the GB railway industry with dedicated engineering knowledge. The IRR works with many of the major UK rail industry stakeholders including Network Rail, RSSB, London Underground, Transport for London, Lloyds Register Rail, TATA Steel, Ove Arup and the majority of UK light rail operators. The Institute also collaborates with many other universities both in the UK and worldwide.

The IRR has attracted significant funding which enabled it to build a full roller-rig test facility to serve the industry and research alike. We are extremely proud of such magnificent test facilities and the value it has for industry implementation projects.

A project that we are particularly proud of is the work we do with Crossrail where our engineering modelling expertise is embedded in an integrated asset management system. The integrated management system is another example where GB leads the IT transformation process on the railways.

The Big Data Risk-Analysis Symposium has been a success since we started it last year. It is a platform where the industry can debate the IT transformation of railway safety systems. Last year's proceedings will be published as a special issue of the SaRS journal which was recently turned into an international scientific journal.

Professor Pasi Lautala, USA:

Our undergraduates' senior design projects are being taken up by the industry. A notable one is a technology which ensures that repairs to rails have been thorough using magnetic viewing film which works in cold conditions to find any missed defaults. This project was with CN Railway who are now looking at field testing the technology for a large-scale implementation.

Professor Uday Kumar, Sweden:

Many of our research work has been successfully implemented in Swedish Transport Administration (Railway). To name a few: LCC analysis of switches and crossing, RAMS analysis of signalling systems, e-Maintenance for railway systems etc.

Professor Simon Iwnicki, UK:

The outcomes from many of our projects have resulted in improvements in understanding and often in the way that parts of the railway system are designed or operated. For example we have worked with industry partners to use computer simulation tools to optimise maintenance of railway wheels and this has resulted in significant life extensions without compromising safety.

As part of several collaborative projects we have helped the railway to develop tools to effectively allocate the cost of track deterioration to the vehicles causing this and this has also driven innovative vehicle designs. In the SUSTRAIL project we and other academic and industry partners developed a high-speed freight vehicle which, through innovative design of the running gear, results in greater stability and reduced track forces. This in turn reduces track damage and results in lower system maintenance costs and improved vehicle ride despite the higher speeds.

Professor Shri Prakash, India:

Yes, one of our research studies helped Indian Railways to rationalise route allocation for transport of imported coal to powerhouses, increasing revenue.

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Breaking Records with Spanish High-Speed Rail

This summer will see the completion of a world record-breaking viaduct at a point where the Almonte River meets the Alcántara reservoir in the west of Spain, close to the Portuguese border.

By Pedro Cavero

The structure forms part of the Madrid-Extremadura High-Speed Line, with an estimated length of 450km, which runs through the municipalities of Garrovillas de Alconetar and Santiago del Campo in Cáceres. It will be the third-largest concrete arch in the world, and it will also hold world record-breaking status in railway arch bridges.

In addition to being a remarkable feat of engineering in its own right, the viaduct is symbolic of Spain's bold ambition when it comes to the delivery of its high-speed rail network. Since the high-speed rail infrastructure plan started in 1987 Spain has established itself as the largest network in Europe at 3,100km. It has already surpassed Japan and is second only to China in the world. With the intention of reaching 10,000km by 2020 there is plenty of ambition that still remains.

The network has met with a number of challenges along the way – not least the impact that the economic crash in 2008 had on financing. However, it has remained a priority for infrastructure spending throughout. The government has invested over 45 billion euros in the development of the network over the years, during which Spain has gained a reputation for rapid delivery at a price that compares well with similar systems around the world.

FCC, the Spanish environmental services, infrastructure and waste management group, a specialist in delivering conventional, high-speed and underground railway infrastructure, has been involved in the construction of the country's network from the outset. It started with the construction of four sections, together with two of

the largest stations in the high-speed network, Atocha in Madrid and Santa Justa in Seville, with the first line being put into service in 1992. FCC has now been involved in the development of 700km of high-speed rail lines across the country.

In September 2010 the Spanish Ministry of Development, acting through ADIF (the state-owned organisation charged with the management of most of Spain's railway infrastructure), contracted a joint venture organised by FCC Group and the Portuguese firm Conduril. Their task was to build the 6.265km section of the new 165km stretch of the Madrid-Extremadura High-Speed Line in Cáceres between the Alcántara Reservoir and Garrovillas. When completed travel times for direct and semi-direct services will be reduced by up to one and a half hours. The 109 million euro contract covers all the work necessary to build the infrastructure, such as earthworks, drainage work, tunnels, structures, shifting of easements and relocation of affected services, including cross-connections to ensure the line's permeability to roads.

Some of its unique aspects include the fact that it crosses over the Almonte River by a 996 m long viaduct, with a deck fixed upon a 14 metre-wide and 3.1 metre-thick box section. The viaduct is divided into three distinct parts: two access roads and one central section. The central part has an arch with an octagonal section varying in width and thickness with a span of 384m. The arch is built with in situ concrete, and concrete was pumped from the base to each of the 65 segments that set the total length of the 384m arch. The quantity pumped varied in accordance with the size of each segment but it was always in amounts of less than 180 m^3, totalling 7,500m^3. In addition to the use of high-resistance self-compacting 80MPa concrete for the arch, innovative aspects of the project include the installation of sensors to monitor the structural behaviour of the arch. The team used this real-time feedback to adapt the positioning of the cable stays and the arch segments.

For bridges of the same use, the Almonte Viaduct dwarfs its nearest rivals in Spain and Europe by one-and-a-half times. The two German bridges, Froschgrundsee and Grümpen both have arches spanning 270m. Yet it is still smaller than arch bridges (regardless of use), coming behind the Wanxian Bridge in China with a 421m arch, and the KRK Bridge in Croatia with a 390m arch.

The Almonte Viaduct isn't the only high-speed rail project that FCC is currently working on in Spain. A temporary joint venture has been formed by FCC Construcción (90%) and COLLOSA (10%) to construct the High-Speed Northwest-North Corridor, Madrid-Galicia High-Speed Line Stretch: Vilariño Left Track. To ensure smooth delivery of these works a temporary joint venture has also been created with the contractors delivering the Vilariño Right Track. FCC has a 47.5% share of this.

The works are being developed in the province of Orense. The majority of the line network stretches are in tunnels, and these works account for 88% of the 209.8 million euro total budget. The main work in the scope of the contract is the excavation of the Bolaños Tunnel on the left track. This is a single-track tunnel running for 6.79km including cut-and-cover tunnel portals of 18m and 57m each at both ends. The bored tunnel is 6.08km long. The delivery of the Bolaños Tunnel right line network is a separate contract. Except for the outer 15m of the eastern end and 70m of the western end, most of the tunnel's length will be constructed using a tunnel boring machine (TBM). At present this is the only TBM in use anywhere in Spain.

It is far from the only tunnelling work FCC has undertaken in recent years though. The company possesses extensive

experience in building underground infrastructure. It has constructed different types of tunnels for roads, railways, metropolitan railways and water supply lines. It owns the machinery to tackle jobs of any size, such as 'Tizona', the biggest TBM in the world, which was used to build the M30 Tunnels in Madrid. Much of its tunnelling work is related to metro systems that FCC has completed, and continues to work on, such as the works in Madrid, Barcelona, Lisbon, Athens, Bucharest, Doha, Panama, Toronto, Bogota and Lima.

With over 110 years of experience, FCC has worked on countless railway projects of all types, both in terms of infrastructure and superstructure: metro, tram, maintenance and renovation of existing lines, and construction of new stations in large cities. The company's main distinguishing feature lies in its use of advanced technology and its ability to offer integrated products and services of high added value across all its business areas. Using this approach, it will continue to play its part in helping Spain reach its high-speed rail network target for 2020, as well as delivering some of the biggest rail infrastructure projects all over the world.

Pedro Cavero is the Railway Infrastructure Head at FCC Construction's Railway Division.

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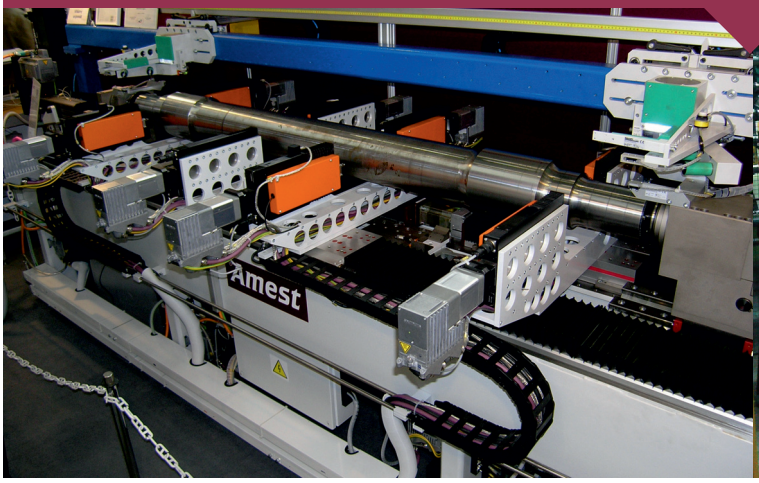
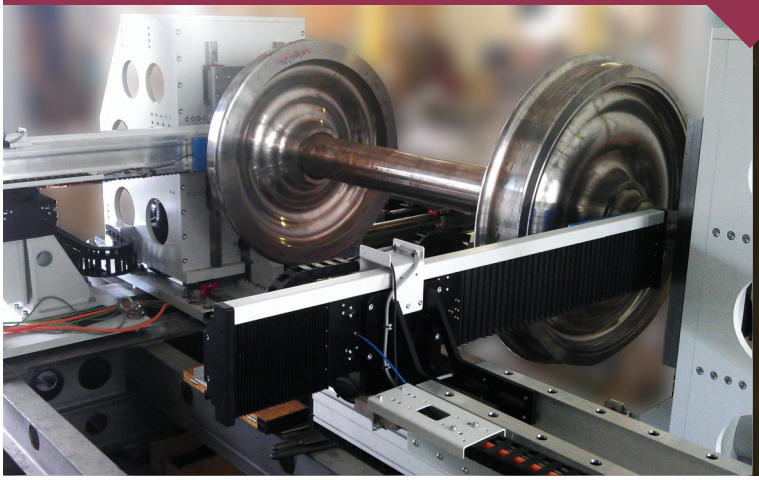


Measurement of wheelsets



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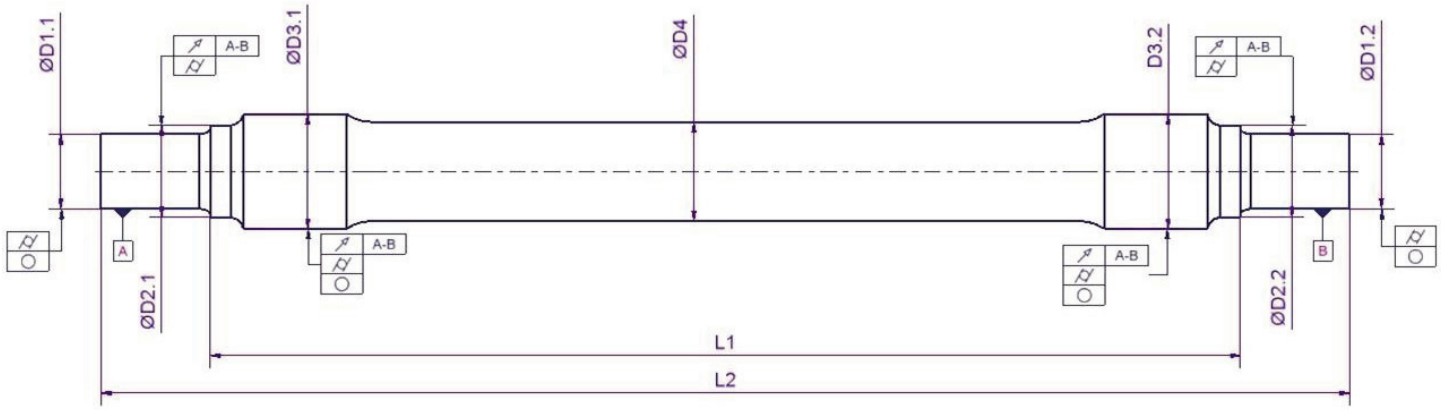

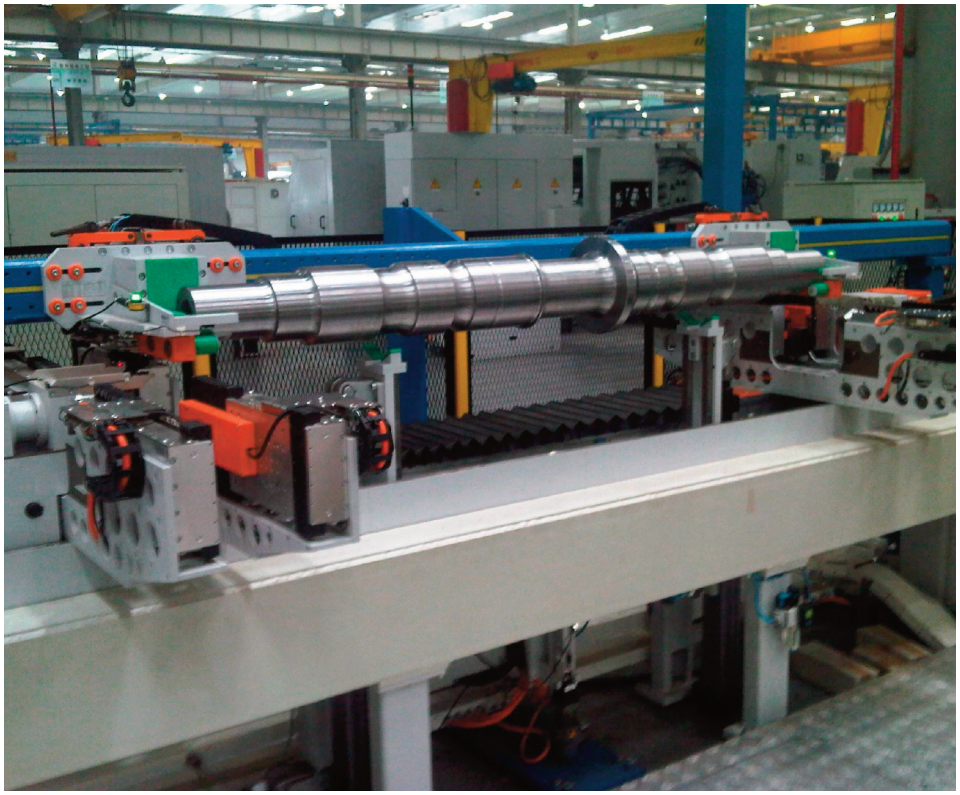

For the past seven years, AMEST has successfully supplied its original automatic dimension control solution for final railway axles to railway producer workshops.

This equipment is based on the principle of contact and optical measurement, and is set up with four measuring arms, lying next to each other on a linear guidance system. Each measuring arm has its own longitudinal metering and an independent servodrive, which means that it can move longitudinally, and measure at a random crosscut. The outer arms obtain the measurements of the diameters of both the bearing and the peg. The inner arms secure the measurement of the large

diameter for pressing on the wheels and other optional diameters of the central part of the axle. Each arm contains a cross non-hysteresis guide and a linear ruler, two inductive heads opposite each other and another servodrive, which secures the measuring head feed to the surface of the axle.

The optical system installed on the arms ensures the measurement of complicated axles shapes and evaluates radiuses, lengths etc.

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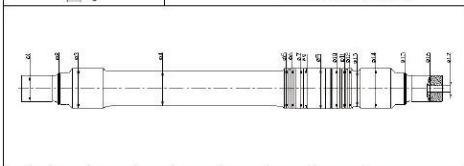
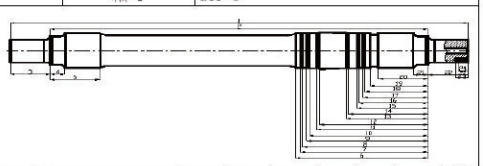




	部位	Φ1 130.043-130.068	Φ2 160.134-160.174	Φ3 198.300-198.340	Φ4 173.000-174.000	Φ5 199.017-199.037	Φ6 199.017-199.037	Φ7 200.050-200.070	Φ8 (415.75mm) 202.840-202.870	Φ8 (435.75mm) 203.240-203.270	Φ8 (455.5mm) 203.590-203.620	Φ8 (475.75mm) 204.040-204.070	Φ8 (495.5mm) 204.440-204.470	Φ8 (511.75mm) 204.760-204.790	Φ10 200.050-200.070	Φ11 199.017-199.037	Φ12 199.017-199.037	Φ13 179.500-180.500	Φ14 198.300-198.340	Φ15 160.134-160.174	Φ16 130.043-130.068
直径	外	130,058	160,147	198,329	173,473	199,031	199,030	200,063	202,858	203,259	203,615	204,056	204,459	204,781	200,059	199,026	199,025	180,020	198,329	160,149	130,063
	中	130,063		198,329		199,028	199,032	200,060							200,059	199,025	199,028		198,329	160,149	130,061
	内	130,064	160,146	198,333															198,326		130,058

		Φ1	Φ2	Φ3	Φ4	Φ5	Φ6	Φ7	Φ9	Φ10	Φ11	Φ12	Φ14	Φ15	Φ16	左端跳	右端跳
跳动		0.02	0.03	0.03	0.3	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02
		0,003	0,001	0,004	0,002	0,003	0,004	0,001	0,002	0,002	0,002	0,002	0,004	0,000	0,003	0,003	0,003

	Φ1	Φ2	Φ3	Φ5	Φ6	Φ7	齿轮座面度	齿面角度	Φ10	Φ11	Φ12	Φ13	Φ14	Φ15
圆柱度	0.015	0.015	0.015	0.015	0.015	0.015	0.010	OK/NO	0.015	0.015	0.015	0.015	0.015	0.015
	0,006	0,000	0,004	0,004	0,001	0,003	0,003	OK	0,000	0,001	0,002	0,004	0,000	0,005

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
长度	2179.4-2181	1798.0-1798.4	190.7-191.3	70.0-70.5	236.0-236.5	629.0-629.5	607.0-607.5	596.5-597.0	578.0-578.5	567.2-567.5	527.5-527.8	515.5-516.0	389.0-389.5	379.7-380.0	339.5-339.8	328.5-329.0	339.5-339.8	299.5-300.0	277.5-278.0	236.0-236.5	70.0-70.5	190.7-191.3
	2180,06	1798,1	190,9	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	191,1

检查员:

日期: 20110321

Lovere, Italy (LUCCHINI); Taiyuan, and China (ZHIBO LUCCHINI). These manufacturers have been operating the AMEST stations on multiple shift operations; their performance, range, and functions have raised the interest of both other foreign railway industry companies and the expert public. AMEST experts have used the experience gained in operation with these customers to further improve the technology.

Basic technical parameters

Range of measured parts:

- diameter: 100–300 mm
- length: 600–2600 mm (with possibility of flexible adjustment to another range)
- weight: up to 1000 kg

Time of measuring cycle:
ca. 120 secs (for measurements at 20 sections)

Weight: 3500 kg

Dimensions: 2320 mm x 5100 mm x 2100 mm

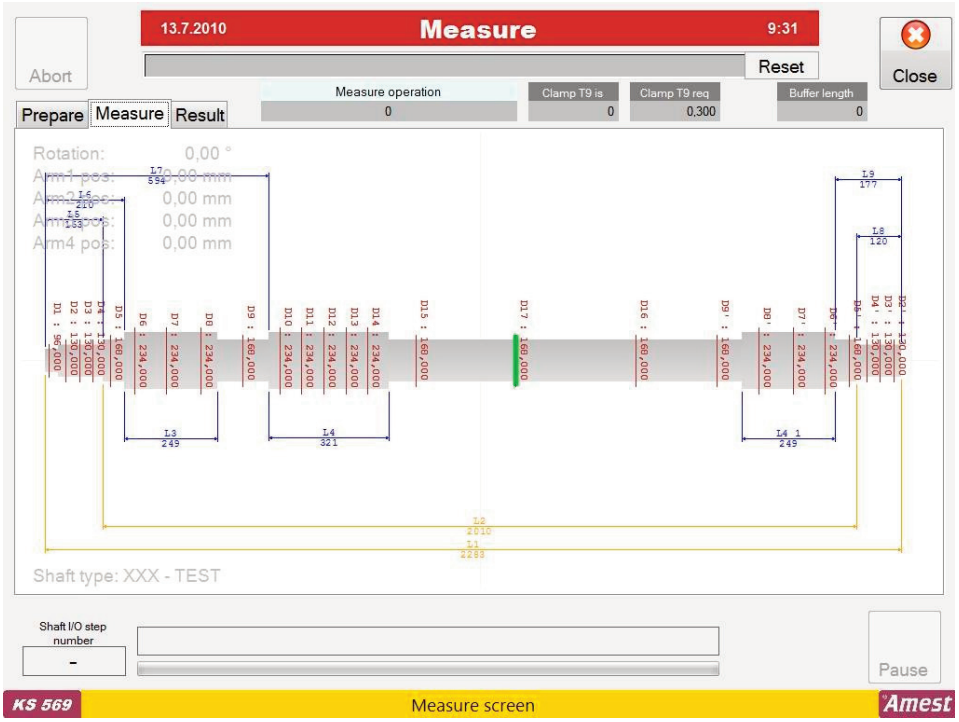
Measured parameters

The device is able to measure these parameters:

- diameters
- lengths
- circularity
- cylindricity
- radial run-out
- axial run-out
- parallelity of frontal surfaces
- cone

Measurement accuracy (repeatability):

- diameters ±1µm
- optical lengths, radiuses ±0,01mm



((GKD))
TECHNOLOGIES
Working around the world

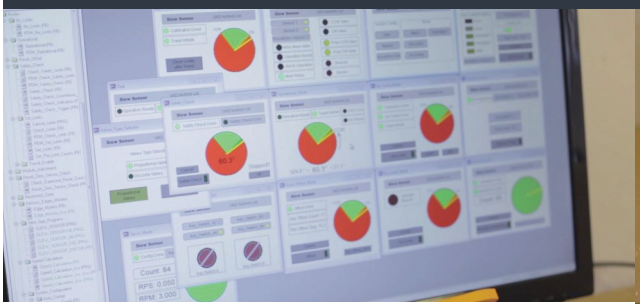
GREATER SAFETY FOR GREATER PRODUCTIVITY

The UK's number one RRV rated capacity indicator

The **3RCi+** is the number one Road Rail Vehicle (RRV) rated capacity indicator in the UK and is highly sought after across the world. The sophisticated system monitors the RRV's load status and compares it to the machine's true lift capacity in its state of gradient, rail cant and axle lock configurations. The system will then cut the machine if it reaches an unsafe position and will only allow movement in a safe state. This allows the RRV operator to use their machine to its maximum capacity, safely.

The additional **SpaceGuard** feature has dual sensing for extra accuracy and protects against system sensor malfunction, inconsistencies and electronic failures. The SpaceGuard feature certifies the RRV to work adjacent line open and under live overhead wires, increasing productivity by allowing work to be carried out without the need for adjacent line closure.

GKD Technologies 17 Cobham Road, Ferndown Industrial Estate, Wimborne, Dorset, BH21 7PE, UK



Design, Develop and Produce

Leading the way in envelope and load control, GKD have been designing systems which enable road rail vehicles to work to their maximum capacity safely since it was established in 1992.

The new 3RCi+ is a specifically developed SensorSafe system for the rail industry, meeting all the requirements for working under overhead cables and adjacent line operation where required.

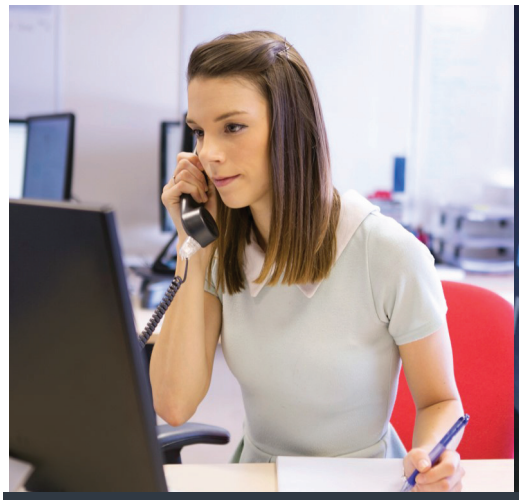
A dedicated production team build, test and dispatch all of the GKD products from their head office in the UK to customers across the world.

Features of the new 3RCi+ system

- New **optically bonded display** for better sunlight and readability, with ambient light sensor
- New **robust and reliable** Gyro compensated sensors
- **Improved** locking foreman key switch
- **Easier to install** and set up new sensors
- **Securely accessible** service menus

Outstanding Customer Support

GKD Technologies prides itself on providing the best support to their customers. With over twenty years of experience working in partnership with the rail industry, they understand the pressures on their customers. A specialist service and support team are on hand to provide all their customers with front line support.



Tel: +44 (0) 1202 971 972 Email: sales@gkdtec.com www.gkdtec.com

Upcoming Railway Events

February, March, April 2017

16 Feb 2017 – 17 Feb 2017
Future Rail India

New Delhi

The Future Rail India summit brings together technology providers, policy makers, and decision makers from the Ministry of Railways and private and public sector stake holders, who will discuss, provide insight and identify technology and best practices for smooth operations. The summit will focus on various aspects of upgrading and modernising projects related to planning, financing, construction, technology, operations and management.

More info: http://futurerailindia.com/

21 Feb 2017 – 22 Feb 2017
Light Rail 2017

Gold Coast, Australia

The Australasian Railway Association and Informa are proud to be bringing the 4th annual Light Rail Conference and Exhibition to the Gold Coast. The Gold Coast is a hub of light rail activity and the perfect place to host Light Rail 2017. The rapidly growing conference and exhibition offers a unique opportunity for professionals involved in manufacturing, the planning and delivery of projects and operational executives, to hear cutting-edge case studies and learn from successful projects in Australasia and throughout the world.

More info: http://www.informa.com.au/conferences/transport-conference/infrastructure-conference/light-rail

01 March 2017 – 02 March 2017
Fire Protection of Rolling Stock 2017

Berlin, Germany

The Fire Protection of Rolling Stock Conference 2017 promises to be the best yet with a stellar line-up, featuring global train operators and manufacturers along with leading component and material suppliers. As a collective, the FPRS community will come together to explore how the industry can continue to strive for better fire safety both now and in the future. Over the course of two days we will be taking an in-depth look at the biggest challenges and opportunities in the sector including how to meet the full implementation requirements of EN45545 and looking to the future for fire safety compliance. We'll be delving into the technical and strategic innovations impacting the sector and will explore as a group what more can be done to set and improve standards.

More info: http://www.arena-international.com/fprs/

02 Mar 2017 – 04 Mar 2017
Eurasia Rail 2017

Istanbul, Turkey

Eurasia Rail is Turkey and the Middle East's leading exhibition providing the perfect opportunity to meet and do business with the leading buyers of railway, rolling stock and infrastructure. The exhibition will be organised for the 7th time in 2017 and is the key international platform to bring together the sector giants with professional visitors under one roof. The conferences and seminars taking place concurrently with the exhibition share the industry knowledge and experience at the senior level. **More info: http://www.eurasiarail.eu/**

07 Mar 2017 – 08 Mar 2017

Middle East Rail 2017

Dubai International Convention & Exhibition Centre, Dubai

The most influential rail event in the region is back for 2017! As Middle East Rail enters its 11th year, it now welcomes over 10,000 attendees and over 400 exhibitors, all coming together to meet the operational needs of regional rail operators.

More info:
http://www.terrapinn.com/exhibition/middle-east-rail/index.stm

21 Mar 2017 – 22 Mar 2017

Asia Pacific Rail 2017

Hong Kong Convention & Exhibition Centre, Hong Kong

Asia Pacific Rail brings together key stakeholders across mainline, metro, freight and more, providing you with the perfect platform to connect and engage with your key prospects. It's a highly cost and time-efficient platform to generate new leads and reinforce your leadership position in the market.

More info:
http://www.terrapinn.com/exhibition/asia-pacific-rail/index.stmrail/index.stm

21 Mar 2017 - 23 Mar 2017

SIFER 2017

Lille Grand Palais Exhibition Centre, Lille, France

France's premier rail industry event. Covering the entire rail market, SIFER is the perfect platform for suppliers to present their capabilities and latest technologies to the market's top buyers, specifiers and engineers. The exhibition showcases the latest technological advances in the rail industry within 3 exhibition halls. More than 160 product categories are represented.

More info:
http://www.sifer2017.com/english/welcome

29 Mar 2017 – 01 Apr 2017

RailwayTech Indonesia 2017

Jakarta International Expo, Indonesia

The premiere of RailwayTech Indonesia 2017 will take place from 29 March – 1 April 2017 at Jakarta International Expo (JIExpo Kemayoran), Jakarta, Indonesia. It will feature the latest technology, equipment and services for the railway industry. RailwayTech Indonesia 2017 will be held together with IIBT 2017 and INAPA 2017 as ASEAN's one-stop for transport mode, public transportation, commercial vehicles and the automotive industry under one roof. RailwayTech Indonesia 2017 is a perfect opportunity and time to meet with railway operators and contractors, network with leading industry professionals from around railway industry. **More info: http://www.railwaytech-indonesia.com/**

18 April 2017 – 20 April 2017

TransRussia Translogistica

Moscow, Russia

TransRussia/TransLogistica is the largest Russian business event of Transport and Logistics Services and Technologies. TransRussia will take place under the patronage of the Ministry of Transport of the Russian Federation and with official support from the State Duma Committee on Transport, Rostransnadzor Federal Service for Supervision in the Sphere of Transport, the Federal Agency for Railway Transport, Russian Railways, the Freight Forwarders Association of the Russian Federation and other federal structures and industry associations. **More info: http://www.transrussia.ru/en-GB**

18 Ap25 Apr 2017 – 26 Apr 2017

World Metrorail Congress

London, UK

The 13th annual Metrorail World Congress will bring together worldwide urban rail experts to deliver the latest insights into ground-breaking strategies and topics set to revolutionise your day-to-day activities. Alongside the main strategic conference we are also running an exhibition where you can demonstrate your solutions to the rail community. If you provide products or solutions for the rail industry, our buyers, we want to meet you. **More info: http://www.terrapinn.com/conference/metrorail/index.stm**

Staying cool on and off the tracks

During a sporting summer the reliability of our railway network is not always at the forefront of our minds.

By Steve Ehrlich, Space-Time Insight

If anything, we take transport for granted, expecting trains to run on time and not be overcrowded. An estimated half a million British fans travelled to France this year for Euro 2016. That number of people using a limited number of transportation hubs can cause major disruption.

To maintain a reliable service, it's vital to consider the effects of people travelling in their thousands to certain places at one time. If we do not use all the information available to us to plan for these situations, the consequences can be anything from not having enough drivers on duty to delayed trains, missed connections and overcrowded platforms to people not making it to the big game on time.

Mind the flak

Last year's Rugby World Cup [in the UK] provides a cautionary tale to all involved in large-scale events. The championship may have been a success for the country, despite performances on the pitch, but it did not pass without incident and rail companies particularly came in for a significant amount of flak.

At the start of the competition, headline after headline pointed towards transportation issues that resulted in organisers having to swiftly introduce changes to get the games up and running again. The situation reached boiling point when the Enterprise and Business Committee in the Welsh Assembly called a meeting with the transportation and council bosses to discover what had gone wrong. The issues during the Rugby World Cup, despite thousands of extra seats being made available (at a cost of £429,000 during the matches in Wales alone), were in a large part due to overcrowding. The organisers had not accurately planned for the number of rugby fans who would be travelling to the games, resulting in overcrowding and fans not being able to get to the matches. This was particularly evident during the matches for which more than ten times the number of spectators travelled than had previously been predicted.

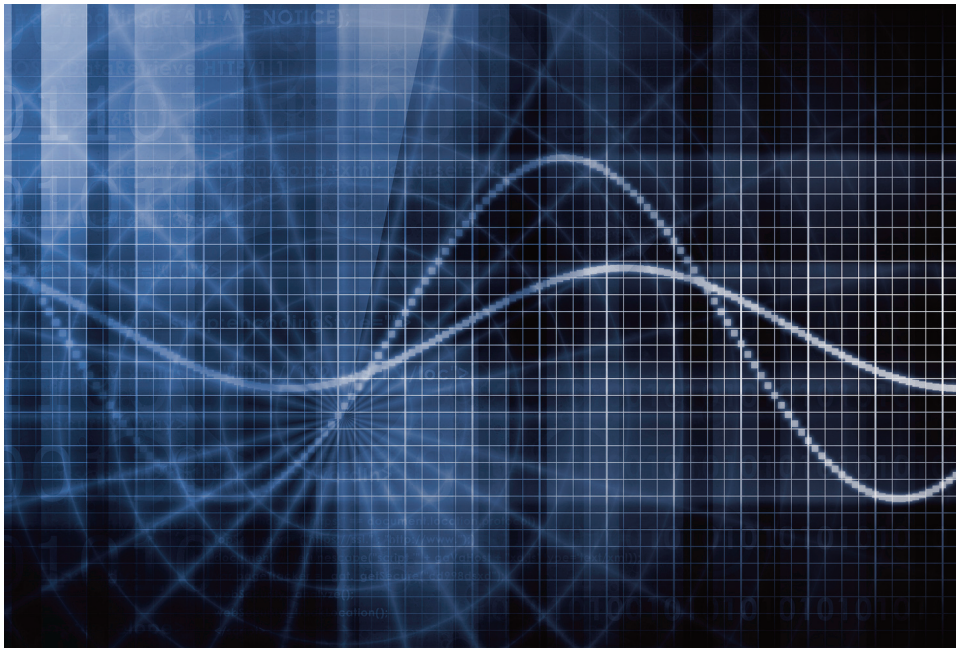
Looking at Wales in more detail, to address the complications, the organisers of the World Cup established a regular transport working group, the Venue Transport Working Group (VTWG). The working group was made up of representatives from local government, transportation, uniformed services and infrastructure organisations. In addition to this the regional working group, members were invited to join national members in the larger oversight transport group that met on a quarterly basis.

Waterloo Station
© Jim Linwood, Flickr, licence CC BY 2.0

The collaboration between different groups provides access to a wide variety of data sets ranging from the number of people travelling from certain locations around match times to the number of people who purchased tickets for particular events. For example, the organisers knew that the proportion of tickets sold to people with a Welsh postcode varied between around 5% for matches not involving the Wales team and 25% for matches when Wales were playing. This is the exact kind of data that is vital to being able to successfully plan for large-scale events using analytics. Using data during these crucial planning processes can enable organisers to move large numbers of people at the same time.

Despite provisions being made for large volumes of fans, rail networks were overwhelmed by the sheer number of passengers, causing issues throughout the tournament. While the challenges posed by this summer are on a far lower scale as the major international competitions are not being hosted by the UK, similar flash points are likely to occur at certain times and locations. This is especially true when we consider unexpected hazards like the strikes and flooding that affected the French rail network before and during the 2016 Euros, as well as the storms which wreaked havoc in London in mid/late June. Therefore, if organisers and transportation chiefs do not accurately plan appropriately for increasing numbers of people using public transport, issues may arise.

It's vital that transport chiefs use a combination of real-time analytics and retrospective data collected over a longer period of time to build the best possible picture of what the crowds might look like in situations that are being planned out. This particular example highlighted issues and inefficiencies in planning train operations, queuing arrangements, provision for parking and travel demand management. The key lessons learnt meant that the organisers knew they had to make several changes before the event.
One of the issues highlighted by the working group, queuing, resulted in several immediate amendments being made whilst the frequent meetings enabled for updates to be made, which contributed to the competition eventually being heralded as a



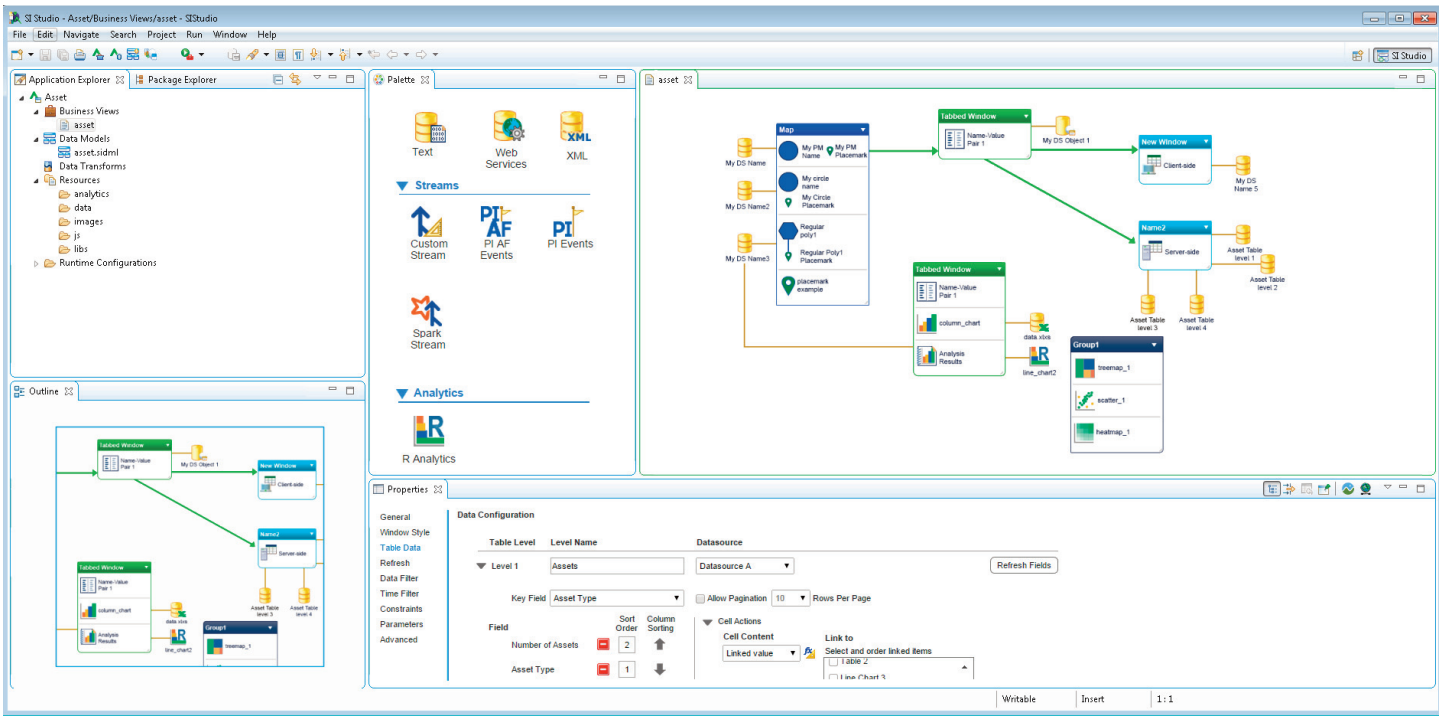
success by most commentators.

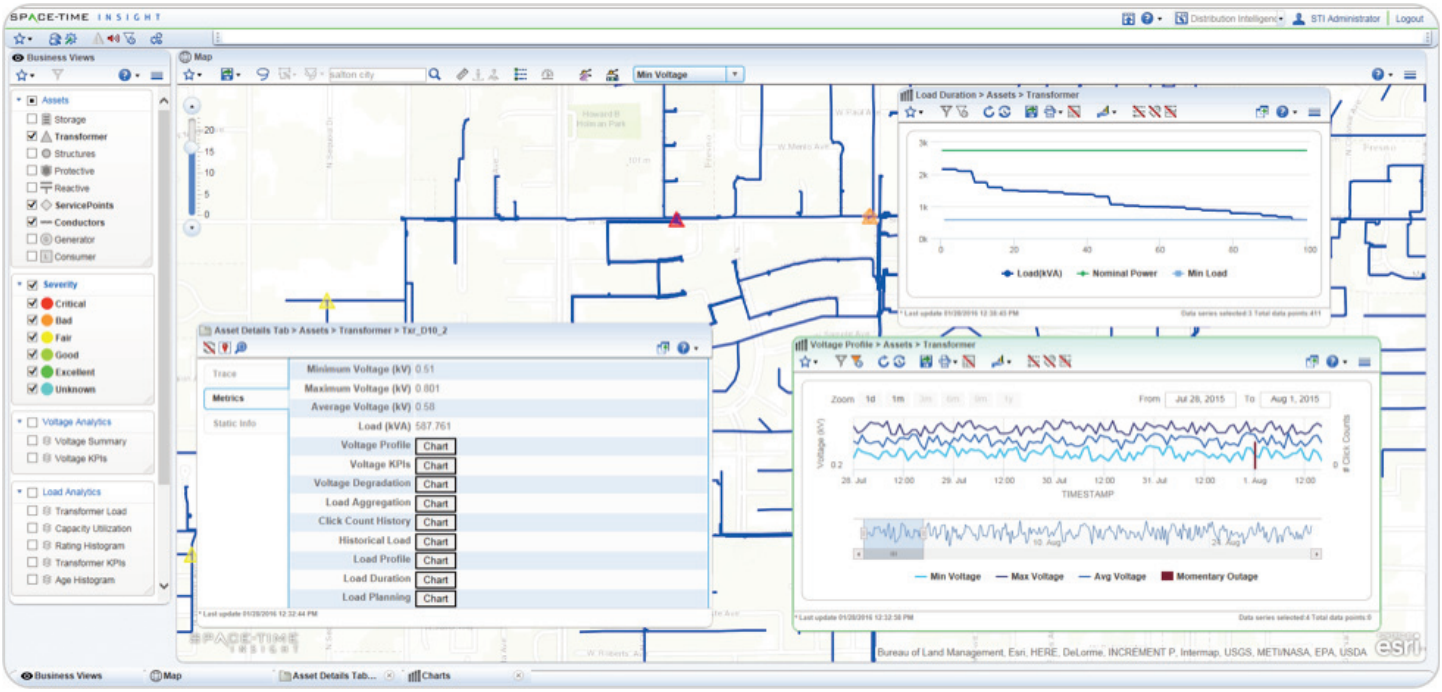
One of the initial action points looked at flow impacted by the proximity to the stadium. Organisers were aware that there was a lack of buffer space between the venue and a building in the way meaning they were able to make changes and divert human traffic. In a similar way, travel demand management led the organisers to influence background users and spectators to change their travel behaviours and limit the volume of passengers and size of queues prior to the competition itself starting.

Staying on track with analytics

To avoid large crowds at key transport hubs and all the issues they can bring, decision makers must base their scheduling on predictive analytics using real data. We can turn to a British sporting summer of yesteryear for a good example of this. The 2012 Olympic Games saw record numbers passengers on the London Underground with over 60 million journeys being made (up 30% on normal levels) and some days seeing as many as 4.6 million passengers travel on just one day. However, using predictive analytics to assess how many services were needed to cope with demand at peak times based on real data, the London Underground stood up to its toughest ever test. A total of over 21 million rail journeys were made during the Olympic and Paralympic Games – prompting major news outlets and commentators to praise the efforts of Transport for London (TfL).

Building on the example above, predictive analytics technologies, such as situational intelligence, can take this level of planning a step further. By considering where people are going to be at a given time and what the direct impact of this will be, as well as by analysing





a broader range of data sets at the same time as opposed to in silos, situational intelligence unveils a bigger picture. For example, a Euro 2016 game involving England is likely to lead to more people watching the game in pubs. The knowledge of when and where that situation is occurring means transport planners can forecast the impact on their services and plan accordingly. Taking this a step further, in a multicultural city such as London it is likely that some nations are well represented by their migrant community in certain areas. However, if you analyse data in silos, it's less likely that you will make the link that a game involving team x is happening and there are lots of people from nation x in location y.

By analysing multiple data sets from multiple sources, situational intelligence can provide insights at a macro as well as a micro level that apply to the immediate reality and are contextually aware. This is potentially an invaluable resource for companies looking to plan their operations better further in advance and gain insights that allow them to take advantage of potential opportunities or pre-empt issues that they would not have otherwise foreseen.

In addition to the real time analytics, whilst running large-scale operations it is important that this data is fed into a broader management process. For example, by having regular review meetings, as happened during the Rugby World Cup, it is possible to establish what additional data sets might be helpful to ensure that the event runs as smoothly as they can. The frequent tournament review meetings during the Rugby World Cup, attended by uniformed services, local government and transportation chiefs, meant that the issues that they faced were cut down throughout the tournament following a "step change". The meetings allowed them to discuss positive and negative feedback whilst finding the eventual steps to enable a smooth tournament. This included an increase in train capacity, supplementary bus capacity to free up the demand on the rail network and allowing for additional queuing space. Towards the end of the tournament the national conversation had moved on from transportation issues to the quality of the sporting moments seen on the field. By basing the discussions at these regular review meetings on insights derived by real data, transport planners can make better decisions and improve the provision of transport at peak times.

As the summer heats up in terms of temperature and excitement for sporting success with Wales reaching the Euro 2016 semi-finals and Andy Murray winning Wimbledon, the Olympics bring further opportunities for people to enjoy great sporting moments. Therefore, transport planners must ensure that they are using predictive analytics to accurately plan for the unique situations they cause. This can help ensure the summer is as successful on the train tracks as we're hoping it we will be on the track and in the field.

We hope you have enjoyed our latest Railway-News magazine. Be sure to look out for our next issue.

We are now producing a magazine on a quarterly basis so please do not hesitate to contact us at al@railway-news.com if you would like to feature your latest technology in an upcoming issue. Please also take a look at www.railway-news.com for all the latest rail news, events and technology.

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