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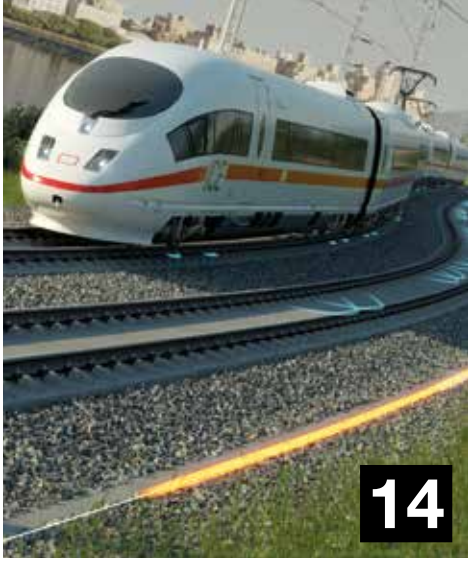
Ultimate Rail

MAGAZINE FOR RAILWAY TRACKING

THE FUTURE OF TRAIN DETECTION

FRAUSCHER
SENSOR TECHNOLOGY

CONTENT



Dear reader,

Do you remember the time when experienced engineers could still relatively easily estimate how long certain trends would last in the railway industry? Today we live in a time when developments which seemed totally inconceivable five years ago may well become a reality by tomorrow. Simply put, the future of our industry is happening here and now.

In only a few years, and against the backdrop of ever-advancing digitisation, we shall have new technological resources at considerably lower costs. The entire rail system will hereby change considerably, also as a result of new, disruptive ideas. Some of these have already been discussed at the Wheel Detection Forum 2017, which we are reporting about in this issue of Ultimate Rail.

New technologies and applications are needed for mobility on the rails. While this is the only way to make this sector competitive and attractive in the long term, such developments may also lead to uncertainties. But to those with an open mind, this approach will unveil completely new possibilities waiting to be tapped!

In the current issue, we reveal what these changes mean for the future of train detection. At Frauscher, we see numerous opportunities here. We want to make the most of them to further increase the performance of our systems. At the same time, we want to increase the cost-effectiveness for our customers and create completely new solutions. We are therefore pursuing the approach of combining existing axle counters and other tried-and-tested components with new technologies. The results of these developments shall be presented later this year.

It is no longer a question of when we will tackle it – but how! With that said, I hope you enjoy reading this edition of our customer magazine Ultimate Rail.

Michael Thiel
CEO, Frauscher Sensor Technology

MIXED NEWS

Being close to our customers around the world and to their needs – that is the aim of Frauscher Sensor Technology. Our people remain true to this philosophy, showing a great deal of dedication and motivation in all that they do.

30+

FTS INSTALLATIONS

have been put into operation around the world since the Frauscher Tracking Solutions FTS were presented at InnoTrans 2016. Railway operators and development teams are equally delighted with the results. The knowledge gained is being directly incorporated into the ongoing work on the system.

43

TRADE FAIRS AND EVENTS

were attended by Frauscher in 2017 as an exhibitor or visitor, in order to talk to existing contacts and potential new clients. A list of the events we will be attending in 2018 can be found on page 34.

23

KEYNOTES, LECTURES AND DISCUSSIONS

were on offer at the Wheel Detection Forum 2017, which took place in Vienna from 4–6 October. The topics were divided into four sessions and one podium discussion: “Trends and visions”, “New concepts for train tracking”, “Innovations with Distributed Acoustic Sensing” and “Best practices in wheel detection and axle counting”. A full report can be found on page 30.

55,301

BOARD UNITS

have been manufactured by Frauscher during the past year at our location in Austria. These, together with 20,422 wheel sensors, have been sent to customers in various rail markets. A further increase in this figure is expected in 2018.

747

SQUARE METERS OF OFFICE SPACE

for the new offices of Frauscher Sensor Technology India Private Limited in Bengaluru.

13

LOCATIONS AND REPRESENTATIVE OFFICES

are now operated by Frauscher. The company is represented on all continents and has expanded its network through numerous sales and cooperation partners. The latest premises were acquired in Toronto, Canada and in Dubai, United Arab Emirates. Details of the regional contact persons can be found under www.frauscher.com.

370+

EMPLOYEES

are currently employed around the world by Frauscher. Our customers therefore have access to contact partners anywhere in the world, who know the language as well as the regional requirements and standards. The largest Frauscher location is in Austria, followed by India. The teams in Great Britain and the USA have grown considerably in 2017.

50+

TEST FACILITIES

are currently being maintained by Frauscher for different railway operators throughout the world. The systems and components demonstrate their performance capability under local conditions and are adapted by experts on the ground in order to find an optimum solution for different applications.

→ Digital possibilities change the concepts of train detection.

TRAIN DETECTION: A SNAPSHOT

Modern train detection systems use different approaches. Franz Pointner, Frauscher RAMS Director, analyses various options in terms of their ability to meet current requirements.

What are the core functions of signalling systems? They should guarantee effective traffic management and prevent collisions and derailments. For this, the systems need one thing in particular: information which is as up-to-date and reliable as possible about all trains in the track sections being monitored. Train detection systems are used for this purpose. They confirm the presence of a train and continuously update the details of its position. Train detection systems hereby enable the safe and efficient operation to be maintained and relevant information to be passed on to passengers and other persons, e.g workers on the line.

Diverse requirements

Based on practical experience, a whole range of requirements can be defined for such systems. This includes for instance meeting the technical prerequisites to be able to detect stationary and moving trains and their integrity in accordance with CENELEC safety standards through to SIL 4. The actual detection speed itself is a key factor, particularly in the vicinity of level crossings. The local accuracy with ↘

which trains are precisely detected plays a significant role, for example in railway stations and for shunting operations. The ability to detect and report broken rails is also becoming more important. Automated or intelligent functions that can take over repetitive tasks in particular can guard against human error. Other determining factors include high availability, easy maintenance, an attractive cost structure and minimised risks to personnel.

The system that a railway operator ultimately chooses also always depends on their strategic requirements. After all, in view of the diversity of the different factors, it is very unlikely that a single system can optimally cover all parameters. Instead, each solution will demonstrate particular strengths – even if the aim of all developments is to implement as many of the requirements as possible.

[cf.: Marc Antoni | Director of the Rail System Department, UIC: What will digitization bring for train detection? – Paper at Wheel Detection Forum 2017, pp. 1-2]

State of the art

Axle counters and track circuits currently represent the state of the art in train detection. Since both approaches are already well-established, a detailed description of their function would be superfluous here. In light of their high availability and due to significantly lower life cycle costs compared with track circuits, axle counters continue to be on the rise throughout the world. They can therefore be regarded as the more sustainable of the two technologies. While both systems are in principle suitable for the fail-safe output of clear/occupied status of a section of track, they only detect the train in restricted track sections and so do not facilitate the continuous tracking of trains.

Trend: Continuous train tracking

It is precisely these continuous train detection systems which are attractive to many railway operators; by enabling a greater train frequency rate, they allow better utilisation of the lines. With this in

↓ Based on inductive wheel sensors, axle counters provide reliable and precise data.

mind, a whole host of new approaches has already been developed for the recording and transmission of the relevant data. Besides continuous train detection, the aim of these systems is also often to reduce the number of components installed along the lines.

These solutions include the European Train Control System programme (ETCS) and other systems which are based on satellite positioning, train-to-train communication or detection by means of glass-fibre optics, and a combination of these and other technologies.

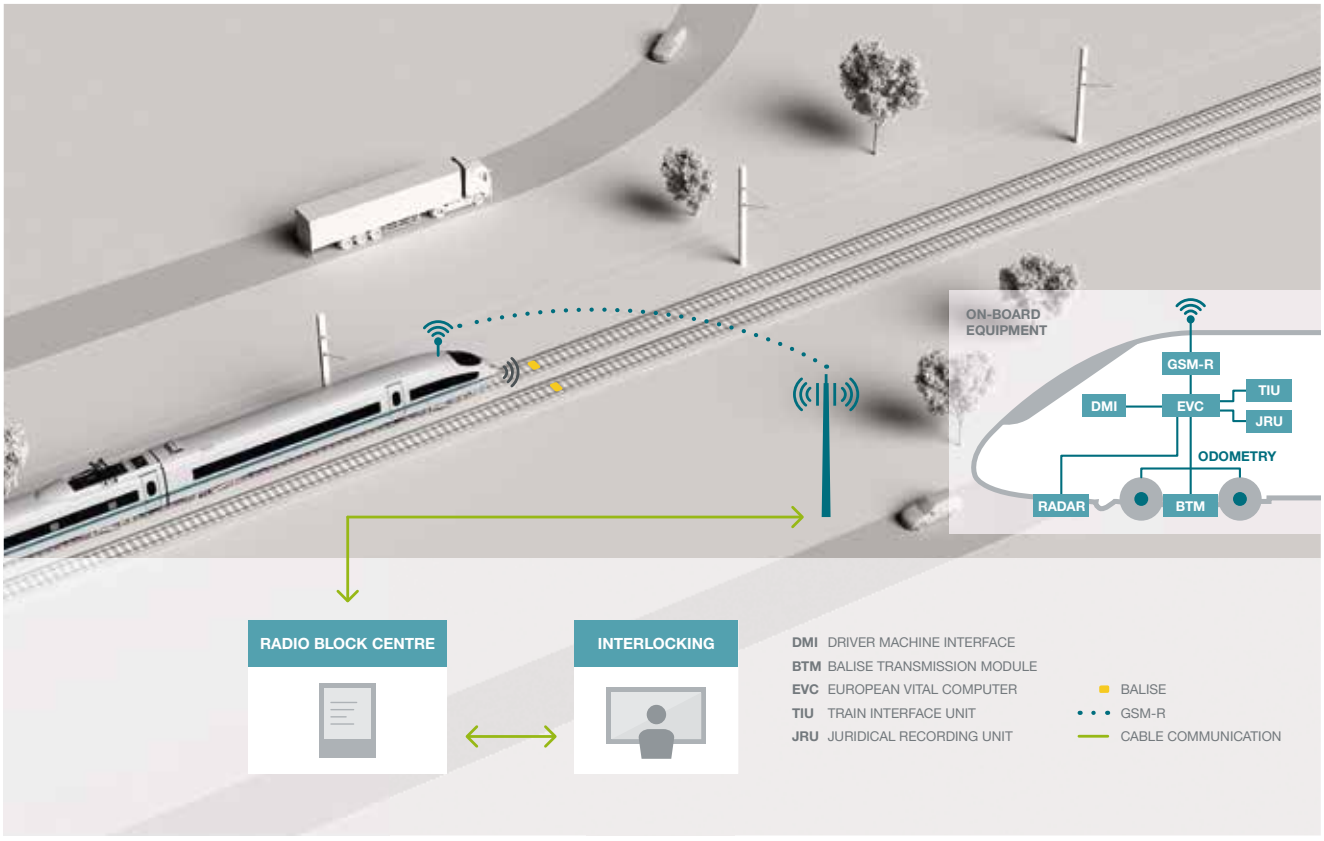
European Train Control System (ETCS)

The ETCS includes three system expansion stages which, owing to long-existing concepts, can also be included in the established train detection methods. They are based on a combination of innovative on-board equipment for trains and the communication of different parts of the operational system via wireless networks. ↘

↑ Balises transmit information to passing trains.

EUROPEAN TRAIN CONTROL SYSTEM

ETCS Level 1 and 2 combine on-board equipment and trackside installations. The latter shall no longer be required in Level 3.



When ETCS is being used, each railway vehicle needs antennae for radio communication: for the exchange of data with balises or loops and for distance measuring devices, such as odometric systems or Doppler radars. In addition to this, trains are equipped with a separate computer, the European Vital Computer (EVC). It calculates speed profiles, stores train and route data, and controls the operation. The information collected for the train driver is output via a Driver Machine Interface (DMI).

Trackside, ETCS systems need balises. These are installed in the track and transmit the data stored on them to passing trains. Two balises are always needed per signal for direction detection. In addition to this, the system needs transmitter masts for GSM-R-based communication with the Radio Block Centre (RBC).

Whilst additional lineside safety systems such as axle counters are used for ETCS Level 1 and 2, the aim of the development of Level 3 is to completely forego the need for corresponding components. Furthermore, the integration of satellite positioning enables virtual balises to be established, which should reduce the number of physical Eurobalises in the track.

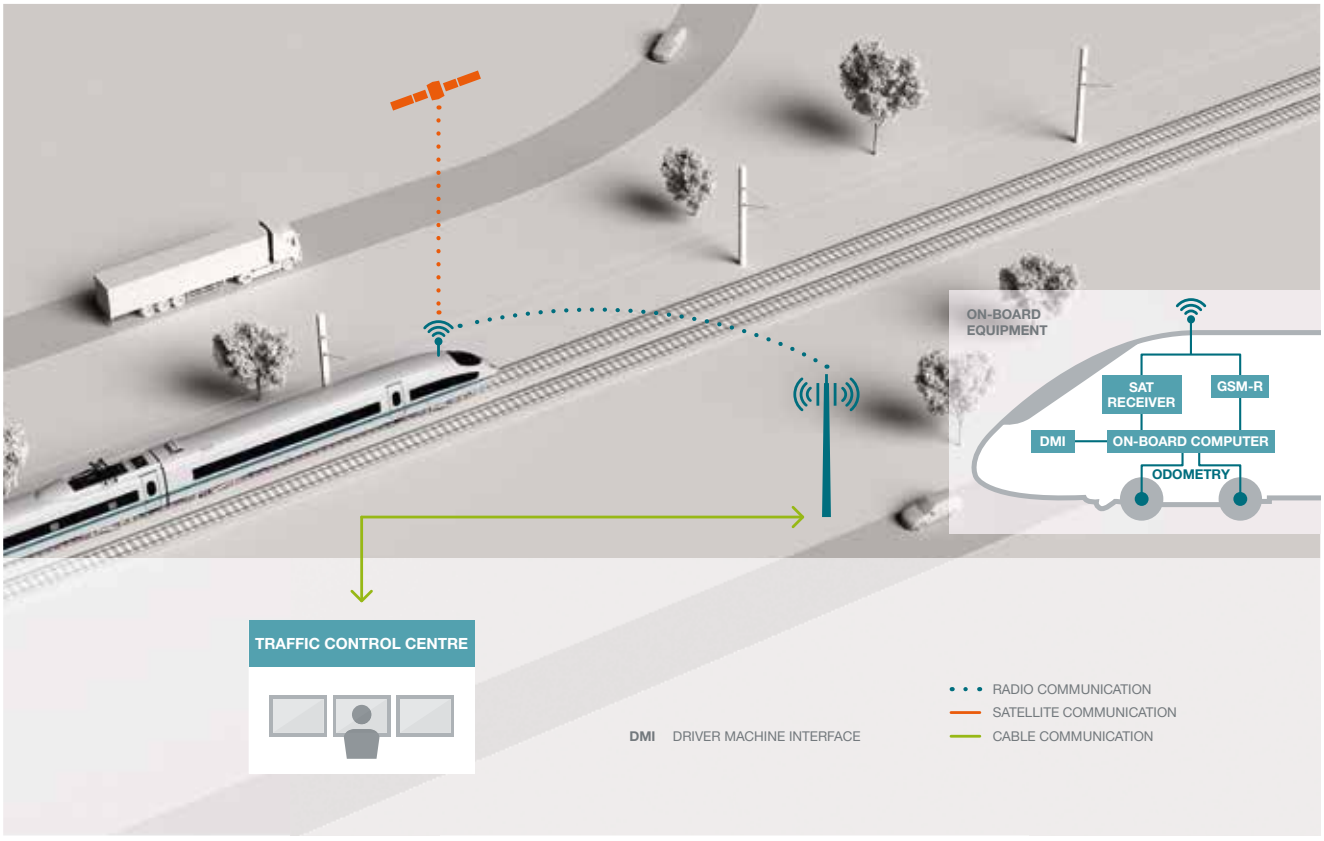
Fixed block sections are to be substituted by so-called moving blocks, which allow the seamless control of the distances between trains and thus – at least theoretically – enable travel at an absolute stopping distance. Each train transmits its own position via the RBC and in return receives information about the current position of the train ahead of it, allowing for optimised brake and acceleration control. The distance to the next braking point, the speed and the dynamically calculated speed reduction are displayed via the DMI.

Satellite-based systems

A point of criticism which is often cited in conjunction with the ETCS program are the costs for the relevant equipping of trains. In light of the growing demand for cost-effective alternatives for continuous train detection, the EU has also promoted research projects such as SATLOC. This is a train positioning solution based on the Global Navigation Satellite System (GNSS) and

SATELLITE-BASED TRAIN DETECTION

Trains located by satellite have additional on-board equipment and communicate their current position to the Traffic Control Centre.



“COMPONENT MANUFACTURERS, SYSTEM INTEGRATORS AND OPERATORS MUST WORK CLOSELY TOGETHER”

public mobile networks, which has been and continues to be specifically developed for lines with simpler operating conditions. In this system, the Radio Block Centre (RBC) and the Control Centre from the ETCS merge with a Traffic Control Centre (TCC).

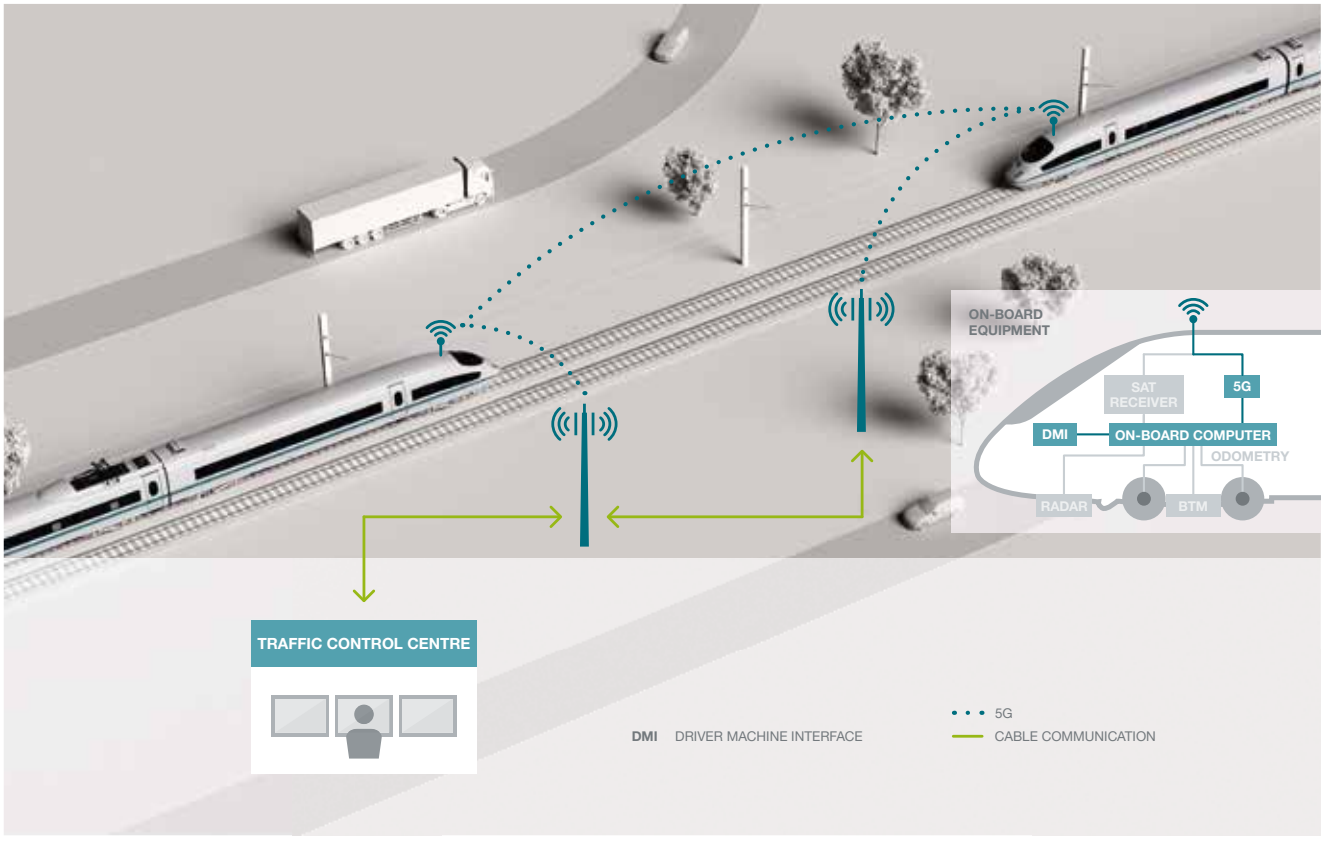
Rolling stock is located using GNSS, odometers and balises, and transmit the corresponding data to the operation control centre via public mobile networks. Train detection systems and signalling devices with this solution are made largely obsolete. Communication takes place via mobile radio modems with dual-SIM, which allows the use of two networks, thereby providing increased availability.

Successful journeys have already been completed on a test track with good conditions for recording trains via satellite and communication via mobile networks. The system works in compliance with the European Rail Traffic Management System (ERTMS) and supports the necessary ETCS modes and telegrams.

Even the “Train Integrated Safety Satellite System” 3InSat has the aim of reducing trackside components. Using SatNav and SatCom should mean that the ↘

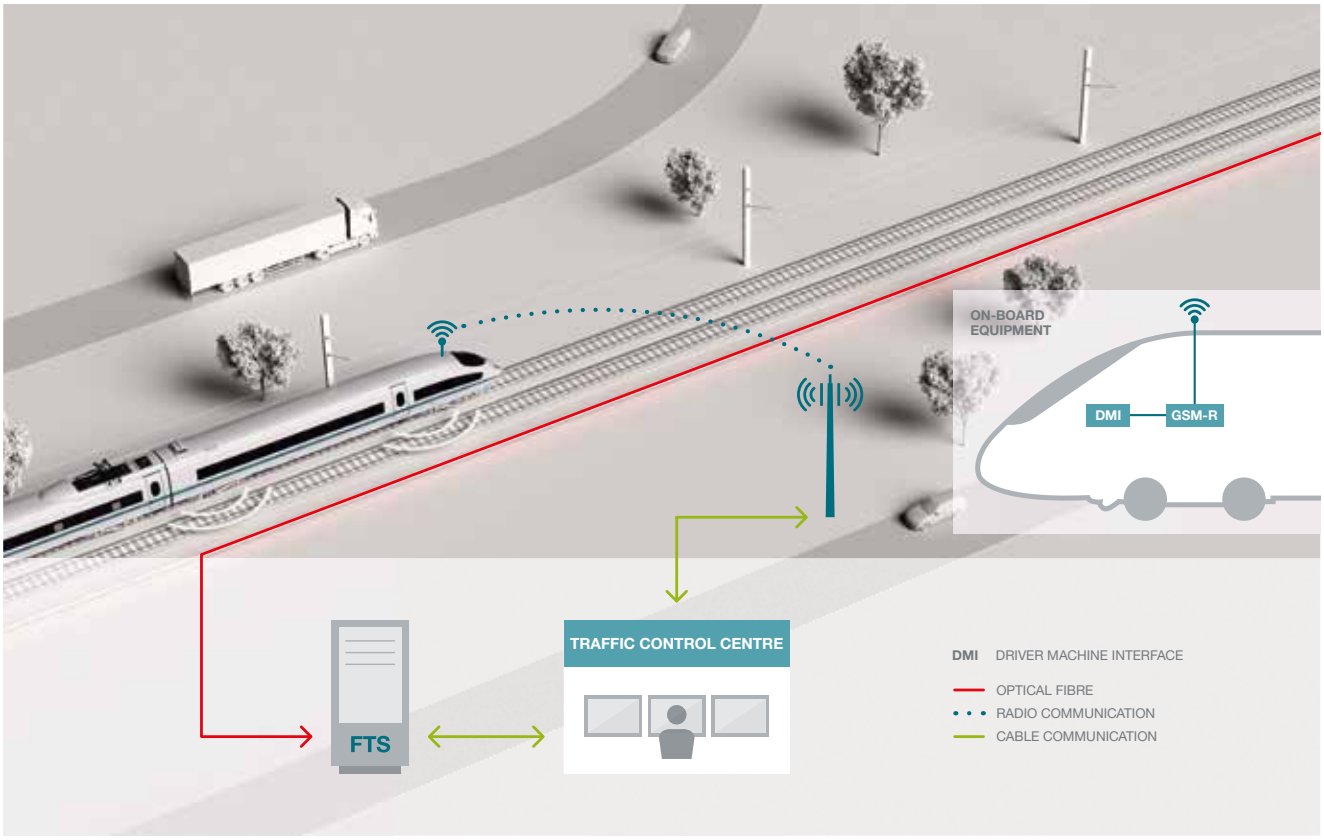
TRAIN-TO-TRAIN COMMUNICATION

Powerful radio networks to 5G standard enable trains to be networked.



GLASS-FIBRE OPTICS

Using systems based on glass-fibre optics for train detection reduces the retrofitting costs for trains to a minimum.



majority of physical balises are no longer needed. Instead, a satellite-based train tracking solution should be used which can be integrated into ERTMS systems. These systems should become more affordable, especially on less-frequented lines such as branch lines, regional lines and freight links.

A corresponding presentation by Ansaldo STS at the Wheel Detection Forum 2017 in Vienna gave a hint of how far these approaches have already progressed.

Train-to-train communication via 5G radio networks

5G is a new mobile communication standard which is intended for a new market with new requirements. The objectives are to use higher frequency ranges than 4G and other predecessors, latency times of under 1 millisecond, compatibility with machines and devices and to reduce the energy consumption per bit transmitted.

The principle of closely meshed links should allow individual points in the communication network to be simultaneously connected to several or potentially with all other available points. Highly efficient connections can therefore be established between moving trains. This also enables information about speed, position and acceleration to be passed on to subsequent trains. Another benefit provided are additional options for the moving block approach of ETCS Level 3 mentioned above, for example on highly frequented high-speed lines.

Data relating to possible sources of danger can also be provided effectively. This is obtained via train-to-X-communication – i.e. communication between trains and any objects – and transmitted directly, allowing journey characteristics and operation as a whole to be significantly optimised.

The greatest challenges when introducing 5G is the increased data throughput, reduced latency and – particularly crucial to the railway sector – maximum availability and safety.

Glass-fibre optics

Unlike the solutions described above, which are geared towards a reduction in trackside components, systems based on glass-fibre optics focus on minimising retrofitting costs on trains. Origin, design and a technical inventory of the rolling stock are insignificant when it comes to detection, since this is exclusively realised across fibre optic cables along the track. For this, only a single fibre of these cables has to be charged with laser pulses. The light of the pulses is reflected at a number of points within the glass-fibre and the reflections are captured at the transmitting unit.

If vibration or sound waves hit the fibres, the reflected light only changes slightly. This produces a signature which can be evaluated with the relevant algorithms and assigned to specific events at a specific location. A variety of information can be deduced from the possible recordings from rolling stock along a monitored section of track. The number of systems and components needed for continuous train detection can hereby be reduced to a minimum, whilst operational efficiency and interoperability are increased significantly.

Conclusion

Each of the approaches described here has the potential – as a stand-alone solution or in combination with other technologies – to increase the train frequency rate on certain lines. Depending on the characteristics and costs, the individual concepts are suitable for use in different segments, such as freight routes, highly frequented lines, or branch lines with little traffic.

On the outskirts of sensitive areas especially, such as at level crossings or in railway stations where several sections of track run directly side by side, various points still need to be clarified for the options described here. This applies in particular to applicable standards concerning safety. The requirements regarding redundancy, precision and availability must also be met. There are therefore still many challenges when it comes to developing new train detection systems.

Progress is already clearly noticeable, not least because of the increasing digitisation of the railway sector. New impetus can also be found outside of the railway industry, e.g. from new ways to record – and in particular transmit – data.

Operators and system integrators shall face major challenges in future in light of this dynamic and the diversity of the topic. They will have to come to grips with the strengths and weaknesses of individual solutions (or in the case of the ETCS, its expansion stages) and balance the conflicting priorities of safety criteria and cost-effectiveness. They can therefore decide which approach is the best one for them, depending on the individual requirements, actual or planned train frequencies, condition and status of the track infrastructure, geographical conditions and other criteria.

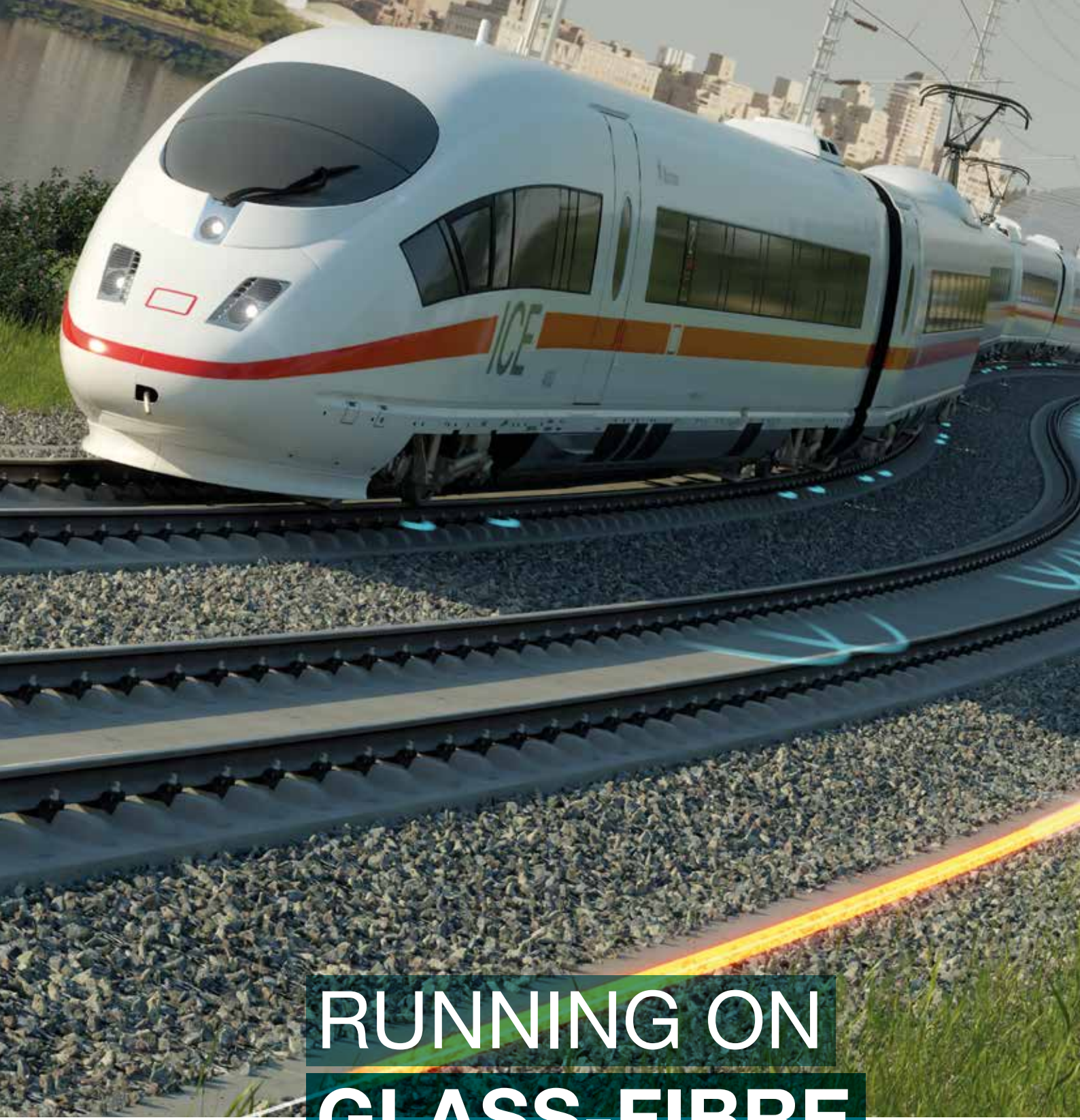
Close collaboration between component manufacturers, system integrators and railway operators shall therefore be more important in the future than ever before. Only then can the complex challenges in the triangle of technical possibilities, normative requirements and individual parameters be met. ●

AUTHOR

Franz Pointner

RAMS Management | Director,

Frauscher Austria



RUNNING ON GLASS-FIBRE

Current developments show that glass-fibre technologies will significantly impact the future of the railway industry. Kevin Tribble, FTS Product Management at Frauscher, casts an eye to the future of corresponding train detection solutions.

Train detection systems are essentially caught between the conflicting priorities of safety requirements, performance expectations and cost-effectiveness. Fulfilling all three criteria entirely at the same time, is extremely difficult; after all, the three factors depend on very different parameters. Glass-fibre technologies such as Distributed Acoustic Sensing (DAS) however offer major potential when it comes to the key aspects of each of these areas. This is evident from the experiences gained by the railway industry from this approach over the past few years.

The potential is extremely high when corresponding train tracking solutions are used. Like other approaches, they too enable rolling stock to be detected in real-time and across vast sections of the track. However, only a minimal track infrastructure is required. There is virtually no need for any retrofitting to trains as well.

TRACK MORE WITH LESS

Using DAS for train detection offers an array of advantages:

- **Trackside-only** equipment
- **Independent** of the design and origin of the train
- **Existing fibre-optic cables** can be used
- **Minimum retrofitting** on trains

DAS offers huge potential

A mere glance at the technical bases shows that little hardware is needed for train detection with DAS: as a trackside infrastructure, it simply needs a single glass-fibre. This is then charged with laser pulses. By evaluating the changes in the reflection of these pulses, the fibre is converted into a sensor that runs along the track and is capable of detecting sound waves and vibrations. Due to its technical properties, DAS thus enables moving objects to be reliably tracked over long distances.

Train tracking is on track!

The Frauscher Tracking Solutions FTS presented by Frauscher in 2016 are now being used around the globe in different applications. This has allowed the development team to continually gain new insights into the properties, strengths and potential of this technology in the field of train detection.

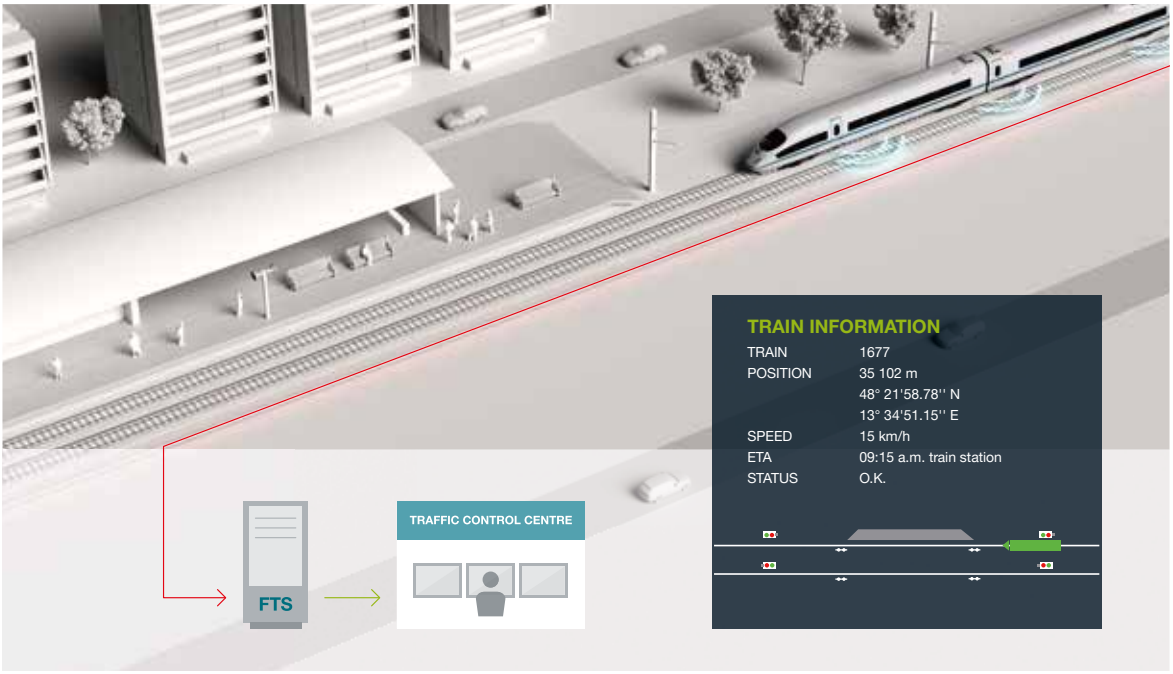
Installations have been realised in countries with a broad range of conditions; besides Germany and Austria, these nations include France, Australia, China, Brazil, India, the USA, Belarus, Ukraine, Turkey and the UK. The wide range of applications forms a basis for the diverse testing of the properties of the Frauscher Tracking Solutions FTS in the field of train detection.

Take up position

Practical experience has also shown that certain installation parameters can have a positive impact on the accuracy of DAS-based applications in train detection. This includes the position of the cable and its distance from the track as well as the type of installation itself – in other words, whether the cable is buried, is in a trough, or affixed to the wall of a tunnel. Previous installations have demonstrated that cables laid in concrete troughs or directly in the ground are especially well-suited to detecting different influences. Cables installed above the ground however are often affected by additional factors such as wind, rain or hail and therefore register a higher “ambient noise level”. The ideal type of installation ultimately always depends on the requirements which the application must satisfy. ↘

REAL-TIME TRAIN TRACKING

When detecting trains using DAS-based systems, such as the Frauscher Tracking Solutions FTS, users can generate various kinds of useful information.



In addition to this, it is vital to calibrate the system with precise geo-referencing data. Information about the position of the glass-fibres is hereby linked with GPS or route data which, during operation, gives some indication of the precise routing of the fibre-optic cable along the line being monitored. This routing may under certain circumstances deviate from the position of the track – in order to bypass an obstacle, for instance.

Digitisation opens up possibilities

The lines equipped with test installations are already benefiting from the data from the FTS system. Besides information for the actual traffic control system, i.e. the current position of a track vehicle, its speed, direction of travel and length, it is also possible to generate information for other systems. This includes the estimated time of arrival at a defined point, for example a railway station, in order to provide platform announcements or train timetables. Level crossings which are currently being activated and deactivated by axle counters, can in future be controlled with even greater precision by implementing the additional information.

The examples show how important the interoperability of data and systems is. By having a combination at a fundamental level, exact data can already be output in the first instance. This can then be linked with further information.

In order to exhaust the best possibilities this technology has to offer, it is essential to have logical links between the various data. It is also important to include approaches such as cloud computing and machine learning in the relevant concepts.

Conclusion

Train detection solutions, which like FTS, are based on glass-fibre optics, will in future play an ever-increasing role in the railway industry. Recent years have already demonstrated a broad field of application.

From past experience, Frauscher has already been able to develop a strategy which is based both on a stand-alone solution and on combined systems using tried-and-tested components.

This is significant for two reasons. Firstly, it offers the possibility of a gradual introduction, including in safety-critical areas. Secondly, by combining various detection technologies, it is possible to generate added-value data of considerable relevance.

In order to implement the relevant applications successfully, rapid progress must be made with digitisation strategies. After all, it is these strategies that will allow a more efficient use of data in the sense of conversion into concrete and useful information.

Yet this necessity applies not only to new solutions. If a combined approach with axle counters and wheel detection systems is to continue to be pushed – especially in safety-relevant areas – then these components too must follow the path of digitisation in order to be able to provide data via the relevant channels and with maximum efficiency. ●

AUTHOR

Kevin Tribble,
FTS Product Management,
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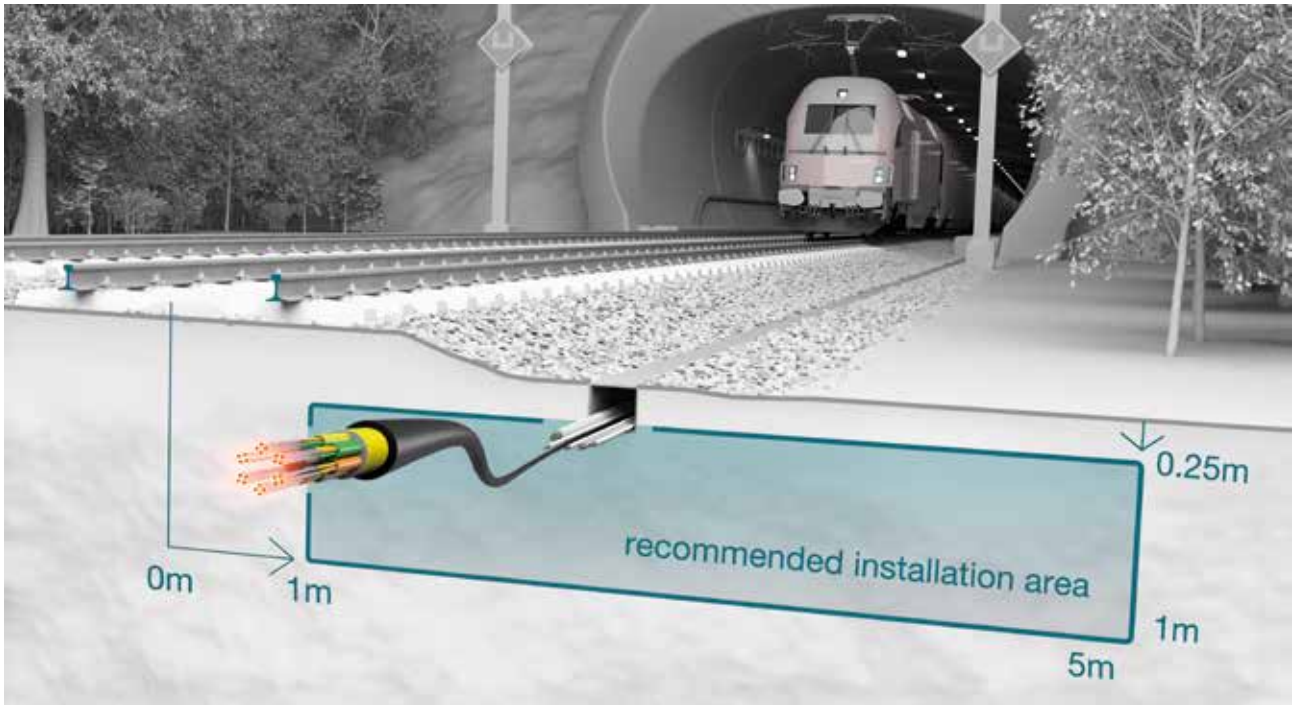


↑ Fibre-optic cables are often already in place along a track and can be used to install FTS.

AXLE COUNTING: THE FUTURE

↑ The British railway market was quick to realise the potential of axle counters and has adopted the technology.

Wheel detection and axle counting are currently the state-of-the-art technology when it comes to the reliable detection of trains. Elaine Baker, Managing Director Frauscher UK, summarises a few examples which show that this is unlikely to change for a long time – even in the light of new possibilities which the digitisation of the railway industry brings with it.

Decades have passed since axle counters were first used. Since then, a vast knowledge of applications that can be realised using this technology has been acquired across the entire railway industry. This is what lies behind the long-lasting success of axle counters: the number of installations where they are used continues to increase.

In 2011, Frauscher consolidated its vast experience of axle counters to produce the Frauscher Advanced Counter FAdC. In order to meet the needs of various markets and to incorporate practical know-how into the development, this axle counter was created in close collaboration with railway operators and system integrators.

There from the beginning

In Great Britain, the FAdC was immediately met with great interest and was installed for the first time immediately after the market launch. Since then, there have been countless projects implemented where choosing not to use this axle counter would have been unthinkable. Nowadays it is installed on many lines across the UK and is used in many different applications, thus making the British railway network now one of the most modern and efficient networks in the world.

Due to the high flexibility of this product, Frauscher was also able to meet very specific requirements over the years – even if this meant adapting individual components. In light of the experience gleaned, the portfolio of solutions which Frauscher can offer its customers, is also growing. The relevant developments of the FAdC can be divided into three areas:

- Robustness and reliability of the wheel sensors being used
- Flexibility in the system and interface design
- Implementation of additional functionalities

Guaranteed not to miss a train

Being components which are installed on the track, wheel sensors must function reliably, sometimes under adverse conditions. Guaranteed train detection requires a robust design that can withstand extreme temperatures and strong environmental and mechanical influences. International projects have also demonstrated that electromagnetic influences may require specific adaptations. When installing a system in the British Isles, electromagnetic influences were identified at the neutral sections of the overhead line, which presented EMI levels that well exceeded the values safeguarded for during tests.

In order to find a solution, Frauscher first of all analysed the situation extensively on site and then assessed the acquired data in the company's laboratories. The wheel sensor RSR123 was then updated accordingly. This optimised version demonstrated even better resistance to electromagnetic influences in comparison to its predecessor.

The refined RSR123 can now be used on rail networks with direct current and on those with alternating current – thus also on all lines in the UK. Once the sensor had been installed at Crossrail and in Manchester, it soon came to be the first choice for all applications nationwide.

Free interface selection

In the modern railway industry, it is becoming increasingly critical for data to be flexibly and easily available. Equipped with parallel and serial interfaces, the FAdC is considered to be extremely future-proof in this context. For, depending on the project-specific requirements, it can be easily and quickly integrated into different infrastructures.

This flexibility was for instance utilised in 2017 for the first tram project in Great Britain where this axle counter was used. Its integration was realised via three different relay interfaces. During the course of the project there were also various other operational advantages to the rail network.

The serial interface of the FAdC is one of the reasons why this axle counter is considered as an option for modernising a substantial proportion of the 6,400 level crossings managed by Network Rail. ↘

INFORMATION

Other architectures for level crossing solutions are described in the specialist article “Innovative tracking of trains for high-availability and cost-effective level crossing protection systems” by Manfred Sommergruber, which can be found in the media archive at www.frauscher.com.

Its design enables customer-specific software protocols to be used as well as the Frauscher Safe Ethernet FSE protocol, which we reported about in detail in the last issue of Ultimate Rail.

Being able to quickly and easily connect the axle counter to the level crossing control system also leads to significant cost reductions. Wireless connections can even be established in some situations, such as via mobile networks. Furthermore, additional savings can be achieved if the same wheel sensor is also used as the activation point and for train detection in the signalling system.

Unique designs

Based on the example of the level crossings, it is already evident that axle counters with different interfaces offer a high level of flexibility when it comes to the architecture of systems. This allows significant savings to be made in both safety-relevant and non-safety-relevant fields.

Flexible designs are a necessity under quite different conditions. This was evident on the Crewe-Shrewsbury (SYC) line and on the Great Northern/Great Eastern (GNGE) line. Here, the routes on which the FAdC was used included long sections in remote areas. The adaptability of the FAdC made it possible for components to be installed in decentralised cubicles spread out along the track.

Altogether different requirements were laid down by the installation in the extremely busy Manchester Piccadilly station, where all the components were bundled into one central system.

Making the most of intelligent functions

Reliability and accuracy are already largely guaranteed by the technical prerequisites when the inductive sensor technology is being used. On top of that, other innovative ideas are also needed to further increase availability. Apart from being able to install redundant structures,

↓ In Manchester, the FAdC was installed in a central architecture.

Frauscher has therefore also developed two other approaches which are now being implemented as standard in their products: Counting Head Control CHC and Supervisor Track Section STS. Thanks to the modular design of the systems by Frauscher, the components which are essential to these functions were able to be quickly identified and modified during the development.

The Counting Head Control CHC function was originally developed based on the Axle Counter System ACS2000. Its first version was for instance used to suppress the damping of sensors by trolleys, which are used in India. These days, it is also used in other markets. This includes inter alia Canada, where a section of the Yonge-University line in Toronto has been fitted with CBTC. As a fall-back system, axle counters are used here which, in order to increase availability, also work with CHC.

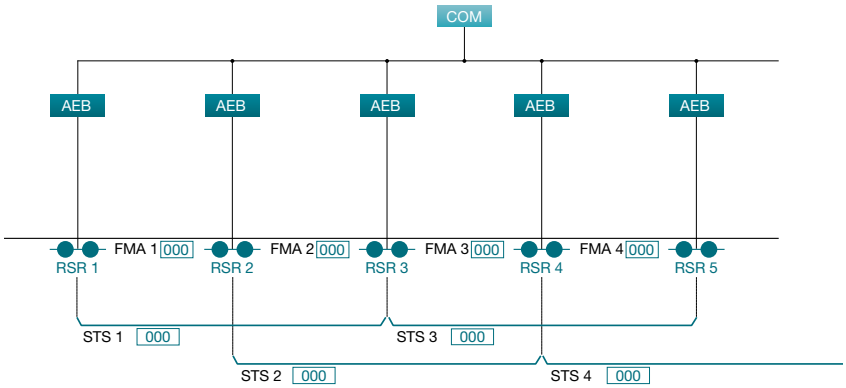
The Supervisor Track Section STS function was established in conjunction with the development of the FAdC. Since then, Frauscher has developed various integration options. For railway operators, this means increased availability of their signalling systems without coming into conflict with the safety standards. Both functionalities are also being followed with great interest by the British railway market. Approval for their use is anticipated in the near future, especially with regards to CHC.

Collecting data – generating information!

The FAdC also provides additional useful diagnostic information via the Frauscher Diagnostic System FDS. Railway operators therefore have the possibility to implement predictive maintenance strategies and to solve any problems which arise at short notice. Short installation times and optimum maintenance windows also contribute to the safety of workers on the track. Their time spent in the hazardous area is significantly reduced when axle counters are used, as compared to track circuits.

SUPERVISOR TRACK SECTION STS

Virtual supervisor sections overlay existing clear track sections and can be evaluated in the event of a fault.



The examples given in this article from the UK and other railway markets show that in order to make axle counters future-proof, it is essential to be able to easily and quickly provide data via flexible interfaces. A combination of reliable hardware and innovative approaches can also increase availability and reduce the life cycle costs. Modern axle counters are therefore able to combine proven reliability and high flexibility – whilst in future still remaining attractive for a long time for a variety of applications in different railway markets.. ●

AUTHOR

Elaine Baker,
Managing Director,
Frauscher UK

INFORMATION

Details about CHC and STS are described in more detail in the specialist article "High availability: definition, influencing factors and solutions".
This can be found in the media archive at www.frauscher.com.

UNDER THE SPELL OF THE TIGER

Indian success story: Michael Thiel, CEO Frauscher Sensor Technology, and Alok Sinha, Managing Director Frauscher India, discuss the location's progress since 2013. It is the story of a successful strategy that uses know-how and openness to successfully meet specific needs.

Frauscher India has already celebrated its fourth anniversary. What does that feel like?

Michael Thiel: In a word: amazing! After four years of hard work in India, this has confirmed that the decision to open a dedicated location here was absolutely the right one. At the time, we had already gained some experience in this market and were aware of the potential, but we were also fully aware of the risks. So I was all the more delighted when Alok agreed to support our entry into the market and to manage the business for Frauscher in India. Today I can say that the Indian market is in fact just as impressive and unique as we keep hearing about over and over again from many sources. Perhaps we even initially underestimated the possibilities which we have here. The market volume itself is huge and the Indian government has also drawn up impressive infrastructure plans for the future, which will have a big impact on the railway and metro networks. When it comes to our customers, we have also noticed a soaring interest to continue to press ahead with innovative developments.

Alok Sinha: That's right, yes. The potential that we discovered as a company is in fact even greater than we initially thought. This of course also meant that we were faced with unexpected challenges. The progress which Frauscher India has made, however, also shows how well we mastered these tasks. Within a few years, the location grew from two to more than 100 employees and we've increased our order backlog to 40 million euros. We have expanded our business to three locations across the country. We have established a production facility for axle counting systems and set up a dedicated R&D team which is working on the market-specific adaptation of existing products and the development of new solutions. So far our products have already been certified by the RDSO [Research Designs and Standards Organisation, Ministry of Railways, Government of India – ed.] in India and by a series of other railway operators in Southeast Asia.

Does India differ substantially from other markets in which Frauscher is active?

MT: In principle, each of our markets is unique in its own way. In India however, the railway is immensely important. That's why, from a strategic point of view, this market is extremely important. In many ways however, the country presents special requirements which we haven't yet come across anywhere else. These include cultural differences which in particular affect the way in which one conducts business. You have to keep reminding yourself of these differences and challenges again and again. This ultimately gives you the opportunity to enhance your product portfolio. The role which the Indian market takes on for us is certainly reflected in the agility with which our global team has approached their tasks here.

What have been the most important accomplishments achieved to date in the Indian market?

AS: The largest project to date was implemented with MRVC [Mumbai Railway Vikas Corporation Ltd. – ed.]. 1,600 detection points were used to create 1,200 track sections spread across 19 stations. This is also the largest scope of delivery which Frauscher has ever provided in a single project. In addition to this, Frauscher India was able to make a name for itself in the metro sector. Virtually all projects which are implemented in this segment are now reliant on our axle counters. There are currently around 1,300 detection points in use on the respective lines. We have also been selected as a partner for the “Dedicated Freight Corridor” projects. These infrastructure undertakings include more than 9,000 detection points used to set up a signalling system along more than 1,600 kilometres of track. One of the latest projects where our components are being used is in Hyderabad. The design, provision, installation, testing and commissioning of the axle counting system were realised within less than two months. Thanks to the high flexibility and short throughput times, we were able to help our customer meet their deadline for this project.

The project in Mumbai also marked the start of Frauscher's entry into the Indian market?

AS: Yes, that's right – but from a technical perspective, it proved at the same time to also be a particular challenge. The main focus of this project was to maintain operations on Mumbai's urban railway lines even when tremendous rainfall caused floods during the monsoon season. Around 200 of the 1,600 detection points installed are in sections where we are dealing with very extreme conditions. On top of that, ↘

→ Frauscher India has also been able to establish itself in the metro sector.

the measurement of vibrations and shocks when trains passed produced figures in places that exceeded 2,000 g. The material which had been used to install the trackside components was in part unable to withstand such loads. Developing a suitable solution based on analyses in the field was also made more difficult due to the immense traffic volume of more than 1,200 trains a day.

How did you ultimately overcome these challenges?

AS: To be honest, it took quite some time to develop a satisfactory solution. At first, the initial approaches looked very promising. But then problems started again after a few months, so we continued to work on alternatives and on the stability of the individual components. In the end, the structure of the rail claw system was completely optimised in order to increase its stability. At the moment we're also working on the further development of the wheel sensor RSR180, which is used in Mumbai. Using improved materials and adapting the inner structure should also further increase its durability. For the installation of sensors in places which are severely impacted by very heavy shocks, we have enhanced our portfolio with a specially developed mounting assembly.

Apart from that, have there been any other requirements that Frauscher has been able to provide a technological solution for in India?

AS: One topic which also resulted in the enhancement of our portfolio is the handling of so-called trolleys. For this, we refined the Counting Head Control CHC principle which allows a freely definable number of dampings from a wheel sensor to be suppressed. This function is used on rail networks around the globe and has been optimised to meet the requirements of Indian Railways. In the meantime however, another scenario was identified that was not yet covered. It occurs when a trolley is used in a track section which has already been occupied by another track vehicle. Working together with the RDSO, the Frauscher development team came up with a relevant adaptation of the CHC function. The damping of sensors from trolleys can therefore now also be suppressed even if the track section is already occupied. The resulting solution was also tested straight away on site in close collaboration with RDSO to ensure it was suitable for the Indian rail network, and can now be used here. And so we have now developed a reliable and strong solution for a market-specific problem which perfectly meets the requirements in the rail network of Indian Railways.

→ The Frauscher location in India is growing steadily.

Indian Railways plans to extensively modernise the existing signalling system. This will lead to a massive demand for axle counting products. Will Frauscher be able to cope with such demands?

AS: The capacity of the production plant in India, with which Frauscher also backs the “Make in India” initiative since opening three years ago, currently allows an increase in production of around 10,000 detection points a year. This corresponds to the projected needs of Indian Railways.

But in 2018, we want to further extend the production facility in order to be able to meet the increasing demand from the market. At the same time, the technical skills of our employees will be promoted. This will allow them to offer optimum support for various matters.

How are Frauscher products perceived these days in the Indian market?

AS: Our axle counting products differ substantially from the systems of other providers thanks to a series of unique selling points. This includes the options to mount sensors to the track without the need for drilling work, without having to install any active electronics near the track or being able to establish an automatic failover, i.e. a hot-standby structure, via redundancies. Another feature is surely the innovative diagnostic tools which we provide with our axle counters. These characteristics and features were also for example listed in a letter from the Chief Commissioner of Railway Safety, who recommended the implementation of our components to Indian Railways.

And what role do the new Frauscher Tracking Solutions FTS play in India?

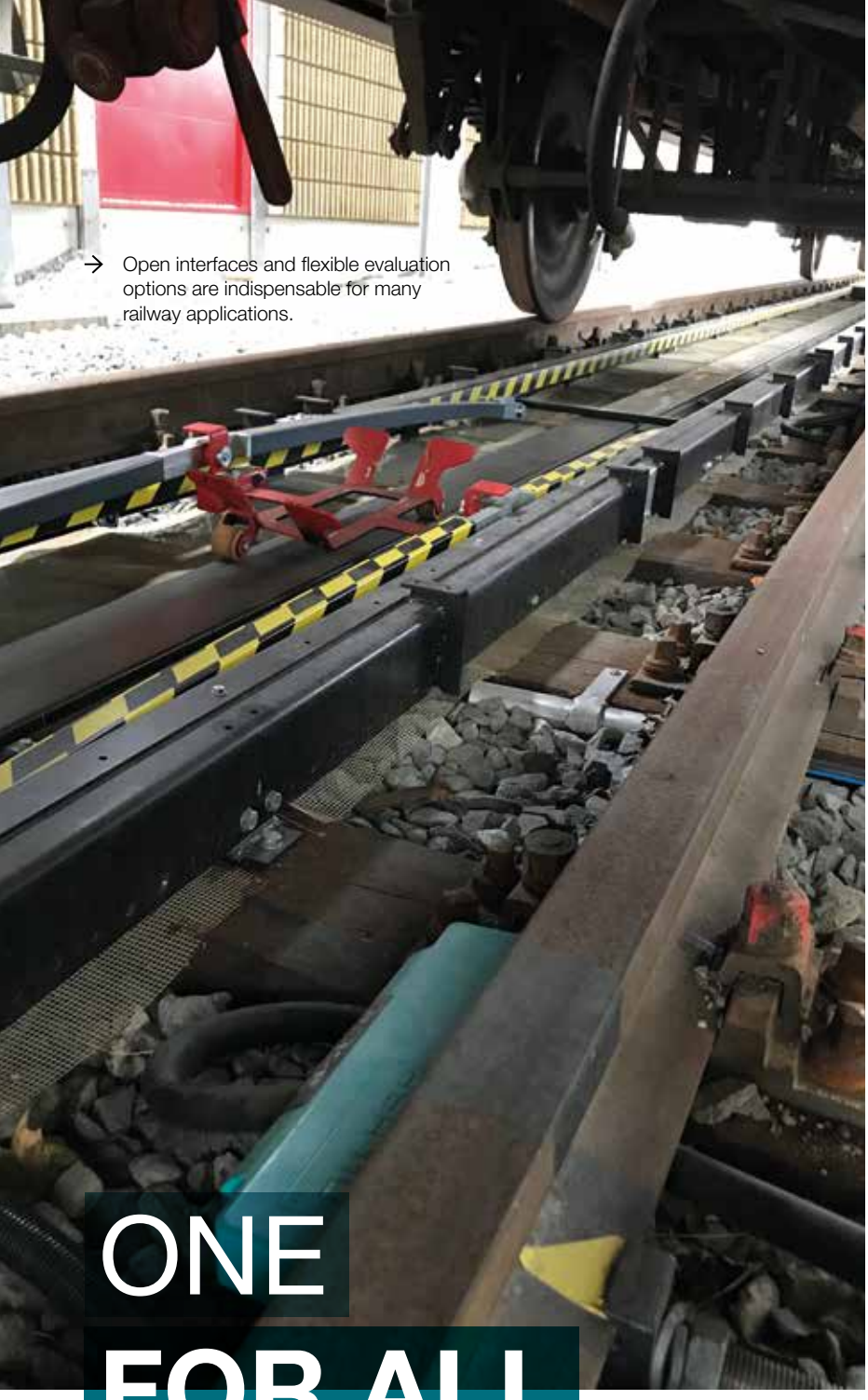
MT: India is classed as one of the core markets for this system, which is based on Distributed Acoustic Sensing (DAS), since it can offer potential solutions for the fundamental requirements of Indian Railways. This includes the monitoring of train and infrastructure components and the detection of unauthorised movements in certain areas. In pilot projects which are implemented in close collaboration with Indian Railways, we check the relevant characteristics of the FTS. Together we want to develop a system which facilitates the ongoing real-time monitoring of different components and the transfer of relevant information for the planning of preventive maintenance, or the execution of acute maintenance works.

→ The railway in India is immensely important.

If we cast an eye to the future, what can we expect, especially with regard to the collaboration between the two largest Frauscher sites?

AS: In a global company such as Frauscher, it is extremely important to use different communication technologies in order to be able to work together across borders and time zones, transfer know-how and use the skills of individuals accordingly. Furthermore, we are convinced that a direct exchange between our experts through regular visits to different locations around the globe is of vital importance. This also increases the feeling of being part of one big team.

MT: And this is how we wish to continue to expand our position of leadership in the coming years in the fields of axle counting and wheel detection in India and other global railway markets. With the ongoing implementation of a comprehensive digitisation strategy, we want to not only continue to refine our products, but at the same time our whole working environment too.. ●



→ Open interfaces and flexible evaluation options are indispensable for many railway applications.

ONE FOR ALL

Inductive wheel sensors are reliable, robust and flexible. These characteristics make them the ideal basis for existing and new applications in the railway industry. Hannes Kalteis, Frauscher Product Management, presents a few examples.

Inductive wheel sensors are now being used in many railway markets around the world as a basis for axle counters. Their key function is track vacancy detection. In this function, they are also often used as signal generators for level crossings.

The establishment of the technology in different regions and railway segments around the globe does however mean that new areas of use are constantly being discovered for wheel sensors. Their possibilities are wide-ranging. In different installations, they can therefore reliably provide information about the presence of a train, its speed or direction of travel. Wheel centre pulses or wheel diameters can also be evaluated.

Flexibility of course plays a significant role here. And in order to meet the project- or market-specific requirements, models already established elsewhere have to be adapted in some circumstances. This always occurs as a balance between the conflicting priorities of demand, technical characteristics and know-how.

It was from here that the key points for the development of the Frauscher Wheel Sensor RSR110 were derived, which, due to its open, analogue interface, can be easily and quickly integrated into any infrastructure. Nowadays, this sensor is available in two system variants: the RSR110d contains two sensor systems, the RSR110s has one sensor system. Very individual systems can therefore be set up with the RSR110 which are supplied by the wheel sensor with precise measurement data. More detailed information about the RSR110 can be found in the infobox on page 29.

Strong partner for innovative systems

Increasing electrification of railway lines means that installations for different tasks in the railway industry have to satisfy ever-increasing challenges in fields such as EMC. Manufacturers of such systems often rely on inductive wheel sensors these days which, also demonstrate a level of

robustness with respect to electromagnetic compatibility.

Hump yards: new components for tried-and-tested concepts

Hump yards are still an essential part of many shunting systems. Wheel sensors can undertake various tasks against this backdrop, such as speed measurement.

Points which are used to assign the wagons to the relevant trains, can be reliably set with the help of inductive wheel sensors. Furthermore, they facilitate – like when wagons may have to be weighed – accurate positioning via wheel centre pulse.

An installation of this type has been in use in North America since September 2017. Ongoing problems with the existing infrastructure have meant that the operator has had to look for alternatives. The decision was made to install two RSR110d at the top of the hump yard. The pulse for setting two points is sent by additional RSR110s' to the relevant point mechanism.

The trains are identified and sorted via an Automatic Equipment Identification (AEI) system. It was possible to incorporate the wheel sensors into the AEI system and the control centre of the system integrator without any further adaptations. Since being commissioned, the system has worked to the customer's complete satisfaction.

Detecting, counting, measuring and activating

Wayside Inspection Devices Inc. from Canada can be found far beyond its domestic frontiers. The company's laser based TBOGI system measures the bogie geometry of passing trains. It identifies, at a very early stage, bogie misalignments leading to accelerated wheel wear and subsequent rail wear, allowing ↘

TRACK MORE WITH LESS

Frauscher wheel sensors offer various advantages, such as:

- **High resistance** against electromagnetic interference
- **Reliable** function under extreme conditions
- **Easy** to install using the patented rail claw
- **Flexible interfaces** for individual applications

↑ Inductive wheel sensors are used for various applications in hump yards.

corrective action to be taken before severe wear sets in. Such deviations could otherwise lead to the rapid wear of train wheels and could subsequently even damage the tracks.

The wheel sensor RSR110d is used here to indicate the presence of a train and its direction of travel, its speed and to measure the distance between individual axles and to activate and then deactivate the recording of data by the TBOGI system.

"The sensor was implemented using a specially developed hardware interface which digitises the signal. Costly adaptations to the hardware and firmware of the TBOGI system were not necessary. The company's laser based TBOGI system measures the bogie geometry of passing trains. The high precision of the RSR110d's measurement data is of significant relevance for our system," says Denis D'Aoust. The president of Wayside Inspection Devices Inc. is convinced by the characteristics of the wheel sensor.

↑ The decoupling robot EntKuRo in use

Project EntKuRo

The role which the high precision of Wheel Sensors in particular can play is demonstrated by the EntKuRo project – a "decoupling robot". This is being promoted by the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Austrian Research Promotion Agency (FFG) as part of the "Mobility of the future – freight mobility" programme. The project partners are the University of Applied Sciences Upper Austria, ÖBB Infrastructure, the St. Pölten University of Applied Sciences, the Austrian Institute of Technology, and Ulbrich.

"European rail freight transport is still characterised by the screw coupling which was developed in the 19th century. It is designed for manual operation and does not meet the requirements of today in terms of productivity and occupational safety," reports Christoph Zellner from the University of Applied Sciences Upper Austria on the background of the project. Zellner explains: "With the EntKuRo project, the processes for separating wagons was analysed and after that a mechatronic device was developed which separated wagons completely automatically.

On a test track at the shunting yard in Linz, the decoupling robot is tested under real conditions. In order to successfully develop a system like this, a variety of sensors is needed, such as the Frauscher Wheel Sensor RSR110d. This makes it possible to not only reliably determine the number of axles and to compare this to the database, but also to give the approval for the decoupling process. The evaluation of the signal edges also makes it possible to calculate the speed of the passing train. The wheel sensor is hereby an essential factor in the safe and reliable decoupling process."

Precise train detection remains on the agenda

Even this small selection of application examples for a single sensor model shows how important this technology will be in the future railway industry.

Especially with regard to accuracy and reliability, inductive wheel sensors will continue to be state of the art for a long time to come. Additional characteristics such as the establishment of various models with separate wiring options or open interfaces, make these devices even more competitive. ●

AUTHOR

Hannes Kalteis, Product Management | Innovations, Frauscher Austria

FROM SENSOR TO PRODUCT RANGE

The RSR110 has already been used in various projects because of its open analogue interface and its positive characteristics. The current signal can be evaluated completely as desired using simple electronics, a PLC or a microcontroller. This reduces the number of hardware components as well as the space requirements and power consumption. The threshold values for triggers and the sample rate can be freely selected depending on the application at hand. For systems where tailored software integration is not required, the wheel sensor information can be digitalised using the Frauscher Wheel Sensor Signal Converter WSC.

On a number of occasions, the RSR110 has also successfully replaced individual sensors. To further simplify this process, Frauscher developed a sensor model which has only one sensor system and enables the corresponding wiring to be implemented. A distinction is now made in the portfolio between the RSR110d (double) with two sensor systems and the RSR110s (single) with one sensor system. Following years of experience developing reliable sensors, Frauscher has created an extremely flexible product which allows a whole range of applications to be implemented. This meant that well-known applications could be significantly improved and completely new approaches could be developed.

↑ Information, discussion and vision: moderator Peter Bradley (right) takes delegates through the programme.

4TH WHEEL DETECTION FORUM

The fourth Wheel Detection Forum has set new benchmarks for this established industry event. Over 260 participants from 36 countries attended over 20 lectures and presentations. An exciting networking programme set the scene.

TRACK MORE WITH LESS

WDF 2017 in figures:

- **262 delegates**
- from **36 countries**
- **more than 20 lectures** and **presentations**
- **7 networking events**

In this day and age of rapid digitisation, the concept of the Wheel Detection Forum (WDF) reveals its strengths more than ever. The aim of the format is for all participants to press ahead with the integration of new approaches into the railway industry. And there is an urgent need to do so; new technologies offer previously undreamt-of possibilities for train tracking and for monitoring components on the track and on rolling stock. The ever-increasing requirements for reliable and efficient rail traffic can hereby be satisfied.

Looking ahead

The agenda of this year's WDF was shaped in particular by presentations on highly topical issues and a real focus on new technologies in the field of train detection. The speakers covered a comprehensive pool of topics which the participants rated as interesting, diverse and forward-looking.

Thanks to the international character of the event, it was possible to discuss a broad spectrum of ideas about the future of train detection from the widest variety of railway markets. The topics were divided into four sessions and one podium discussion:

- Trends and visions
- New concepts for train tracking
- Innovations with Distributed Acoustic Sensing (DAS)
- Best practices in wheel detection and axle counting

Balance between lectures and networking

Networking is just as important as a dialogue relating to technical questions. That is why in 2017 the WDF again provided ideal opportunities for networking in a relaxed environment. Every session lasted no more than 90 minutes, with a half-hour break in between. All the participants made the most of these breaks to discuss the

presentations or establish ways in which the content is relevant for other topics too.

One special highlight was the Wheel Detection TALK. This took place against the very historical and elegant backdrop of the Schönbrunn orangery. Virtually everyone attending the forum saw the day out at the evening event, drew conclusions about what they had heard, established new contacts and met old acquaintances.

Shaping the future together – today

"Operators, system integrators and manufacturers are facing similar challenges around the world. The solutions however are often very different due to the specific local conditions. Swapping ideas on different approaches is more important than ever these days," says Christian Pucher, Marketing Director at Frauscher Sensor Technology. He continues: "Developments and changes in and around our industry are happening at an increasing rate. It is also imperative to examine solutions from other mobility segments and to analyse and explore the possibilities which digitisation opens up. This is why we have expanded the WDF 2017 with inputs on visionary concepts and digitisation. During the course of many one-to-one conversations, the feedback I got was that this global network of railway technology experts is extremely useful. This is a crucial element in being able to structure the railway system in a sustainable and attractive manner for the long term." ↘

"...there are many innovative products and a lot of information coming to the markets in the fields of reliability and safety and today we look forward to more and more artificial intelligence as we go into the fourth industrial revolution. Obviously these are the highlights and we look forward to seeing what the future holds for us in taking these innovations forward for all of us in the rail industry as a whole."

Romesh Srinivasan, Managing Director at KL Consult Associates SDN. BHD., Malaysia

"A greater variety of speakers"

"I am more used to US or Canadian conferences as I come from Canada. Here we have a greater diversity of the speakers, because they come from different countries and different environments – so for me it was very interesting and I really enjoyed it and hopefully I'll be able to come to another one."

Denis D'Aoust, Co-Founder and President of Wayside Inspection Devices Inc., Canada

"ACCEPTING AND UTILISING INNOVATIONS AS AN INDUSTRY"

"I am really enjoying the forum"

"...and I'm learning quite a lot I think from listening to the talks. I'm particularly interested in the advances that are being made in wheel detection and sensor technology. I have been interested to learn about what advancements are happening in the railway sector regarding the Internet of Things, and also similarly Data Analytics. So there have been some great talks so far, but also I think it has been a well organised event because one presentation follows logically from the previous one."

Mike Greenan, Director Rail & Transport Strategy at Altran, UK

SAVE THE DATE!

Wheel Detection Forum 2019
5–7 June 2019 | Vienna, AT
www.wheeldetectionforum.com


WHEEL
DETECTION
FORUM
2017

CONTACTS & DATES

Frauscher is always present at key rail events around the world. 2018 shall again bring many opportunities for a personal discussion, and not just at InnoTrans. Appointments: marketing@frauscher.com

EVENTS REVIEW

RAILWAY INTERCHANGE | AREMA

17–19 September 2017 | Indianapolis, US

The new exhibition stand of the Frauscher US team generated tremendous interest at the largest trade fair in North America.

TRAKO

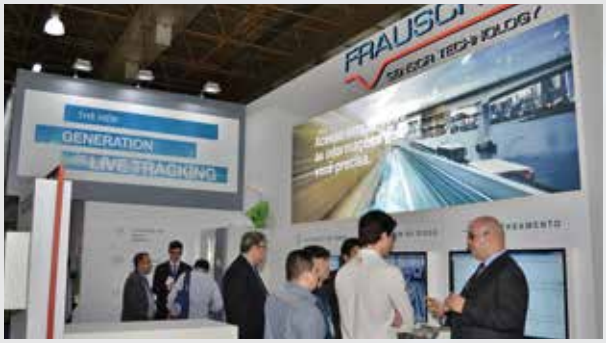
26–29 September 2017 | Gdansk, PL

Frauscher Poland presented the company's latest innovations at the key gathering for rail experts in the country.

NT EXPO

7–9 November 2017 | São Paulo, BR

The professional appearance from Frauscher Brazil impressed visitors to NT Expo 2017.



AUSRAIL PLUS

21–23 November 2017 | Brisbane, AU

Numerous visitors took the opportunity to talk to experts from Frauscher Australia at Ausrail Plus.

COME AND VISIT OUR EXHIBITION STAND

- **ASLRRA, 2018 Annual Convention**
  7–10 April 2018 | Nashville, US
- **Rail Solutions Asia**
  2–4 May 2018 | Kuala Lumpur, MY
- **The rise of IoT & Big Data in Rail**
  29 May 2018 | Munich, DE
- **World Metrorail Congress Americas**
  26–27 June 2018 | Philadelphia, US
- **InnoTrans**
  18–21 September 2018 | Berlin, DE

ARRANGE A MEETING

- **Europäischer Schienengipfel**
  1–2 March 2018 | Vienna, AT
- **Middle East Rail**
  12–13 March 2018 | Dubai, AE
- **Istanbul Railtech**
  11–12 April 2018 | Istanbul, TR
- **Joint Rail Conference**
  18–20 April 2018 | Pittsburg, US
- **APTA Rail Conference**
  10–13 June 2018 | Denver, US

5TH WHEEL DETECTION FORUM

Save the date: 5–7 June 2019 | Vienna, AT

We invite any interested speakers to submit their paper for the next Wheel Detection Forum from September 2018. The key issues to be explored shall be trends in train tracking and the condition monitoring of track systems. Further details and information as they are announced can be found on the event website:
www.wheeldetectionforum.com

Key dates:

Submission deadline for abstracts	**20 Dec. 2018**
Communication regarding acceptance	25 Jan. 2019
Submission deadline for full papers	18 Feb. 2019
Submission deadline for presentations	20 May 2019

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