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MAGAZINE

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ISSUE ONE 2020 – RAILLIVE!

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Letter from the Editor

Josephine Cordero Sapién, Editor-in-chief

Dear Readers, Rail Live! Madrid 2020 will take place in the Spanish capital from 31 March to 2 April and will comprise an exhibition section as well as a conference.

I want to take this opportunity to take a closer look at Spain through the lens of rail.

In January this year Spain's rail infrastructure manager ADIF became the 8th member of Eress, the European Partnership for Railway Energy Settlement Systems. On 4 July 2020 every EU Member State must have its exchange and settlement system for energy data in place. Accurate billing for rolling stock energy consumption incentivises operators to invest in lightweight, energy-efficient trains, which makes trains even more environmentally friendly. (In this issue: "2020 Deadline: EU Exchange and Settlement of Energy Solutions", p. 20)

With the launch of the European Green Deal, the European Commission's set of policy initiatives aimed at making the EU climate-neutral by 2050 and with transport still accounting for 25 percent of the EU's carbon emissions, making trains more environmentally friendly and investing in rail infrastructure to increase capacity and improve the passenger experience are vital in bringing about the urgently needed shift to rail and this includes freight as well. Addressing the Green Deal in this issue is Anu Tuominen, Principal Scientist at VTT Technical Research Centre of Finland, in "Rethinking the Mobility Culture of the Future", p. 29.

One of the ways in which the European Commission wants to highlight the importance of rail in achieving its climate goals is its proposal to make 2021 the European Year of Rail ("European Commission Proposes 2021 as the European Year of Rail", p.43). The proposal wants to promote rail as the most environmentally friendly land transport option, highlight the European cross-border aspect of rail, and enhance the contribution of rail to the economy, industry and society of the Union.

Consequently, we have put a Talgo AVRIL for Renfe on our cover ("On the Cover", p.6) – a Spanish train for the Spanish market. Talgo manufactures variable-gauge, lightweight trains – this one being for Spain's high-speed market, and due for delivery starting in 2020. Spain has six high-speed corridors with eight lines under construction. The first high-speed rail link between Spain (Barcelona) and France (Paris) opened in 2013, with travel times at 6.5 hours. A second cross-border connection is planned at Irun/Hendaye. It is this kind of investment in rail that is necessary to entice passengers to use rail over short-haul flights and achieve a carbon-neutral Europe by 2050. Spain is therefore a perfect example of rail's central role as part of the solution.

Our second magazine of 2020 will focus on Infrarail in London, which takes place 12–14 May. The publication date for this magazine is 27 April. If you would like to be represented on our website or in this magazine, please contact Andrew Lush at **al@railway-news.com**.

Please enjoy our 1st issue of 2020!

Josephine Cordero Sapién, editor-in-chief

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Issue One 2020 Rail Live! Madrid

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On the Cover

Spanish Rolling Stock Highlight: the Talgo Avril for Renfe

Producing lightweight trains that are environmentally friendlier than their heavier counterparts and that can compete with short-haul flights for passengers are key to bringing about a carbon-neutral EU by 2050, the goal of the European Green Deal.

The central role rail will play in this is highlighted by the European Commission's proposal to make 2021 the European Year of Rail.

One exciting train in this regard is the Talgo AVRIL for Renfe. It is only fitting that it is a Spanish train for the Spanish market as Spain is also the host country of Rail Live! Madrid. And of course Talgo is a Platinum Sponsor of the event.

In November 2016 Talgo won a contract with Renfe to supply 15 high-speed trainsets. The first of these trainsets are to be ready for service in 2020.

Each 330km/h train will have 416 standard-class seats and 105 business-class seats in 2+2 and 3+2 arrangements that are adjustable so passengers can sit in the direction of travel.

The AVRIL is the widest very high-speed train currently on the European market. The design is based on short articulated vehicles, which allows

Talgo to use lighter bodyshells. Therefore the AVRIL gives operators a greater width without exceeding the infrastructure loading gauge.

Talgo's President, Carlos de Palacio, said, *"Nowadays, technological development must go hand in hand with environmental care to create both economically and energetically sustainable products. With the liberalization of the European market, rail operators will be forced to reduce their operating costs and the ratio of investment per passenger. It is due to this that we wanted to anticipate the future of the rail industry by making AVRIL available throughout our country: a faster, lighter, more efficient and sustainable train that not only saves energy and maintenance costs for operators, but also further preserves the ecological spirit that governs our time and that of our future generations."*

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Welcome to Rail Live! Madrid 2020

Rail Live! Madrid will take place at IFEMA (Madrid, Spain) from 31 March to 2 April. It will comprise two elements, the exhibition and the conference. Entry to the exhibition is free but won't give visitors access to the conference.

The Exhibition

- **Tuesday 10am–6pm**
- **Wednesday 9am–7pm**
- **Thursday 10am–4pm**

More than 300 exhibitors will attend the exhibition, representing all aspects of the rail industry, from technology to services, rolling stock, track, IoT and AI, connectivity and automation. The exhibitors attending will come from all over the world – with 80+ countries represented – to showcase their innovations.

IFEMA © Luis Garcia CC BY-SA 3.0

Exhibition Categories

- Rolling stock
- Maintenance
- Cables and cabling
- Press
- Power and energy
- Engineering / construction
- Stations
- Smart mobility
- Signalling and telecommunications
- Track and track products
- IoT / AI
- Freight
- Steel / wheelsets
- Safety and security
- Universities
- Cybersecurity

A new feature at the Rail Live! 2020 exhibition in Madrid will be the AR/VR Zone. Visitors will be able to experience the latest mixed-reality solutions currently on the market.

The Start-Up Village will be home to the future of the rail industry. More than 50 start-ups will be exhibiting.

Feature Start-Up

One is NaviLens, which helps the visually impaired find their way. Unlike conventional QR codes, NaviLens uses a powerful algorithm based on computer vision, which is

able to detect multiple markers at great distances in milliseconds, even in full motion without the need for focusing. A marker 20cm wide can be detected from 12m away. The algorithm can even read multiple markers at the same time.

Users are guided indoors through virtual arrows in an augmented reality experience, without GPS or Bluetooth. Ig also gives real-time train arrival information.

The technology is already in place on the New York Metro, Madrid Atocha High-Speed Train Station, Barcelona Metro, the tram in Murcia and others.

Exhibition Presentations

The exhibition will feature two stages for presentations, where speakers will give talks and workshops about the latest technologies, research and rail solutions.

Stage A will be the venue for the Sustainability Workshop, hosted by the UN Environment Programme; the Innovation Hackathon hosted by RENFE, MAFEX & Railgrup; a seminar hosted by the Railway Innovation Hub; and a session hosted by Plataforma Tecnológica Ferroviaria Española, which will focus on the latest fields in research and innovation.

Stage B will see start-ups and exhibiting companies present pitches. There will also be a panel focused on women in rail (31 March, 2pm) and presentations on the latest research conducted by universities and research centres. This research focuses on technologies such as 5G, maintenance, cybersecurity, and new materials for the rail industry.

Networking

One of the key benefits of attending the exhibition, beyond showcasing and learning about new innovations and solutions in rail is the opportunity to network with other industry members. The platinum sponsors of Rail Live! 2020 Madrid are CAF, Ingeteam, Microsoft and Talgo.

The Conference

- **Tuesday 8am–6pm**
- **Wednesday 8am–6:30pm**
- **Thursday 8am–4:30pm**

Access to the conference will give visitors access to three full days of industry-leading content with exclusive networking events and local site visits. The conference will concentrate on how new technologies – e.g. machine learning – are being applied to a 'traditional' industry in ways that could lead to potentially revolutionary outcomes for operators and their partners.

The focus topics at the conference will be: digital & IoT; mega projects; intelligent infrastructure; smart train control; metro; integrated mobility; cybersecurity; smart stations; freight; power & sustainability; smart construction; finance and funding; and light rail.

Keynote speakers include big names such as Elisabeth Werner, Director Land Transport at DG Move, Lena Erixon, Director-General at Trafikverket, Lies Alderlieste-de Wit CISO at NS, and many others from HS2, Network Rail, Renfe, the California High Speed Rail Authority and Comunidad de Madrid.

To secure a place with a 100 euro discount to the conference, register at **www.terrapinn.com/raillive-railwaynewsbook before 13 March 2020.**

RAIL LIVE!

Tuesday 31st March - Thursday 2nd April 2020 | Madrid, Spain

Rail Live! brings the global leaders of the railway industry together to discuss how new technologies are shaping the future of rail. Covering all the key areas of development in rail including intelligent infrastructure, freight, automation, sustainability, cyber security, smart mobility and stations. Speakers include world leading CEOs and visionary thinkers from networks and projects around the world.

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RAILLIVE!
31st March - 2nd April 2020
Madrid, Spain

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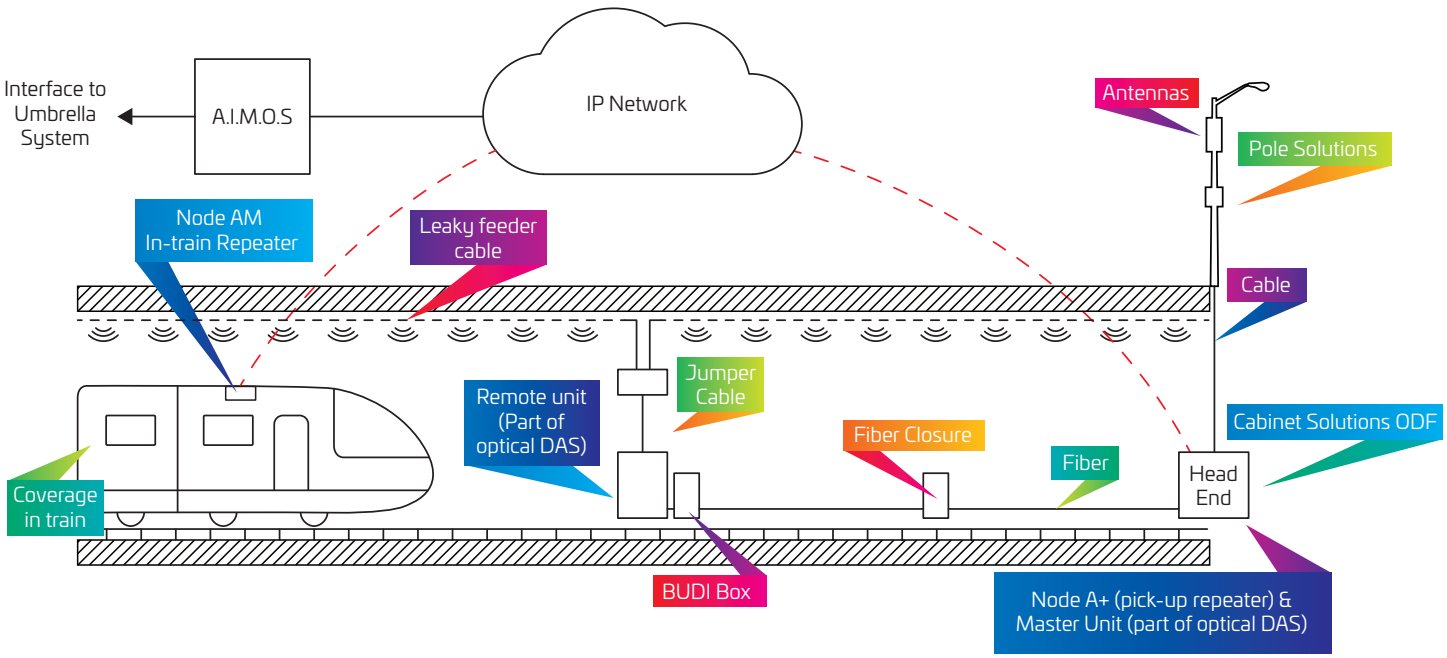
- **connect trains to the public safety infrastructure of the rail network**
- **connect passengers to their digital lives – wherever they travel**



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CASE STUDY

CommScope Connects Passengers and Crew in the World's Longest Railway Tunnel

Completed in the summer of 2016, the Gotthard Base Tunnel is the longest railway tunnel in the world, running 2.3 kilometres below the Swiss Alps at 250 km/h for a length of 57 kilometres.

Alcatel-Lucent Switzerland (now Nokia) looked to CommScope to develop a DAS solution that would allow wireless communication for passengers and crew alike – so that connecting in the tunnel was as effortless and reliable as doing it at the station.

CommScope answered the Gotthard Base Tunnel challenge with a highly-customisable, multiband, multi-operator, fibre-optic DAS platform that is fast and reliable enough to handle the lightning-fast handoffs required by bullet trains. Parallel networks for public and railway communications extend throughout the tunnel. The solution ensures that connections made throughout the tunnel are as fast and reliable as they are in the centre of Zurich or Milan.

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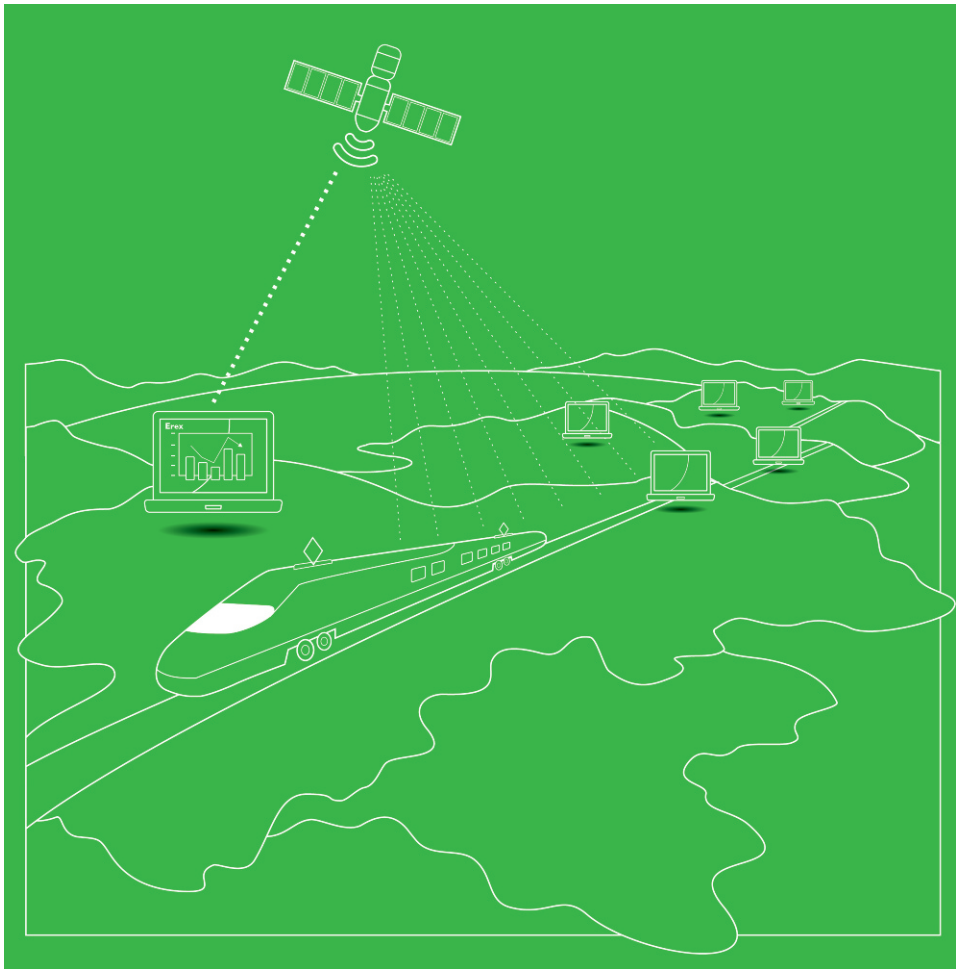
2020 Deadline:

EU Exchange and Settlement of Energy Solutions

Development in the railway sector is currently focused on EU deadlines for exchange and settlement of energy in July of 2020. International collaboration within the railway energy sector in Europe promotes this effort to standardise. Train companies work together to compete as a green transportation method into the future.



What Each EU Country Needs for the July 2020 Deadline

The European Commission previously published regulation EU 2018/868. This implementation regulation closed the open point of communication between onboard energy meters to the data collection systems on the ground.

As of 4 July 2020, every EU member state must ensure that it has implemented an on-ground settlement system. Each suitable settlement system accurately receives data from a Data Collection System (DCS) and accepts the data for billing. The settlement system exchanges Compiled Energy Billing Data (CEBD) with other settlement systems. Then, the settlement system validates the CEBD and allocates consumption data to whoever requires the information. The dissemination of this data considers all relevant legislation, both national and that of the European Commission.

Eight European countries, including Sweden, Finland, Belgium, The Netherlands, and most recently Spain, decided to join with Eress to use Erex. Each saw the need to forestall implementation and management issues to comply with these EU regulations.

The proposal to regulate the governance of the Energy Union is all part of the 'Clean Energy for all Europeans' package. Issued in 2016 by the European Commission, the package includes legislative proposals to deliver the EU 2030 climate and energy targets.

- **Reduce greenhouse gas emissions by 40 percent as compared to previous 1990 levels**

- **At least a 27 percent increase in energy efficiency**

- **Production of 27 percent or more of energy from renewable sources**

Measured train journeys show 30 percent energy savings when using the Erex system from Eress. This achievement meets and exceeds the EU's environmental target of a 27 percent increase in energy efficiency by 2030.

The Energy Union governance system helps coordinate efforts and develops long-term strategies for decarbonisation. By November 2015, the Council of the EU had adopted conclusions that identified the governance system's main components. Specifically, they stressed that National Plans would need to be finalised by December 2019. Now, the next phases for 2020 and 2022 move forward in the pre-determined timeline.

The Timeline: EU Dates for Metering and Billing

Mandatory in the EU from 2014 – Energy Meters on Trains

Starting in November 2014, energy meters became compulsory on all new, renewed and upgraded rolling stock. (Commission Regulation 1302/2014)

Mandatory in the EU from 2020 – Exchange and Settlement System for Energy Data

Every EU country, starting in 2020, must have a settlement system. By July 2020, each member state in the EU must exchange and settle energy data. This includes both the validation and allocation of energy consumption to the correct end-users. (Commission Regulation 1301/2014)

Mandatory in the EU from 2022 – Data Collection System (DCS)

Every EU country must have a Data Collection System (DCS) in place by 2022. Starting in January 2022, each member state in the EU must collect and exchange energy data. (Commission Implementing Act amendment of TSI ENE and TSI LOC&PAS)

Railway energy interoperability makes it possible for international trains to pass smoothly throughout the EU using different national railway systems. This cooperation is vital to the creation of a functional, integrated European railway.

Interoperability enhances train transport competitiveness for both passengers and freight. So, operators and infrastructure managers adopting energy monitoring and billing systems link directly to technical harmonisation for railway energy ulitisation.

An accurate measurement of energy consumption is the starting point for energy efficiency programmes. A clear understanding of energy usage patterns allows users to modify behaviours and shift standards. In addition, accurate measurement of energy consumption is a prerequisite for correct settlement and billing of energy costs. Train operators pay for their real energy consumption and at the correct marked prices. Neither consumption nor marked prices can rely on inaccurate estimates.

How the 2020 and 2022 EU Exchange, Settlement and Collection of Energy Solutions Benefits the Railway Sector

The EU Exchange, Settlement and Collection of Energy Solutions Regulations require members to make changes for July 2020 and January 2022. Each EU country is expected to put an energy settlement system in place by 4 July 2020. Then, the data collection system can wait to be on the ground by 2022.

Using Erex fulfills all current EU requirements.

For invoices to be processed accurately, EU countries must meet two specific requirements. Firstly, the train operators are required to have onboard energy meters installed on

all trains. Secondly, infrastructure managers must implement a data collection service that collects data from each of the onboard energy meters. Then, the data is processed by an energy settlement system that analyses and sorts all energy data according to national rules and prepares the invoices.

Mandatory energy meters have been around since the previous EU commission regulation in 2014 on new, renewed, and upgraded rolling stock. Nothing changed in terms of energy billing in 2019. However, for 4 July 2020, every EU member state must have their energy settlement system up and running. With only a few months to meet the deadline, countries are out of time for developing and implementing these settlement systems on their own.

The EU Member States Are Out of Time to Meet Energy Settlement System Deadlines

For EU member states that have preferred to develop and implement a separate, distinct system, they created a tender, followed up, and will need to put it in service. This complex process is both expensive and time-consuming, uses infrastructure personnel and resources, and adds additional technical and non-compliance risks. Fortunately, joining a successful, fully functional, running application with customised features saves time, budget and eliminates non-compliance risks. Without the requirement to create a tender, the most efficient way to meet the 4 July deadline is to join Eress.

Ultimately, these latest EU regulations are designed to standardise the railway sector. Since each country shares borders with other countries, managing a multitude of approaches to energy settlement becomes an enormous challenge. As more EU member states use the standardised Erex system, more precise energy settlements expedite billing processes across the industry. The same energy settlement system across borders allows countries greater freedom of collaboration. Plus, a consistent approach allows for absolute elimination of any country-to-country data exchange issues.

Energy Savings

Measured train journeys show a 30 percent energy savings when using Erex. Since the EU environmental target for 2030 is a 27 percent increase in energy efficiency, so far, eight EU member states have implemented the all-in-one, customisable system.

The highest expense for train operators remains as payments to access the network. However, the second-most significant expense is energy costs. So, energy metering, data collection, and accurate invoicing based on metered data become a critical issue across the sector.

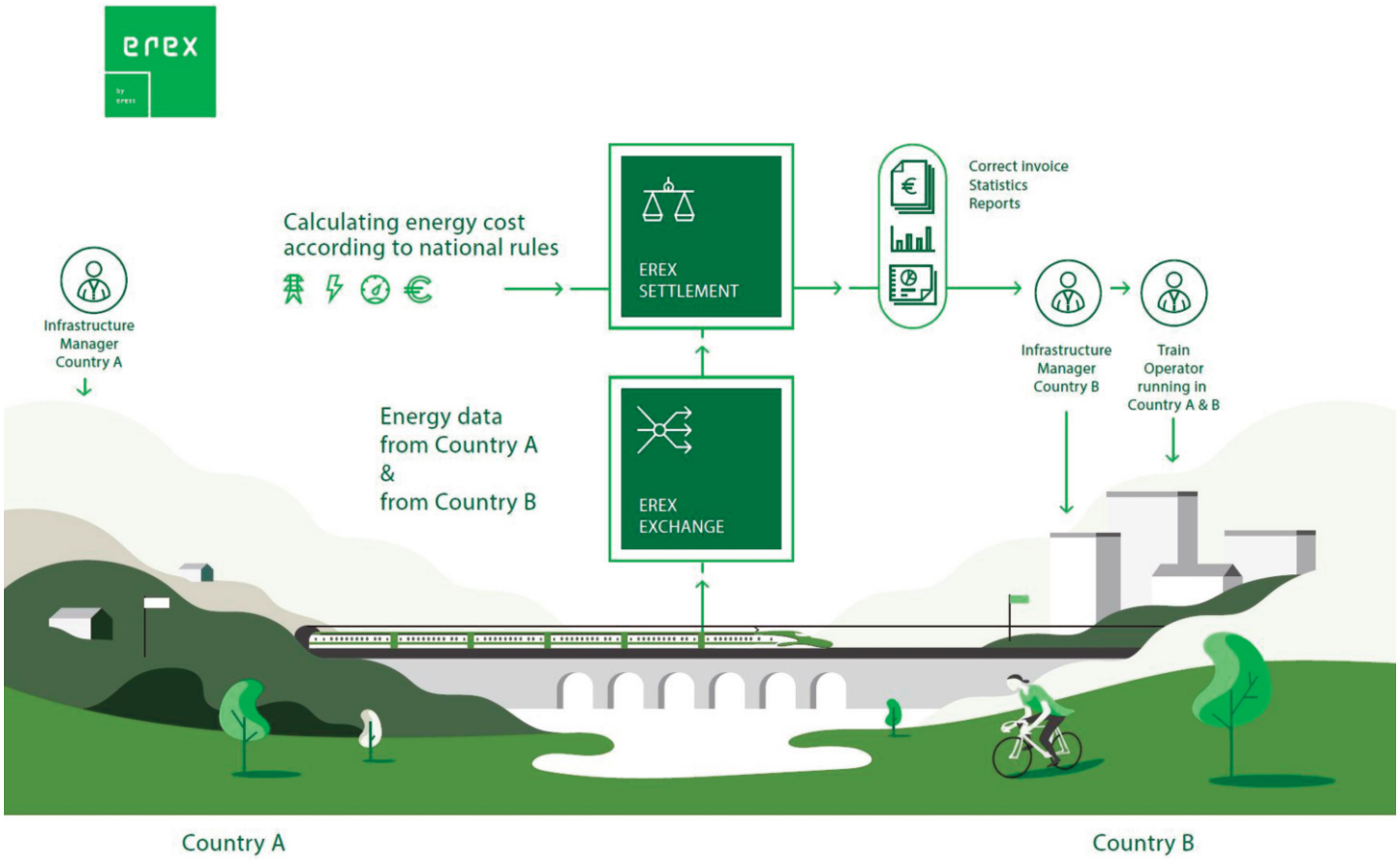
Previously reluctant train operators managed the costs of meter installation for initial compliance. Over time the operators discovered that metered energy allows infrastructure managers to invoice accurately. When bills are based on the exact cost of energy consumption, operators focus on saving energy. More efficient operation becomes top-of-mind, so by purchasing energy-efficient rolling stock, train operators have quickly seen continual returns on their investments.

To determine the return on investment (ROI), train operators compare installation costs of the meters to the annual consumption costs of traction units. The initial investment of between €10,000 to €20,000 immediately gains between five and ten percent yearly return. So, the meters often take only one year to see a return, although some do take up to two years, at most.

The Benefits of Energy Metering
Energy metering allows train operators to know precisely how much energy they save. And, therefore, support a reduction of the energy bills. So, protecting the environment through saving energy and cutting costs by paying for meters upfront provides an enormous incentive for EU member states to start metering energy consumption.

Energy meters directly impact energy efficiency. Eco-driving, analysing the energy consumption, and the circulation of rolling stock material all engage through the use of energy metering systems.

Infrastructure managers use onboard energy meters for more precise data. From an infrastructure perspective, more accurate data allows for more precise forecasting and settlements. Ultimately, this develops a foundation for additional market fairness. Plus, when operators fully equip their trains with onboard meters, they then attain the direct right to purchase energy for real marked prices.



Energy Settlement and Billing Systems

In most countries, energy settlement and billing systems are notoriously complex. However, many still flounder, trying to measure exact energy consumption levels. The installation of onboard energy meters by train operators enables infrastructure managers to provide accurate invoicing services. Energy settlement and billing systems rely on the onboard energy meters to collect the initial data. Only then can accurate invoices be created based on the real energy consumption, instead of estimated consumption levels.

Infrastructure managers can then oversee energy distribution in the most efficient way possible. Besides, train operators become more responsible for individual energy consumption levels. As a result, the operators are more likely to behave proactively to improve energy efficiency.

The chain of dependencies, including the onboard meters, energy settlement and billing systems, develop a foundation for international communication and energy savings.

A Case Study – Swiss Railways

Eight European countries, including Switzerland, Sweden, Finland, Belgium, The Netherlands, and most recently, Spain, have implemented Erex, the Eress, open-source cross-border system. This metered energy billing works independently of each country's infrastructure and the train operators. A radical innovation for the railway sector, any existing system can utilise the complete Erex solution with almost no learning curve.

When Swiss Railways (SBB) decided to introduce energy billing using onboard meters, they quickly discovered there were many questions, complications and potential risks. They needed to define billing systems criteria to cover every possible scenario. They soon recognised that a whole new system would have been costly, plus their personnel didn't have this kind of knowledge or experience. So, they joined Eress.

As a result, they quickly introduced a fully operational, industry-proven, metered billing system customised to the Swiss railway network.

Some customisation and adaptation to domestic specifications make this turn-key solution a natural choice. Each member state saves thousands of hours and the high costs of specialised R&D. All of the research and development is complete in this ready-to-use application. This is true for all EU member states.

A Case Study – Spain, ADIF Joins as the Eighth Eress Partner

The rail infrastructure manager in Spain, ADIF, maintains a strong commitment to the EU community, energy conservation and sustainable development. As of 1 January 2020, the Spanish state-owned Administrator of Railway Infrastructures, ADIF, joined as the eighth European Eress partner.

ADIF sees the Erex IT solution as an innovative industry leader between the energy and railway sectors. Facing the July 2020 deadline, ADIF searched for an accurate method to invoice the energy consumed by national trains. They knew they required a solution to perform actual calculations for each and every train across their network. *"It is key for ADIF to be ready to face the new challenges that the liberalisation of the passenger service will bring up. The deadline set by the EU for the supply and invoicing of energy based on the amount of electricity effectively consumed by each train is fast approaching. Therefore, it is important for us to ensure that we will be ready to enforce a single system already implemented in seven other European countries,"* said President of ADIF, Isabel Pardo de Vera.

Responsible Social Commitment to the European Community

The core values of ADIF focus on a spirit of responsible social commitment to the European community and within Spain. *"In addition, it is important for us to learn from the successful experiences in Norway, Belgium, Denmark, Switzerland, Sweden, Netherlands and Finland that have already overcome the challenge. We hope that the agreement we have just signed with Eress on 1 January 2020, will help us succeed in our goal of implementing this system under a framework of certainty, confidence and transparency,"* concluded Pardo de Vera.

As a result, ADIF, the infrastructure manager, and train operators in Spain, now benefit from imported, secured, allocated, settled and distributed data, following national and international requirements.
As other European countries follow ADIF's example, the railway sector could reduce the consumption of electrical power comparable to 35 million European households.

Dyre Martin Gulbrandsen, Eress Director, said: *"As Spain puts the Erex system into production, we see this as another major milestone for the standardisation of settling traction energy throughout Europe. The Eress organisation has been working closely with ADIF to be able to take this step into the future. We have seen continual growth recently, and the fact that Spain is running its data on the Erex system again confirms that we are absolutely prepared to satisfy even the most demanding requirements."*

July 2020 Next Steps

EU Regulations require members to have an energy settlement system in place by 2020 and a data collection system on the ground by 2022. It costs nothing to become a partner with Eress.

- **Energy Savings: measured train journeys show a 30 percent energy saving when using Erex. This accomplishment meets and exceeds the EU's current environmental target of a 27 percent increase in energy efficiency by 2030.**
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With new partners joining, our knowledge base is increasing. Together we exchange competencies to allow partners and their customers, the train operators, improvements every day.

There remain many significant challenges as railway technology moves into the 21st century. However, the standardisation of international railways and updating data collection and settlement systems paves the way into the future. Ultimately, it is time for a significant improvement in efficiency, profitability and compliance for train operators and infrastructure managers across all member states.

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Is Cellular Connectivity Meeting the Needs of Train-to-Ground Applications in Rail?

Today's train-to-ground data needs are predominantly met by cellular services, albeit with varying levels of data throughput. Combine this with the high cost per GB of data and incomplete cellular coverage. Today's LTE and LTE-A networks have predominantly been deployed and optimised by mobile operators for the distinct purpose of connecting users with smart phones. It is clear the needs of the rail environment differ from the needs of smart phone users and this is particularly evident when it comes to things such as throughput, and the direction of the link where throughput is maximised, the link being asymmetrical. Mobile networks are geared towards greater throughput on the downlink rather than on the uplink. While this is sufficient for WiFi on-board applications, when using cellular for uploading operational train data, such as CCTV images real time or stored, CBM data, the uplink becomes the priority.

In a presentation at the 2019 BWCS conference in London, I was interested to see a paper presented by Deutsche Bahn which analysed the current and projected data demand to and from the train. It concluded that demand hugely outstripped the current data supply that could be achieved by existing MNO LTE cellular deployments. The presentation went on to say the projected supply from the 5th generation mobile network (5G) would still not meet the future projected demand in rail. 5G is also re-farming current <6GHz LTE frequencies with some improvements to throughput but is unlikely to meet the current demand or 27GHz and above using millimetric radios.

This raises interest in deploying a private trackside radio network across parts of a route where coverage is poor, or non-existent, or in areas were the data demand exceeds the MNO supply. This may also be restrictive due to the high cost per GB of data.

Private trackside networks provide the opportunity to offer high data throughput at consistent service levels across the chosen local network routes. Private trackside radios can provide multigigabit throughput from the train to the wayside using 57 to 71GHz millimetric radios to 5GHz radios providing 500Mbps at a lower cost. Often, a private trackside network is deployed as an adjunct to cellular connectivity, and can provide an effective return on the investment against the MNO data costs.

Not forgetting the connectivity that will also come from the Future Rail Mobile Communication System (FRMCS) which looks likely to adopt 5G mobile technology as a private network and will provide a replacement for GSM-r with additional IP data connectivity to the train. However, the key here will be the spectrum (frequency) to be used as this will dictate the throughput that may be achieved.

In summary, cellular services will remain a key component in connecting the train to the wayside; however, where throughputs, the cost of MNO data and coverage are restrictive, significant benefits can be achieved using a private trackside radio. The plans for FRCMS are still being finalised.

Several trials are planned where it will be demonstrated what this technology can achieve, enabling a scalable solution to the current restrictions of the current GSM-r solution.

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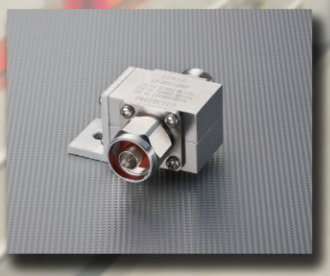

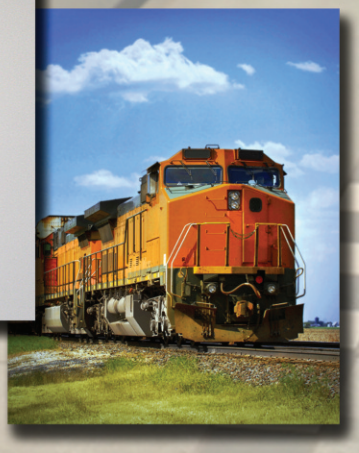

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Rethinking the Mobility Culture of the Future

By: Anu Tuominen
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Foresight for Sustainable Mobility
VTT Technical Research Centre of Finland Ltd.

Climate change is clearly the largest of the contemporary challenges the transport sector is facing. Transport in considered as one of the ten main points in the ambitious European Green Deal to achieve a climate-neutral economy by 2050, introduced by the new European Commission in December 2019.

The Commission President Ursula von der Leyen described the climate policy as Europe's new growth strategy, "leaving no-one behind" in the race. "This is Europe's man on the moon moment," she highlighted in the launching event of the Green Deal.

Rethinking transport – towards clean and inclusive mobility is the main topic of the Transport Research Arena 2020 conference, organised on 26–30 April 2020 in Helsinki, Finland. One of the key discussion points in TRA2020 will be: do we need to reduce mobility as we know it now, or can we find other ways to respond to the challenges?

In past transport climate policy discussions, there has been a tendency to rely on technology measures rather than to widen the understanding of the forces and different dimensions that are having impact on our present and future mobility culture, values and behaviour. Similarly, distributional issues in policy development and the potential of different types of transport system user groups to adopt the new envisaged forms of mobility have received less attention. We have learned in the recent past that climate change mitigation needs attention and contribution from every single one of us. The responsibility must be shared, starting with individual behaviour and ending with corporate strategies and public policies. However, the unpleasant truth is that we do not know yet how this can be realised in practice.

According to one transport literature definition, "Mobility Cultures" are specific socio-cultural settings consisting of travel patterns, the built environment, and mobility related discourses – i.e. they are defined by both the material and the socially constructed dimensions of the transport system (Klinger et al., 2013). Other, quite similar definitions also exist.

The present European mobility culture rests upon the appreciation of speed and efficiency as the key indicators for transport performance, and as the foundations for development and growth. For transport sector climate change mitigation, we need to rethink the present Mobility Culture and transform it into a new one, relying on performance indicators based on new values. The Sustainable Development Goals of the United Nations (SDGs) provide a good starting point for the definition of new values. Further, and very importantly, the European Green Deal Investment Plan (EGDIP), mobilising at least 1 trillion euros in sustainable investments over the next decade, includes the Just Transition Mechanism which will be targeted to a fair and just green transition. The Just Transition Mechanism will allocate at least 100 billion euros in investments over the period 2021–2027 to support workers and citizens of the regions most impacted by the transition towards a climate-neutral economy.

These provide an excellent basis for the development of the new European Mobility Culture. Moreover, new research on the systemic policy instruments, integrating and balancing the perspectives of citizens, politicians and companies, is vital for finding the ways that underpin the sustainable future developments. The research needs to be connected to the solutions that we are looking for in our daily lives.

The TRA2020 conference will facilitate the discussion among the European research community and public and private transport sector actors. How can we commit ourselves to accelerating the sustainability transition needed? What do we expect research and innovation to bring to the table and when? The fields of discussion are manifold, ranging from digitalisation and cybersecurity to human capital and from market efficiency to quality of life, to name just a few examples. The wide scope is vital since we need all the efforts we can possibly think of, and even more, on the way towards clean and inclusive mobility.

The Commission President Ursula von der Leyen described the climate policy as Europe's new growth strategy, "leaving no-one behind" in the race. "This is Europe's man on the moon moment."

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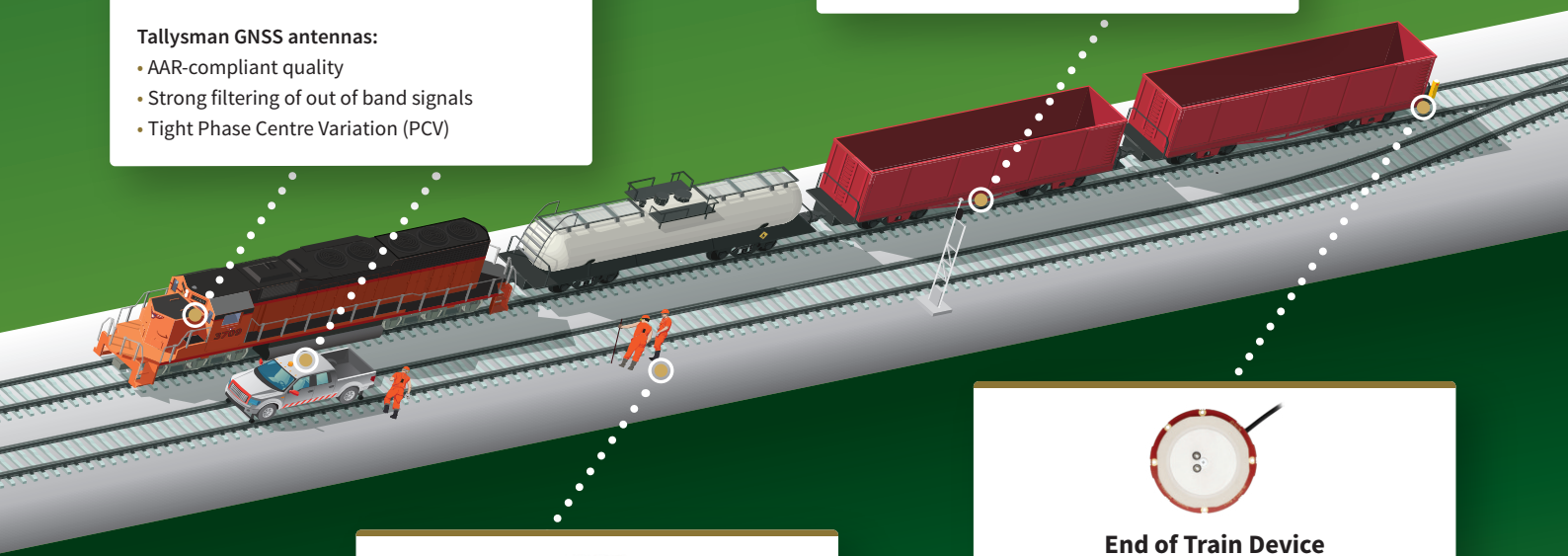

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The ROREXS rail exchange system from Robel (picture 1) is one of the world's leading machines for the delivery and collection of long welded rails.

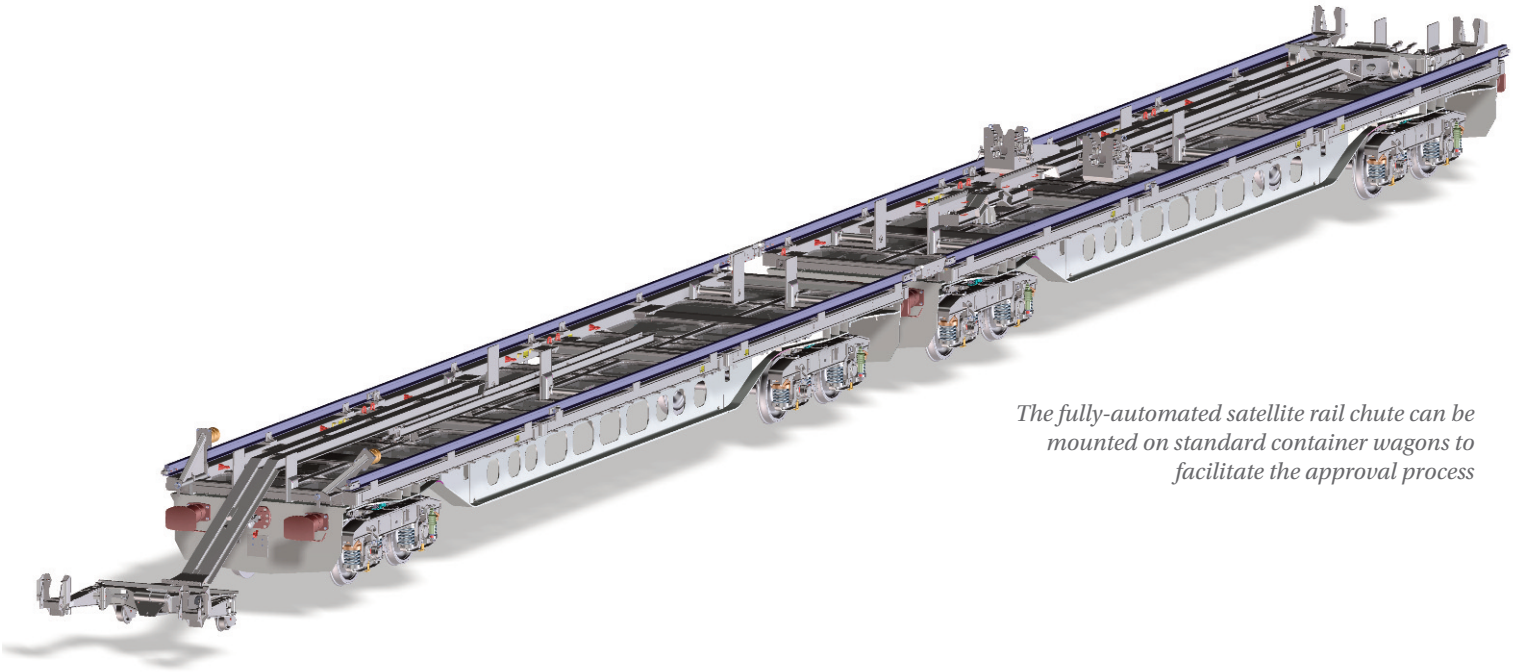
With over 50 years' experience and over 90 systems delivered worldwide, the German manufacturer has developed a global network of customers and a clear understanding of the most critical factors in the handling of long welded rails: safety, fast and reliable operation, and cost-efficient service. Fundamental to this aim is the development of automatic processes in order to:

- **separate the worker from the rail**
- **eliminate any working at height**
- **maximise process speed**
- **maintain perfect rail quality at all times**

Robel's ROREXS rail exchange system. © ROBEL Bahnbaumaschinen GmbH

Fully Automated System

Automation is key in driving improvement in safety, productivity and cost-efficiency. However, it is also important that the design is simple and reliable, allows easy maintenance and ensures dependable performance as well as built-in redundancy. The latest ROREXS is now controlled by just two operators from the safety and comfort of the rail manipulator cab. Automation enables the safe remote operation of the rail clamping station, as well as the roller gates, end retaining wall and the satellite rail



The fully-automated satellite rail chute can be mounted on standard container wagons to facilitate the approval process

chute (picture 2). The operator no longer needs to venture on to the trackside near moving rail and machinery, or undertake tasks working at height on transport wagons. This has the additional benefit that operations can be undertaken under live overhead line offering significant cost and time savings as no isolation is required. In addition, with auto limiters on the rail manipulator and the assurance that no operators need go on to the track, single line operation with adjacent lines open to traffic at line speed is also possible.

Careful Handling and Maximum Capacity

The total capacity depends very much on the operator's permitted loading gauge, with a maximum of 50 rails. ROREXS loads and unloads UIC60/S49 rail from 30m up to 500m in length, handles all standard flat bottom sections up to 68kg/m and also accommodates prefabricated insulated rail joints. Rails are delivered with great care and precision across a 4m lateral range (2m either side of the track's centre line). A special new side-roller system (picture 3) on the roller gates and spring-loaded chute wagon ensures the rails and any special coating are protected at all times and the rail is delivered in rolling-mill condition. Similarly, in the recovery operation, service rails are processed carefully and their condition stays well maintained creating the opportunity of onward cascading from primary to secondary routes.

The roller gate can be configured with up to five layers and has integrated side rollers for lower friction and protection of the rail surface coating.
© ROBEL Bahnbaumaschinen GmbH

Built-in Redundancy

At every stage of the working process the system allows for built-in redundancy with a manual backup for all operations. Roller gates could be manually operated with speed and efficiency, at ground level from either side of the train, with a hand drill on a worm drive system. Similarly, the clamping station, chute system and end walls are also quickly and efficiently managed manually if necessary.

Flexible Working Saves Time and Money

Planning a rail delivery depends on continuously varying factors and

trains quite often arrive on site in the wrong direction for offloading. Customers have therefore long called for an adaptable rail delivery train to offload rail from either end of the system. On ROREXS, the manipulator is quickly rotated through 180 degrees and the satellite chute is readily deployed from either end of the transport system to allow a dual-ended system for loading and offloading. The new automatic clamping station (picture 4) secures to the rail foot, rather than is traditional to the rail end, and is configured in the centre of the train. This provides the combined advantage of rapid and safe rail clamping and unclamping together with bi-directional working flexibility. Furthermore, for the manual system, which encapsulated the complete rail, the clamps had to match the rail section. Changing from UIC60 to S49 would therefore require the laborious process of changing over each individual rail clamp. With automatic clamping to the foot of the rail, however, different clamps are no longer required for different rail sections saving considerable time and effort.

Offloading Rail from Any Layer

A fully loaded transport system is usually deployed at multiple sites over several shifts with specific rail grades needed at each site. Traditional systems require the rail to be unloaded from the top down through subsequent layers. One failed shift could therefore impact the complete week's plan. The new clamping station allows for delivery from any level, not just from the top layer, giving the operator more freedom on rail grade selection.

Container Wagon Solution

The former chute wagon design of ROREXS required a special engineered wagon with channels running through the deck of the wagon. The latest design of the satellite chute system paves the way for the equipment to be attached directly on to a standard container wagon offering considerable customer savings.

This design update also gives the flexibility of equipment mounted on a twist lock-compatible frame attached to customer wagons. Alternatively, depending on customer specification, all equipment can be welded on to purpose-built wagons.

Faster, Safer and More Efficient

The automated ROREXS delivers time and labour savings both for site and depot operations. Traditional work processes typically required additional safety provisions with four operators working on the track and often at height.

With the fully automated systems

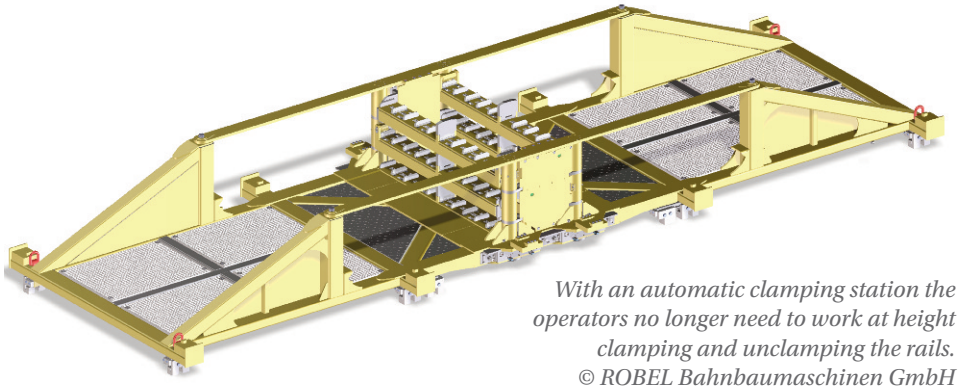
- **all operations take less time, with just two operators working from a remote position of safety**
- **the unloading of a pair of long welded rails (approx. 200m) is now achieved in under 3 minutes and loading in 5 minutes**

A faster system with greater operational flexibility, reliability and in-built redundancy means fewer aborted shifts and more operational efficiency.

An Option for All Budgets and Operational Requirements

Depending on operational demands and customer budget, Robel refines the specification and level of automation to meet all requirements. For each element, be it roller gates, clamping, end wall, chute system or rail manipulator, the company can deliver a safe and efficient fully manual right through to a highly sophisticated fully automated solution.

Robel will also support a range of delivery models from conventional build and supply, build to lease and full service support including maintenance and operations.



With an automatic clamping station the operators no longer need to work at height clamping and unclamping the rails.
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The SmartRail Ecosystem Aims at Customer-Centric Mobility Services

By: **Matti Luhtala**, Research Scientist, VTT Technical Research Centre of Finland Ltd.
Nemanja Vukota, Digital Services Manager, Škoda Transtech Ltd.
Hanna Jartti, Project Engineer, Tampere Railway Ltd.

The SmartRail Ecosystem aims to become the market's most attractive provider of functions and services integrated into tram systems. The goal is sustainable mobility, seamless travel and a user-centric experience.

From a technological perspective the aim is to deliver the best tram in the world for passenger experience, and to improve tram safety and flexibility as cities move towards autonomous transport. Matti Luhtala from VTT, Nemanja Vukota from Škoda Transtech and Hanna Jartti from Tampere Railway explain the concept of the SmartRail Ecosystem further.

The shift in how we move about affects how we experience the city. Movement at its simplest is getting from A to B. However, this view is somewhat limited if movement is viewed from the experience perspective. The way we move about significantly shapes our thinking, our actions and how we relate to our surrounding environment. One could stretch the concept of moving by saying it's a fundamental right that belongs to everyone. Therefore, we may approach designing smart tramways by reaching for novel solutions that enable new ways of co-operating and living together.

As the forerunner of Finnish smart cities, the city of Tampere together with the citizens is developing mobility services that are intelligently connected to people's lives in a timely and personalised way. To meet the needs of the growing city and urban area, a modern tramway system is currently being designed for the city of Tampere. The tram will be introduced in traffic in the fall of 2021, contributing to the development of urban mobility culture. The key goals of the tramway system include making everyday life and transportation easier in the municipality, supporting the growth and development of the urban area, and increasing the appeal of the city. These goals set a landscape for the smart tramway co-creation activities

of the SmartRail Ecosystem project funded by Business Finland.

"Our technology focus is to deliver the world's best tram for passenger and life-cycle services, and to provide solutions that increase the safety and flexibility of trams towards autonomous traffic," says Kai Hermonen, SmartRail Ecosystem Project Manager at Škoda Transtech Ltd.

"Our mission is to make the SmartRail Ecosystem a world leader in smart rail business and multi-disciplinary mobility research measured by relevant societal, technical and economic impacts and international indicators."

VTT is the innovation partner of Škoda Transtech and co-ordinator of research projects in the ecosystem. Tampereen Raitiotie Oy and the City of Helsinki Transport Department enable different experiments in Tampere and the Helsinki Metropolitan Area to accelerate the implementation of solutions that meet the users' needs.

"SmartRail is a good example of ecosystems that are at the centre of the National Transport Growth Program, boosting industry development, business-driven growth and exports as a result of collaboration between the private and public sectors and research," says Raine Hautala, Principal Researcher at VTT.

Co-Creation Platforms Set the Pace for Smart City Development

The SmartRail Ecosystem brings the Finnish research and business sectors as well as cities together to co-create the best tram solutions in the world, while strengthening the export of Finnish know-how. The aim is to become the most attractive provider of tram-integrated operations and services on the international market.

Image: Participatory testing: curios citizens telling AI how to behave

OPEN AND CURIOUS ATTITUDE AT THE EDGE OF THE NEW

"We are curious about different perspectives and new ways of development."

Urban environments aim at a sustainable and user-centred transport system.

We use this approach as a way of multiplying the potential of design thinking to address future mobility challenges through themes such as climate change, sustainability, urbanisation, cyber-security environments as well urban digital identities.

We address these problems through a human-centric and participatory approach by bringing co-creation into the lives of local people in the urban environment. In practice, SmartRail co-creation activities bring together service providers, citizens, municipal employees as well as municipal decision-makers. For example, in our previous LivingLabBus research, public transport vehicles were used as an open innovation platform to help identify and develop ways to improve the appeal and usability of sustainable transport. Moreover, the LivingLab buses were equipped with sensors feeding data about the conditions, situations and activities on the road network and throughout the broader smart city environment [2, 3].

Case Study: Enhancing Passengers' Social Experience through Machine Vision

This mobility service design project started when the SmartRail Ecosystem partners Škoda Transtech (transportation), Tampere Tramway Ltd, a subsidiary of the City of Tampere (tram owner), and the VTT Technical Research Centre of Finland (research) agreed on co-creating a tramway-based mobility service prototype. In this project, the project partners wanted to learn from each other and strengthen the collaboration within the ecosystem while innovating new ways of moving in large cities.

The concrete objective was to explore what kind of possibilities a modern cloud-based data platform and a machine vision-based people counting system could bring about for enhancing passengers' social experience. Following the constructivist design research model, the design artefacts created during the project were developed in phases [1]. During the project, we arranged three co-design workshops, one participatory prototype review session and one final testing session. Artefacts created in the co-design workshops and participatory prototype review sessions allowed us to effectively scrutinise and re-evaluate the objectives of the project. What is more, aside from the project practicalities, the co-potential of the project builds up the creative confidence among the partners through three social agreements. These values set a base for the collaboration for this project.

New Mobility Service Development

The development of the technological prototype focused on building a Minimum Viable Product (MVP) of a cloud-based data platform. We wanted to explore what kind of possibilities a modern cloud-based data platform could bring about. Furthermore, an in-vehicle machine vision-based solution capable of passenger counting was developed into a more complete digital service. In this project, the idea was to build a data pipeline from trams through cloud-based data platform and finally into UI-layer. The data in question was the raw passenger-counting data acquired from the machine vision-based passenger-counting system inside the tram. The architecture is designed so that it is easy to add more components to the platform in the future. In addition, existing components can easily be replaced with new ones. We used the Azure platform in our development but most of the components can be deployed to other platforms as well, e.g. AWS, Google Cloud, virtual machines and physical servers.

REFLECTIVE AGENCY AND CONTINUING LEARNING THROUGHOUT THE PROJECT

"Continuous evaluation of the development trend is present throughout the project."

Image: Scenario depicting the smart mobility service encounters

Participatory Demonstration with Citizens

Since the machine vision-based passenger-counting system was still in the development phase, it was essential for the project to arrange a demonstration to acquire as much actual test data of the system as possible. For this purpose, we

organised a participatory demo event at the tram mock-up equipped with cameras and machine vision system detecting the people and their movement patterns. Furthermore, an open invitation was issued to citizens to participate. About 20 people took part in testing the system being developed for their upcoming trams.

Resulting Service Prototype Scenario
To explore the design possibilities further, we simulated the service situation together with the city employees. Through the simulated service situation, we wanted to explore the operational environment by exploring the tram mock-up, tram stops and remote tramway operational centre. Our aim in particular was to view the design by emphasising how the environment – that is the network of passengers, materials, technology and workers – creates relationships.

The basic setting of the service scenario is that a local derby hockey game attracts enthusiastic hockey fans to the city. The event causes traffic jams and some of the fans have a reputation as troublemakers, thus security anticipates conflict management. The new system allows the operational centre to plan the fleets to accommodate the number of passengers during the event. Furthermore, the tram equipped with machine vision-based system capable of detecting behaviour patterns significantly enhances the communication between the operational centre, the tram driver and the security personnel. In addition, route planning and ticket purchasing are offered for the passenger via a mobile app that is also capable of suggesting alternative travel options based on the passenger's personalised needs.

TRANSPARENCY IN KNOWLEDGE SHARING

"We emphasise transparent working practices that support active participation."

Authors

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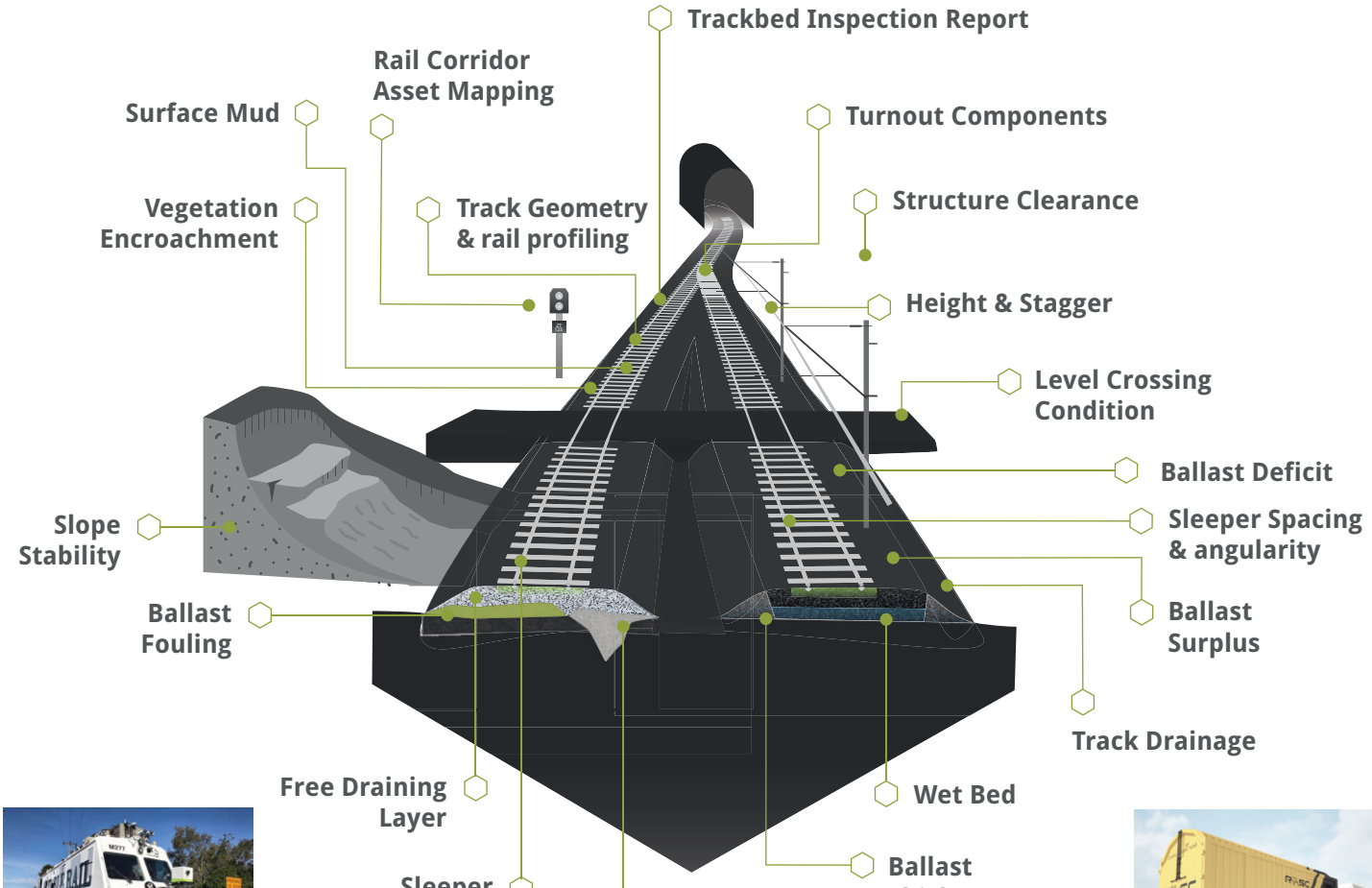

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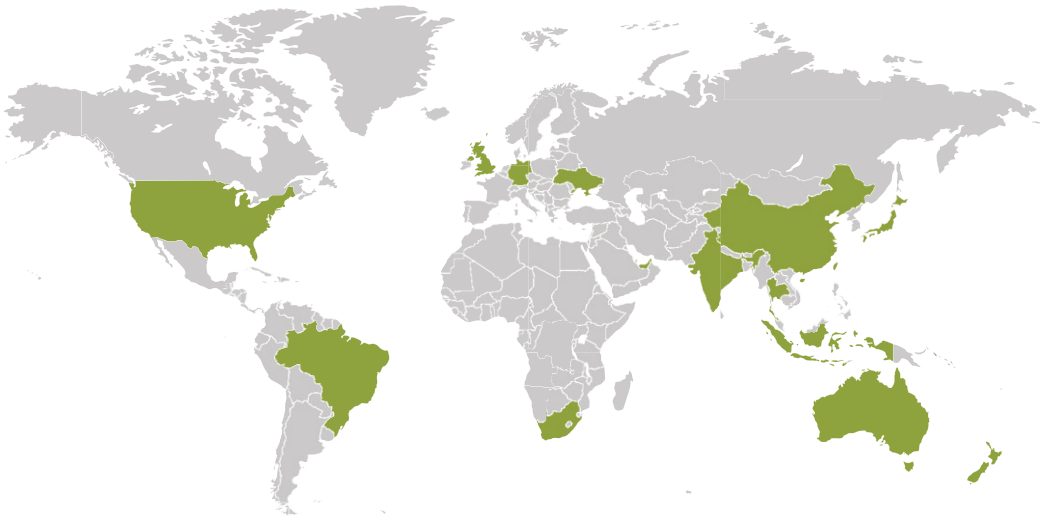

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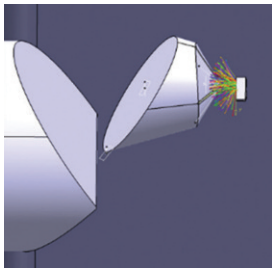

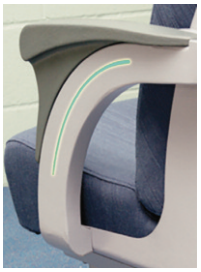

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Brussels Schuman Station
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European Commission Proposes 2021 as the European Year of Rail

In order to meet the European Green Deal objectives in the transport sector, the European Commission has proposed that 2021 be the European Year of Rail.

This will involve a series of events, campaigns and initiatives that will promote rail as a sustainable, innovative and safe mode of transport. Throughout 2021 the goal will be to highlight rail's benefits to people, the economy and the climate and to focus on the outstanding challenges to creating a true Single European Rail Area (SERA) without borders.

The European Commissioner for Transport, Adina Valean, said: "There's no doubt that railway transport

EU map © European Union, 2020

ICE and TGV side by side in Paris
© Deutsche Bahn AG | Oliver Lang

means huge benefits in most areas: sustainability, safety, even speed, once it's organised and engineered according to 21st century principles. But there's also something more profound about railways: they connect the EU together not only in physical terms. Setting up a coherent and functional network across all Europe is an exercise in political cohesion. The European Year of Rail is not a random event. It comes at an appropriate time, when the EU needs this kind of collective undertaking."

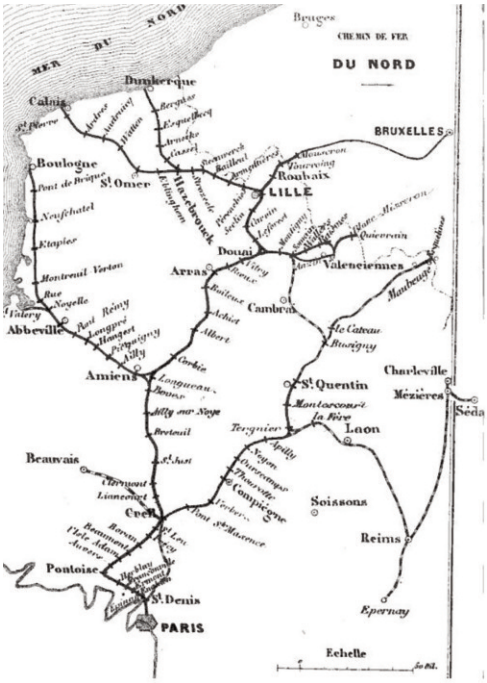
Rail Is Sustainable

In 2019 the Oxford Dictionaries word of the year was 'climate emergency' and with tireless campaigners such as Greta Thunberg keeping the issue rightfully in the public eye, using hashtags like #fridaysforfuture to organise and spread the message online. And rail must play a crucial part it how people and goods travel to address the climate emergency. It is the only mode of transport to have almost continuously reduced its carbon emissions since 1990 while transport volumes have gone up. In 2016 only 0.5 percent of carbon emissions in the transport sector came from rail, while carrying 11.2 percent of freight and 6.6 percent of passengers.

Furthermore, rail also connects people, regions and businesses throughout the EU and beyond. It showcases European engineering and forms part of the continent's heritage and culture. In fact, engineering and environmentalism go hand-in-hand, as Director of Permanent Rail and Lecturer at NCATI Gareth Dennis said: "I'm already an environmentalist. That is precisely why I went into engineering. The greatest medical interventions have been engineering ones (potable water, sewerage, electricity), and I fully expect the greatest environmental interventions to be engineering ones too."

2021

The European Commission wants the European Year of Rail to boost the pace of rail modernisation. This will help make rail more popular than less environmentally friendly transport options.



Moreover, 2021 will be the first full year in which the rules agreed under the Fourth Railway Package will be implemented throughout the EU. 2021 also marks several rail anniversaries for the European Union: it is the 20th anniversary of the First Railway Package and the 175th anniversary of the first-ever rail link between two EU capitals (Paris-Brussels). It also marks 40 years of the TGV and 30 years of the ICE.

The European Year of Rail proposal has four main objectives:

- **To promote rail as a sustainable, innovative and safe transport mode (climate)**
- **To highlight the European cross-border aspect of rail (social cohesion)**
- **To enhance the contribution of rail to the Union economy, industry and society, addressing regional development, industrial competitiveness, sustainable tourism, innovation, employment, education, youth and culture, and improving accessibility for persons with disabilities**
- **To contribute to promoting rail as an important element of the relations between the Union and neighbouring countries, and in particular the Western Balkans (international relations)**

The European Green Deal

The European Commission set out a European Green Deal for the EU and its citizens in 2019. Its goal is climate neutrality by 2050. Transport contributes a quarter of the EU's greenhouse gas emissions, meaning this sector is key to achieving that target. It has the target of reducing its emissions by 90 percent by 2050. Consequently, the Commission is developing a strategy for sustainable mobility. One key priority is shifting a substantial amount of the 75 percent of inland freight currently transported by road on to rail and inland waterways.

The Commission's proposal will now go to the European Parliament and Council for approval. The new European Commission President, Ursula von der Leyen, has adopted the Green Deal as one of her flagship policies.

EU Green Deal © European Union, 2020

Upcoming Railway Events & Exhibitions

March–May 2020

SmartTransit 2020
17–19 Mar 2020 | Boston

Accelerate: Rail 2020
10 Mar 2020 | London

Achieving UK Rail Decarbonisation
17 Mar 2020 | London

SafeRail 2020
17–19 Mar 2020 | Boston

BAPCO 2020
10–11 Mar 2020 | Coventry

Intermodal Asia 2020
17–19 Mar 2020 | Shanghai

Rail Freight Group Conference 2020
02 Apr 2020 | London

Track Access Charges Summit
21–22 Apr 2020 | Riga

MENA Transport Congress & Exhibition
13–15 Apr 2020 | Dubai

4th Annual Transport Infrastructure
06–07 Apr 2020 | Hanoi

4th Annual Ticketing Innovations Summit
23–24 Apr 2020 | Berlin

The Rise of IoT and Big Data in Rail
15–16 Apr 2020 | Munich

RAILLIVE!

Sydney Transport & Roads Expo
19–20 Mar 2020 | Sydney

Northern Transport & Infrastructure Development
24 Mar 2020 | Leeds, UK

Rail Industry Meetings
24–26 Mar 2020 | Anzin, France

World Travel Catering & Onboard Services Expo
31 Mar–02 Apr 2020 | Hamburg

Rail Live! 2020
31 Mar–02 Apr 2020 | Madrid

International Rail Forum and Conference
01–03 Apr 2020 | Prague

Infrarail 2020
12–14 May 2020 | London

Transport Research Arena 2020
27–30 Apr 2020 | Helsinki

ElectroTrans 2020
27–29 May 2020 | Moscow

Rail Freight Summit 2020
11–13 May 2020 | Poznan, Poland

International Transport Forum 2020 Summit
27–29 May 2020 | Leipzig

Innovated KTSZ4H Temperature Switch Designed for Railway Vehicles

www.railwayvehicles.com

Based on our customers' ever growing requests for modification and innovation of the temperature switch designed for railway vehicles, we have set to innovate and modernise the original KTSZ3H temperature switch. Therefore, we would like to present to you our **new KTSZ4H** temperature switch. This KTSZ4H temperature switch, naturally, meets the railway regulations according to the **EN 50155, EN 50121-3-2, EN 61373 and EN 45545-2** standards. We can also produce the temperature switch in a variant meeting the **NFPA 130** standard.

INNOVATED TEMPERATURE SWITCH KTSZ4H

- maximum range of use -50 to 400 °C
- operating temperature range -40 to 85 °C
- possibility of 4-wire connection of the switch
- **higher accuracy of measurement**

EN 50155, EN 50121-3-2, EN 61373, EN 45545-2 and NFPA 130

The **KTSZ4H temperature switch** is designed as a two-state controller (ON/OFF control) which compares a set temperature value with measured temperature, and when the set temperature value is reached, it enables switching the galvanically separated contacts. The switch supply voltage is 10 to 33 V DC / 9 to 24 V AC. Up to 2 temperature sensors can be connected to the switch. During measuring, the switch screen gradually displays instantaneous temperature values from both sensors. Individual parameters can be set using two control buttons.

THE SWITCH CAN BE USED IN 5 DIFFERENT FUNCTIONS

- the switch works as a simple controller, switching one relay according to a set temperature interval and the second relay when a set emergency temperature limit is exceeded (just one temperature sensor is used)
- the switch works as a double controller, switching each relay separately according to a set temperature interval (just one temperature sensor is used)
- the switch works as a double controller, switching each relay separately according to a set temperature interval (two temperature sensors are used, each for one relay)
- the switch works as a differential controller, switching according to temperature difference between two temperature sensors (similar to function 1)
- the switch works as a differential controller, switching according to temperature difference between two temperature sensors (similar to function 2)

Each function can be set with a time delay for relay opening (for relay 1) in the range from 0 to 300 s. The switches are designed for mounting on a DIN rail. The maximum temperature range of sensor use is -50 °C to 400 °C. The standard inputs of the switch are Pt 100/3850 and Pt 1000/3850. Alternatively, the switch can be offered with an Ni 1000/6180 input.

NEW PARAMETERS OF THE KTSZ4H TEMPERATURE SWITCH

• maximum range of use -50 to 400 °C • operating temperature range -40 to 85 °C • possibility of 4-wire connection of the switch • higher accuracy of measurement • newly adapted software

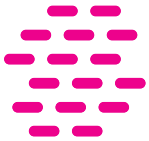
Our development continues...

We are currently designing a **KSTH 120 temperature and relative humidity sensor** for temperature and humidity measurement in air-conditioning ducts. The sensor will be provided with a digital RS 485 (MODBUS) output or CAN protocol output.

Also, we are working on liquid and air flow sensors. We will try our best to get everything ready for Innotrans 2020 in Berlin.

temperature

humidity



CO_2

atm. pressure

VOC

For more information about SENSIT s.r.o. sensors, switches and converters, please visit **www.railwayvehicles.com** or contact us directly at **randysek@sensit.cz**

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