

The logo for the World Congress on Railway Research (WCR) features the letters 'WCR' in a stylized, white, sans-serif font. The 'W' and 'C' are connected, and the 'R' has a distinctive shape with a vertical bar and a curved top. The logo is set against a teal background.

BIRMINGHAM UK | 2022

#wcr2022

13th World Congress on Railway Research (WCR)

Draft Technical Programme

Reshaping our railways post pandemic: Research with an impact

6-10 June 2022

International Convention Centre,
Birmingham, United Kingdom



A Better,
Safer
Railway



UNIVERSITY OF
BIRMINGHAM

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WCRR Programme Overview

Day One: Monday 6th June

DAY ONE – MONDAY 6 JUNE: WELCOME & REGISTRATION	
AM	Exhibition Stand Build
16:00	<p>Welcome Reception <i>UK and International Pavilions, International Convention Centre, Birmingham</i> Delegates will be invited to start networking with colleagues whilst enjoying light refreshments, and entertainment provided by London's Transport Choir.</p> <p>Welcome to Birmingham Councillor Ian Ward, Birmingham City Council</p> <p>Rail regional welcome Tim Shovellor, Managing Director, North West and Central region, Network Rail</p> <p>Welcome to WCRR 2022 Welcome Reception The welcome reception is hosted and kindly supported by Europe's Rail Joint Undertaking.</p> <p>Speakers:</p> <ul style="list-style-type: none"> Carlo Borghini Executive Director, Europe Rail's Joint Undertaking <p>Introduction to Europe's Rail R&I Partnership and its Calls for Proposals Delegates will be invited to find out about the new European partnership on rail research and innovation established under the Horizon Europe programme (2020-2027), and the universal successor of the Shift2Rail Joint Undertaking.</p> <p>In this session representatives from Europe's Rail Joint Undertaking will introduce their Master Plan, its key priority areas and the upcoming Calls for Proposals. Afterwards interested participants will be invited to give short pitch presentations. More information will be provided in due course.</p>
18:30	DAY ONE CLOSE

Day Two: Tuesday 7th June

DAY TWO – TUESDAY 7 JUNE: MORNING SESSIONS

09:00	Opening Ceremony			
	WCRR 2022 Chair Introductions Luisa Moiso, Director of Research and Development, RSSB Professor Clive Roberts, Head of School of Engineering, Director BCRRE, University of Birmingham			
	Welcome Remarks Mark Phillips, Chief Executive, RSSB Professor Adam Tickell, Vice-Chancellor, University of Birmingham			
	Ministerial Welcome Wendy Morton MP, Minister of State, Department for Transport			
	Keynote Address Sir Peter Hendy CBE, Chairman, Network Rail			
09:30	Plenary Session One: The railway in a post-Covid transport landscape			
	Chaired by: Professor Sarah Sharples, Chief Scientific Adviser, Department for Transport The impact of the pandemic has been felt by many industries across the globe. What does it mean for the railways in a post-Covid transport landscape? Senior leaders from the global transport community will join our first plenary session to discuss: <ul style="list-style-type: none"> • Future transport demand • Net zero transport and the role of rail • The priorities for cross-modal integration Confirmed panellists: <ul style="list-style-type: none"> • Eddie Aston, CEO UK/Europe, Genesee & Wyoming Inc. • Annelise Avril, Group Senior Executive Vice President – Marketing, Innovation & New Mobility Services, Keolis Global • TC Chew, Director, Global Rail Business, Arup • Malcolm Holmes, Executive Director, West Midlands Rail Executive and Director of Rail, Transport for West Midlands • Dr Barbara Lenz, Director of the Institute of Transport Research, DLR (German Aerospace Center) 			
10:45	COFFEE BREAK AND EXHIBITION NETWORKING			
11:15	Parallel Sessions			
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	OP.1 Air quality and zero carbon emission trains OP.2 Train braking and low adhesion OP.3 Understanding customer needs OP.4 Materials and track components	IP.1 Carbon reduction and zero carbon railways IP.2 Condition based maintenance and novel inspection	Hydrogen Propulsion for Rail Hosted by: Ricardo	How to implement research successfully Hosted by: University of Birmingham
12:45	LUNCH AND EXHIBITION NETWORKING			

DAY TWO - TUESDAY 7 JUNE : AFTERNOON SESSIONS

14:15	Parallel Sessions			
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	OP.5 Freight performance and safety OP.6 Energy efficient solutions OP.7 Infrastructure condition based maintenance OP.8 Noise / pollution vibration countermeasures	IP.3 Construction and structures IP.4 Safety, security, and certification	System Pillar – Towards a Harmonised and Interoperable European Rail System Hosted by: Europe's Rail	How to implement research successfully Hosted by: University of Birmingham
15:45	COFFEE BREAK AND EXHIBITION NETWORKING			
16:15	Parallel Sessions			
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	OP.9 Safety assessment and derailment OP.10 Accessibility, comfort, and passenger information OP.11 Materials and track components OP.12 Reducing carbon footprint	IP.5 Condition based maintenance and automated inspection IP.6 Passenger experience	Digitisation of remote condition monitoring Hosted by: Trenitalia	How to implement research successfully Hosted by: University of Birmingham
17:45	Session Close			
	BREAK			
19:00	Botanical Gardens Reception <i>Birmingham Botanical Gardens</i> This informal social event will offer delegates the opportunity to network over a light meal and refreshments whilst enjoying entertainment highlighting the best of local arts and culture, all set against the beautiful backdrop of the Birmingham Botanical Gardens.			
22:30	DAY TWO CLOSE			

Day Three: Wednesday 8th June

DAY THREE – WEDNESDAY 8 JUNE: MORNING SESSIONS

08:30 Parallel Sessions				
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	<p>OP.13 Rolling Stock condition based maintenance</p> <p>OP.14 Renewable energy and environmentally friendly railways</p> <p>OP.15 Comfort and passenger information</p> <p>OP.16 Traffic management and planning</p>	<p>IP.7 Condition based maintenance</p> <p>IP.8 Train positioning and detection systems</p>	<p>Twins belong together – combining physical and virtual testing</p> <p>Hosted by: Global Centre of Rail Excellence Ltd (GCRE)</p>	<p>How to innovate in safety critical industries</p> <p>Hosted by: RSSB</p>
09:50 COFFEE BREAK AND EXHIBITION VIEWING				
10:20 Parallel Sessions				
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	<p>OP.17 Electrification and catenary testing</p> <p>OP.18 Infrastructure maintenance</p> <p>OP.19 Noise / vibration countermeasures</p> <p>OP.20 Disruption management and increasing capacity</p>	<p>IP.9 Infrastructure maintenance</p> <p>IP.10 Low emissions and energy efficiency</p>	<p>Collaborative research driving innovation</p> <p>Hosted by: UKRRIN</p>	<p>How to innovate in safety critical industries</p> <p>Hosted by: RSSB</p>
11:45 BREAK				
12:00 Parallel Sessions				
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	<p>OP.21 Wheel rail interaction and maintenance</p> <p>OP.22 Autonomous operations</p> <p>OP.23 Data to improve maintenance</p> <p>OP.24 Safety, security, and certification</p>	<p>IP.11 Infrastructure maintenance and asset management</p> <p>IP.12 Traffic and disruption management</p>	<p>Net zero logistics – The role of Rail</p> <p>Hosted by: RSSB & TTCI</p>	<p>How to innovate in safety critical industries</p> <p>Hosted by: RSSB</p>
13:30 LUNCH AND EXHIBITION VIEWING				

DAY THREE – WEDNESDAY 8 JUNE: AFTERNOON SESSIONS

14:45	Plenary Session Two: Research with an impact: Celebrating success			
	<p>Chaired by: Luisa Moisiso, Director of Research and Development, RSSB (WCRR 2022 Chair)</p> <p>Senior leaders from the global transport community will join our second plenary session to discuss the progress made over the last couple of years and in particular, how research and development has helped with:</p> <ul style="list-style-type: none"> • Operation of the railway during Covid-19 • Moving toward a low emissions railway • Data-driven decisions in maintenance and operations <p>Confirmed panellists</p> <p>Philippe Citroën, Director General, UNIFE Luigi Corradi, Amministratore Delegato e Direttore Generale, Trenitalia Francois Davenne, Director General, UIC Martin Frobisher, Group Safety & Engineering Director, Network Rail Dr Atsushi Furukawa, Executive Director, RTRI Kari Gonzales, CEO & President, TTCI</p>			
16:00	COFFEE BREAK AND EXHIBITION VIEWING			
16:30	Parallel Sessions			
	<p>Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A</p> <p>OP.25 Pantograph / catenary interaction</p> <p>OP.26 Condition based maintenance</p> <p>OP.27 Autonomous operations and train detection</p> <p>OP.28 Testing, acceptance, and electromagnetic compatibility</p>	<p>Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved</p> <p>IP.13 Social value and new markets</p> <p>IP.14 Zero carbon and energy efficiency</p>	<p>Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research</p> <p>Title TBC</p> <p>Hosted by: Knorr Bremse</p>	<p>Session TBC</p> <p>Session TBC</p>
18:00	BREAK			
19:00	<p>Gala Dinner <i>Eastside Rooms, Birmingham</i></p> <p>The Gala Dinner promises to be the highlight of the Congress social and networking event programme. Delegates will enjoy a 3-course banquet, and entertainment, in Birmingham's newest conference venue which combines innovation with industrial heritage.</p>			
23:00	DAY THREE CLOSE			

Day Four: Thursday 9th June

DAY FOUR – THURSDAY 9 JUNE: MORNING SESSIONS				
08:30	Parallel Sessions			
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	OP.29 Passenger flow, information, and ticketing OP.30 Safety, security, and certification OP.31 Signalling and comms systems OP.32 Rolling stock maintenance and design	IP.15 Asset management and interaction IP.16 Passenger movements and multi-modal travel	Digital Automatic Coupling (DAC) – Transforming Europe's Rail Freight Hosted by: Europe's Rail	How to communicate for maximum impact Hosted by: Oxentia
09:50	COFFEE BREAK AND EXHIBITION VIEWING			
10:30	Plenary Session: The journey to rapid benefit realisation			
	Chaired by: Professor Paul Plummer , Professor of Industrial Railway Strategy, University of Birmingham			
	Senior leaders from the global transport community will join our third plenary session to discuss what research and development needs to focus on to:			
	<ul style="list-style-type: none"> Enhance the railway value for money proposition for its passengers and freight customers Increase the financial sustainability of the railways Overcoming barriers to rapid deployments of new solutions and full exploitation of their benefits 			
	Confirmed panellists:			
	Carole Desnost , Chief Innovation Officer, SNCF Carlo Borghini , Executive Director, Europe's Rail Joint Undertaking Mark Thurston , Chief Executive Officer, HS2 Daniela Gerd tom Markotten , Board Member – Digitalisation and Technology, DB			
11:45	BREAK			
12:00	Parallel Sessions			
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	OP.33 Rolling stock design OP.34 Optimising asset use OP.35 Disruption and capacity management OP.36 Safety operations and human factors	IP.17 Rolling stock design and light weighting IP.18 Competition and demand	PERFORMINGRAIL- Moving block system modelling, simulation, testing and optimisation Hosted by: Europe's Rail	How to communicate for maximum impact Hosted by: Oxentia
13:30	LUNCH & EXHIBITION VIEWING			

DAY FOUR – THURSDAY 9 JUNE: AFTERNOON SESSIONS

14:45	Parallel Sessions			
	Oral Presentations (OP) 15-min presentations of novel research across a variety of topics, followed by Q&A	Interactive Presentations (IP) Interactive presentation of novel research across a variety of topics with opportunities to speak to researchers involved	Masterclass Programme Interactive, expert-led sessions focused on successful implementation of research	'How to' Programme Professional growth sessions for early career researchers and professionals
	OP.37 Level crossing safety OP.38 Disaster and extreme event countermeasures OP.39 Rolling stock design OP.40 Lightweight vehicles	IP.19 Signalling and comms systems IP.20 Safety and security	Innovation: Making ideas a reality Hosted by: HS2	How to communicate for maximum impact Hosted by: Oxentia
16:15	Closing Ceremony			
	Best Paper Awards Reflections from WCRR 2022 <ul style="list-style-type: none"> Luisa Moisio, Director of Research and Development, RSSB Professor Clive Roberts, Head of School of Engineering, Director BCRRE, University of Birmingham 			
	Handover to next WCRR Host			
17:00	DAY FOUR CLOSE AND EXHIBITION BREAKDOWN			

Day Five: Friday 10th June

DAY FIVE – FRIDAY 10 JUNE: TECHNICAL SITE VISITS

Morning and Afternoon (Subject to visit)	<p>Delegates will be invited to experience UK research facilities, innovation centres, major infrastructure project sites and points of interest by attending the technical site visit of their choice.</p> <p>Technical Visits: University of Birmingham National Railway Museum: Sustainability through the ages High Speed Two: Curzon Street Construction Site Network Rail: Rail Innovation Development Centre (RIDC), Melton Mowbray Network Rail: Improvements to move passengers and goods across Britain's North West & Central Routes Oleo International: The evolution of energy absorbing technologies Ricardo Rail: Shoreham Technical Centre Alstom: Litchurch Lane Factory Black Country Innovative Manufacturing Organisation (BCIMO) Warwick Manufacturing Group</p> <p>And more!</p> <p><i>Please note all site visit selections must be made via the Congress registration website in advance of the Congress. Delegates will be notified when the technical visit booking process commences.</i></p> <p>DAY FIVE CLOSE AND END OF CONGRESS</p>
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Plenary Sessions

Plenary Session 1: The railway in a post-Covid transport landscape

The impact of the pandemic has been felt by many industries across the globe. What does it mean for the railways in a post-Covid transport landscape?

Senior leaders from the global transport community will join this panel to discuss:

- Future transport demand
- Net zero transport and the role of rail
- The priorities for cross-modal integration

SESSION CHAIR

Professor Sarah Sharples,
Chief Scientific Adviser, Department for Transport

Professor Sarah Sharples is Chief Scientific Adviser for the Department for Transport. She is a Professor of Human Factors in the Faculty of Engineering at the University of Nottingham and from 2018 to 2021 was Pro-Vice-Chancellor for Equality, Diversity and Inclusion and People.



She has led research in transport, manufacturing and healthcare, and currently leads the Engineering and Physical Sciences Research Council (EPSRC) Connected Everything Network Plus.

She founded and is co-director of the EPSRC Horizon Centre for Doctoral Training (CDT) and has led research programmes examining implementation of new technologies in rail, highways and aviation.

She was President of the Chartered Institute of Ergonomics and Human Factors from 2015 to 2016.

CONFIRMED PANELLISTS

- **Eddie Aston**, CEO UK/Europe, Genesee & Wyoming Inc.
- **Annelise Avril**, Group Senior Executive Vice President – Marketing, Innovation & New Mobility Services Keolis Global
- **TC Chew**, Director, Global Rail Business, Arup
- **Malcolm Holmes**, Executive Director, West Midlands Rail Executive and Director of Rail, Transport for West Midlands
- **Dr Barbara Lenz**, Director of Institute of Transport Research, DLR (German Aerospace Center)

Plenary Session 2: Research with an impact: celebrating success

Senior leaders from the global transport community will join our second plenary session panel to discuss the progress made over the last couple of years, and in particular, how research and development has helped with:

- Operation of the railway during Covid-19
- Moving towards a low emissions railway
- Data-driven decisions in maintenance and operations

SESSION CHAIR

Luisa Moisio,

Director of Research and Development, RSSB

Luisa Moisio joined RSSB in 2005 to inform and assess changes to standards. She moved to the R&D department in 2008 and was appointed Director of Research and Development in 2017. In this capacity she leads the R&D cross-industry programme run by RSSB and funded by the Department for Transport. This provides new knowledge and solutions spanning a broad range of engineering and operations topics in which cross-sector collaboration is vital.



Working closely with colleagues from Network Rail and UKRRIN, Luisa led the development of the new Rail Technical Strategy launched in Oct 2020.

Since 2014 Luisa has also been a member of the organising committee of the World Congress of Rail Research and she is the current Chair.

CONFIRMED PANELLISTS

- **Philippe Citroën**, Director General, UNIFE
- **Luigi Corradi**, Amministratore Delegato e Direttore Generale, Trenitalia
- **Francois Davenne**, Director General, UIC
- **Martin Frobisher**, Group Safety & Engineering Director, Network Rail
- **Dr Atsushi Furukawa**, Executive Director, RTRI
- **Kari Gonzales**, CEO & President, TTCI

Plenary Session 3: The journey to rapid benefit realisation

Senior leaders from the global transport community will join our third plenary session to discuss what research and development needs to focus on to:

- Enhance the railway value for money proposition for its passengers and freight customers
- Increase the financial sustainability of the railways
- Overcome barriers to rapid deployment of new solutions and full exploitation of their benefits

SESSION CHAIR

Professor Paul Plummer,
Professor of Railway Strategy, University of Birmingham

Professor Paul Plummer is a former CEO, director and economist with experience in policy, strategy, transport and infrastructure.

His key roles in rail included Group Strategy Director at Network Rail, Chief Executive Officer at the Rail Delivery Group and President of EIM.

Professor Plummer is now using that experience at University of Birmingham as a professor, as a non-executive Director, adviser and mentor to help individuals or organisations to make a difference.



CONFIRMED PANELLISTS

- **Carlo Borghini**, Executive Director, Europe's Rail Joint Undertaking
- **Carole Desnost**, Chief Innovation Officer, SNCF
- **Daniela Gerd tom Marktotten**, Board Member – Digitalisation and Technology, DB
- **Mark Thurston**, Chief Executive Officer, HS2

Masterclass Programme

The **WCRR 2022 Masterclass programme** aims to showcase cutting edge research from some of the world's leading railway undertakings and research bodies.

Hall 9

Hydrogen Propulsion for Rail

Tuesday 7 June (11:15 – 12:45) **Hosted by Ricardo**

Is hydrogen a suitable future fuel for rail applications?

This workshop will focus on hydrogen and how it may be applicable in a rail environment. We will start with a review of the substance itself, why is it a possible energy vector for our future mobility before looking at what the technical solutions are that may be applicable within a rail environment. Our interactive workshop will delve into some of the myths around hydrogen use as a fuel source and look to see work through where it may have a future and where we might prefer other solutions. Small group breakouts will tackle some of the issues head on and look at what answers are out there for these, before we have a focused session on safety and emergency response for hydrogen in use.

We'll complete the session working around the next steps for hydrogen and how we as an industry can tackle these remaining obstacles.

System Pillar – Towards a Harmonised and Interoperable European Rail System

Tuesday 7 June (14:15 – 15:45) **Hosted by Europe's Rail Joint Undertaking**

The System Pillar within Europe's Rail Joint Undertaking will provide the governance and resource to support the sector in converging on the evolution of the rail system and providing the operational concept and system architecture to achieve it. The System Pillar brings all rail sector representatives under a single coordination body, therefore bringing us closer to the completion of a Single European Railway Area (SERA).

The aim of the session is to investigate how the System Pillar, through its systemic approach, will make the most efficient use of scarce resources (EU and Member States, rail sector, both financial and human capital), coordinating and consolidating initiatives under one umbrella. During the masterclass you will also find out how the System Pillar will align public and private EU Research and Innovation initiatives with a long-term operational concept and system architecture, supporting interoperability, and ensure a strategic plan for an overall harmonised approach while bolstering deployment.

Digitization of remote condition monitoring

Tuesday 7 June (16:15 - 17:45) **Hosted by Trenitalia**

Final session details TBC.

Twins belong together – combining physical and virtual testing

Wednesday 8 June (08:30 – 09:50) **Hosted by Global Centre for Rail Excellence Ltd (GCRE)**

The GCRE being built in South Wales will be the world's newest and most advanced innovation hub for the testing, validation and certification of rail assets and systems. We will explain why advances in digital twin technology must be fully integrated with a physical sibling to deliver rapid and fully proven innovative solutions for the railways. Both physical and virtual testing have considerable individual merits. Used together we can accelerate innovation through and beyond the barriers of historic caution and conservatism that have been a drag on progress in the railways, but less so in the automotive and aerospace sectors. Andy will demonstrate why Gemini is the star sign of the railway's future and how we progress by matching a complementary and closely connected pair.

Collaborative research driving innovation

Wednesday 8 June (10:20 – 11:45) **Hosted by UK Rail Research and Innovation Network (UKRRIN)**

The UK Rail Research and Innovation Network (UKRRIN) provides a demonstration of the power of collaboration between academia and industry. The network has provided a step-change in innovation in the GB rail sector and is helping to accelerate new technologies and products from research into market applications globally.

This session will cover key examples of world leading research and interactive demonstrations of the testing capabilities for UKRRIN Centres of Excellence.

Net zero logistics – The role of rail

Wednesday 8 June (12:00 – 13:30) **Hosted by RSSB and TTCI**

With every freight train producing more than 70% less carbon per tonne than the equivalent transport by road, rail freight already plays a leading role in a low-carbon logistics sector today. Modal shift to rail freight can support immediate carbon reductions, so how can rail promote and enable this modal shift with the highly price-sensitive customers in. The rail freight sector is working hard to identify ways to reduce its carbon outputs further. These efforts include the pursue of incremental improvements such as adopting stop-start technologies and new approaches to freight pathing to reduce the need to break and stop. Significant efforts, particularly in the R&D space, are focused on moving away from diesel powered freight locomotives overcoming the challenge that this presents due to the significant power demand requirements. This masterclass brings the latest thinking and development from around the world on the topics of modal shift and rail freight growth, solutions to reduce today emissions, and diesel alternatives to power freight locomotives.

Digital Automatic Coupling – Transforming Europe’s Rail Freight

Thursday 9 June (08:30 – 09:50) **Hosted by Europe’s Rail Joint Undertaking**

Europe’s Rail Joint Undertaking will provide a comprehensive view of their work in Digital Automatic Coupling (DAC). This state-of-the-art innovation provides a route to automatically couple and uncouple a freight train both physically, with the mechanical connection and the brake air line, as well as digitally with the electrical power and connection. The technology is considered a key enabler in creating a modern and digital rail freight sector.

The aim of the session is to present some of the latest developments in the field of digital automatic coupling. You will have the opportunity to learn about the current state of affairs with regards to coupling and decoupling freight trains, the need for solutions such as DAC not only from a technological point view, but also from policy perspective at Union level, as well as some of the main challenges ahead of us and the timeline for roll-out.

PERFORMINGRAIL – Moving block system modelling, simulation, testing and optimisation

Thursday 9 June (12:00 – 13:30) **Hosted by University of Birmingham**

The EU-funded PERFORMINGRAIL projects aims to delineate, through formal modelling and optimal traffic management, a moving block railway signalling using advanced GNSS based train positioning approaches that mitigate potential hazards in the diverse market segments. The main objectives of the project are to enhance and verify existing specifications for moving block signalling, while developing formal models, algorithms and proof of concepts to test and validate an integrated future moving block system architecture that will provide safe and effective operational performances

This masterclass is to disseminate the research progress of PERFORMINGRAIL project including the below presentations:

1. Formal modelling for moving block systems
2. Train localisation technique for moving block systems
3. Traffic management for moving block systems
4. Simulation and testing for moving block systems

Innovation: making ideas a reality

Thursday 9 June (14:45 – 16:15) **Hosted by HS2**

Why Innovation should always be considered a delivery function. How to set up an innovation team to own, drive and deliver. Innovation is often seen as a strategic discipline, at HS2 we aim to make ideas a reality in the HS2 Programme, delivering in cross functional teams. Why collaboration and aligned interests are the only way to really make Innovation a reality, leaving a lasting legacy of new practices, technologies and businesses for the UK.

Professional Growth Programme

The **WCRR Professional Growth Programme** has been designed to help early career professionals hone their skills in key areas.

Attendees will gain insights in how to **Implement, Innovate** and **Communicate**.

Session 1: How to **Implement** Research Successfully

Brought to you by:



This session will help delegates understand how to successfully deliver research and facilitate industry take up. Examples will be given of how to make a difference through good implementation planning and collaboration with stakeholders.

The session will provide tools, techniques and case studies that will give delegates the opportunity to understand key research implementation concepts and their applications.

Delegates will gain an understanding of:

- How to scope and assess the case for research.
- How to plan for success implementation throughout the life a project.
- The challenges involved in moving from 'lab to rail' and ways to bridge this gap.
- Ways to measure success and monitor the benefit of research post implementation.

Session 2: How to **Innovate** in Safety Critical Industries

Brought to you by:



This session will provide delegates with an understanding of how new technology can be introduced in safety critical industry, like rail. Delegates will be offered an insight into the role of standards and regulation and the approach to assess safety and reliability of novel technologies, with practical examples and access to industry experts.

Delegates attending this session will:

- Gain an understanding of the role played by standards in enabling innovation.
- Gain knowledge of how change is introduced within regulatory frameworks and an awareness of current challenges and opportunities for improvements.
- Learn about tools and techniques for assessing the safety and reliability of novel technology.

Session 3: How to **Communicate** for Maximum Impact?

Brought to you by:



The Session will focus how to clearly and concisely explain research to a broad audience and make best use of various verbal and written communication and dissemination platforms when doing so. Delegates will gain an understanding of how to communicate effectively and present research outcomes verbally and in writing to a non-specialist audience such as rail researchers in other sectors, directors and other executives within the rail industry, government contacts, and decision makers.

Delegates will gain have an opportunity to:

- Explore some of the common challenges researchers face when communicating their findings, and how to overcome these challenges.
- Learn how to connect with and understand different audiences, including the various interests of different stakeholders involved and what language and level of detail is appropriate for each audience.
- Refine both verbal and written communication skills and learn how to use different dissemination channels effectively including social media.
- Learn how to present a clear, concise, and compelling written or verbal summary of research findings for research peers in other sectors, government or industry contacts, and key decision makers.

Oral and Interactive Presentation Sessions (OP and IP)

Day Two: Tuesday 7 June 11:15 – 12:45

Hall 10a

OP.1 Air quality and zero carbon trains

Session Chair: TBC

- **11:15 Bi-Mode Hydrogen Train Requirements Using Geospatial Line Assessment**

Sebastian Herwartz¹, Johannes Pagenkopf¹, **Florian Kühlkamp**², Abraham Fernández Del Rey³, Antonio M. Carillo⁴, Francisco Ganhao⁵, Maider Varela⁶

(¹German Aerospace Center (DLR), Institute of Vehicle Concepts, Berlin, Germany, ²German Aerospace Center (DLR), Institute of Vehicle Concepts, Stuttgart, Germany, ³Renfe Operadora E.P.E., Madrid, Spain, ⁴Administrador De Infraestructuras Ferroviarias (ADIF), Madrid, Spain, ⁵Infraestruturas de Portugal, S.A., Almada, Portugal, ⁶Construcciones y Auxiliar de Ferrocarriles, S.A. - CAF, Beasain, Spain)

- **11:30 Improved emissions mapping across the GB rail network**

James Wright¹, Philbert Chan¹, Mark Gibbs², Neil Grennan-Heaven³

(¹RSSB, London, United Kingdom, ²Aether, Oxford, United Kingdom, ³Carrickarory Consulting, London, United Kingdom)

- **11:45 Development of Performance Improved Fuel Cell Hybrid Powered Test Railway Vehicle**

Takashi Yoneyama¹, Kenichi Ogawa¹, Takayuki Kashiwagi¹, Takayuki Sudo¹

(¹Railway Technical Research Institute, Kokubunji-shi/Tokyo, Japan)

- **12:00 Decarbonization of work trains – optimal solutions for diverse boundary conditions**

Matthias Landgraf¹, Martina Zeiner¹, Dieter Knabl¹, Victor Barrena², Bernhard Antony³, Christian Koczwar⁴

(¹Graz University of Technology, Graz, Austria, ²Global Rail Consulting, Vienna, Austria, ³Plasser & Theurer, Vienna, Austria, ⁴Plasser & Theurer, Linz, Austria)

Hall 10b

OP.2 Train braking and low adhesion

Session Chair: Walter Rosenberger, TTCI

- **11:15 Development of Low Adhesion Estimation algorithms using data from wheelset and bogie mounted inertial sensors**

Tim Harrison¹, Peter Hubbard¹, Christopher Ward¹, Roger Goodall¹

(¹Loughborough University, Loughborough, United Kingdom)

- 11:30 The Adaptive Wheel Slide Protection. From mathematical models to a real-time algorithm evolving in an industrial environment allowing to increase performance and lower life cycle costs**
*Luc Imbert*¹
 (¹Wabtec, Turin, Italy)
- 11:45 Improved Wheel-Rail Adhesion Estimation**
*Hamid Alturbeh*¹, Julian Stow¹
 (¹University of Huddersfield, Huddersfield, United Kingdom)
- 12:00 Effect of the number of control command steps in brake system with deceleration feedback loop structure on accuracy of train stop position**
*Shin-ichi Nakazawa*¹
 (¹Railway Technical Research Institute (RTRI), Tokyo, Japan)
- 12:15 ADHERE Adhesion Research Programme**
 Anup Chalisey¹, Paul Gray¹
 (¹RSSB, London, United Kingdom)

Hall 8a

OP.3 Understanding customer needs

Session Chair: Munenori Shibata, Railway Technical Research Institute (RTRI)

- 11:15 Intelligent train for real-time onboard services**
*Francesco Sorvillo*¹ (¹Trenitalia S.p.A., ROMA, Italy)
- 11:30 Assessing the value of travel time for intercity railway passenger transport in Brazil**
*Cassiano Augusto Isler*¹, Marcelo Blumenfeld², Gabriel Pereira Caldeira¹, Clive Roberts²
 (¹University of São Paulo, São Paulo, Brazil , ²University of Birmingham, Birmingham, United Kingdom)
- 11:45 The Context-Oriented Information Service based on Semantic Computing**
*Motoki Yokoyama*¹, Yasushi Kiyoki², Tetsuya Mita¹, Sei Sakairi¹
 (¹East Japan Railway Company, Saitama, Japan, ²Keio University, Fujisawa, Japan)
- 12:00 Valuing Customer Experience – How KPIs can distort investment decisions by focusing on economic aspects obscuring secondary benefits**
*Svenja Hainz*¹, Ida Kristoffersson², Filiz Kurt³, Cengxi Liu², Antoine Verrier⁴
 (¹Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR), Brüssel, Belgium, ²Swedish National Road and Transport Research Institute, Stockholm, Sweden, ³Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR), Braunschweig, Germany, ⁴SNCF - DIRECTION GÉNÉRALE TECHNOLOGIES, INNOVATION ET PROJETS GROUPE, Paris, France)

OP.4 Materials and track components

Session Chair: Munenori Shibata, Railway Technical Research Institute (RTRI)

- 11:15 Experiences of Using Premium Rail on an Urban Metro Network**
*Svenja Hainz*¹, Ida Kristoffersson², Filiz Kurt³, Cengxi Liu², Antoine Verrier⁴
 (¹British Steel, Scunthorpe, United Kingdom, ²London Underground Limited, London, United Kingdom)
- 11:30 Concrete Tie Life Extension**
*Yin Gao*¹, Christopher Johnson¹, Joseph LoPresti¹
 (¹Transportation Technology Center, Inc. (TTCI), Pueblo, The United States of America)
- 11:45 Under Sleeper Pad (USP), One of the most innovative cost saving products for tracks for the last 20 years**
*Mercedes GUTIERREZ FERRANDIZ*¹, Rodolphe POTVIN², Bernhard Knoll³
 (¹UIC, Paris, France, ²SNCF, La Plaine Saint Denis, France, ³OEBB, Vienna, Austria)
- 12:00 Dynamic performance analysis of ballasted track with tire-derived aggregates with a coupled discrete-continuum model**
 Can Shi¹, Valeri Markine², Guoqing Jing³, Chunfa Zhao⁴, *Yunlong Guo*²
 (¹Shenzhen University, Shenzhen, China, ²Delft University of Technology, Delft, The Netherlands, ³Beijing Jiaotong University, Beijing, China, ⁴Southwest Jiaotong University, Chengdu, China)

IP.1 Carbon reduction and low carbon railways

Session Chair: Vincent Delcourt, SNCF

- 11:15 Impact of Conventional Driving Strategies on Fuel Cell Hybrid Train Consumption**
*Rabee Jibrin*¹, Stuart Hillmansen¹, Clive Roberts¹
 (¹University of Birmingham, Birmingham, United Kingdom)
- 11:20 The EU Project FCH2RAIL - Fuel Cell Hybrid PowerPack for Rail Applications**
*Holger Dittus*¹, Eva Terron², Thomas Landtmeters³, Abraham Fernández Del Rey⁴, Antonio M. Carillo⁵, Carlos de la Cruz⁶, Francisco Ganhao⁷, Susanna Kück⁸
 (¹DLR Institute of Vehicle Concepts, Stuttgart, Germany, ²Construcciones y Auxiliar de Ferrocarriles, S.A. - CAF, Beasain, Spain, ³Toyota Motor Europe, Brussels, Belgium, ⁴Renfe Operadora E.P.E., Madrid, Spain, ⁵Administrador De Infraestructuras Ferroviarias (ADIF), Madrid, Spain, ⁶Centro Nacional del Hidrógeno, Puertollano, Spain, ⁷Infraestruturas de Portugal, S.A., Almada, Portugal, ⁸Stemmann-Technik, Schüttorf, Germany)

- 11:25 Bio-based materials with economic and ecological performances for railway rolling stock**
*Patricia Morey*¹, Benoit Dodin², Philippe Clément¹, Samuel Puech¹
 (¹SNCF, Le Mans, France, ²SNCF, Saint-Denis, France)
- 11:30 Development of an ecolabel for rolling stocks – Application to an energy labelling of suburban trains**
*Philippe Clément*¹, Andre Philippe Chamaret¹
 (¹SNCF Voyageurs, Centre d'Ingénierie du Matériel, Le Mans, France)
- 11:35 Medium voltage DC railway electrification system Assessment of performance**
*Sina Sharifi*¹, Pietro Tricoli¹
 (¹University of Birmingham, Birmingham, United Kingdom)
- 11:40 Sustainable Approach to Delivering Railways of the Future**
*Bharath Ranganathan*¹, Jack Hesford¹
 (¹Siemens Mobility Limited, Chippenham, United Kingdom)
- 11:45 Technical-economic study to evaluate, for existing non-electrified lines, the adoption of new technology electric-hybrid (emission-free) train with on-board energy storage system as alternative to a total or partial electrification of the line**
*Guido Guidi Buffarini*¹, Nicola Carones¹, Roberto Consalvi¹, Giovanni Trezza¹

Hall 11b

IP.2 Condition based maintenance and novel inspection

Session Chair: Paulo Masini Trenitalia

- 11:15 The Challenges in Introducing the Felix S&C Laser Profile System to Network Rail**
*Phil Winship*¹
 (¹Network Rail, Milton Keynes, United Kingdom)
- 11:20 Development of Visibility Examination System for Emergency Signals for Level Crossing with Infrared and Image Processing Technology**
*Yuuki Mori*¹, Koji SUGIURA¹, Hideaki ABE¹
 (¹East Japan Railway Company, Tokyo, Japan)
- 11:25 An innovative approach in interfacing Diagnostic Application protocols for the RFI Network with legacy communication stacks**
*Mirko Ermini*¹, Giuseppe Cadavero², Fabrizio Tavano², Sebastiano Trigila³, Luca Rea³, Samuela Persia³, Francesco G. Lavacca³, Francesco D'Alterio³
 (¹Rete Ferroviaria Italiana (RFI), Firenze, Italy ²Rete Ferroviaria Italiana (RFI), Roma, Italy ³FUB (Fondazione Ugo Bordonis), Roma, Italy)

- **11:30 Use arc measurements to optimize catenary maintenance**
Valéry BOUCLET¹, Rabie MEFTAH², Samuel DUBOIS³, Andréa LOYER-POLLASTRI⁴, Guillaume BOGAERT¹
 (¹SNCF RESEAU, La plaine Saint Denis, France, ²ITG, PARIS, France, ³SNCF RESEAU, Paris, France, ⁴SNCF VOYAGEURS, Saint-Pierre des Corps, France)

- **11:35 Method of soundness evaluation based on sound generated by traction substation equipment**
Taichi Hirano¹, Shigeo Mukai¹, Hiroshi Katou¹
 (¹East Japan Railway Company, Tokyo, Japan)

- **11:40 Efficient Railway Drainage Management Systems: Data Driven Failure Prediction**
Ehsan Kazemi¹, Andrew Nichols¹, Yiqi Wu¹, Fei Liu¹, 2, Simon Tait¹, Jamil Raja³, Sunny Modhara³
 (¹The University of Sheffield, Sheffield, United Kingdom, ²ABI Research, London, United Kingdom, ³Network Rail, Milton Keynes, United Kingdom)

- **11:45 Emerging inspection methods to support more proactive maintenance of railway drainage assets**
 Santiago Rojas Arques¹, ², Gavin Sailor², Caroline Wadsworth³, Jamil Raja⁴, Simon Tait², **Andrew Nichols²**
 (¹Anglian Water, Huntingdon, United Kingdom, ²The University of Sheffield, Sheffield, United Kingdom, ³Isle Utilities, Kenilworth, United Kingdom, ⁴Network Rail, Milton Keynes, United Kingdom)

Day Two: Tuesday 7 June 14:15 – 15:45

Hall 10a

OP.5 Freight performance and safety

Session Chair: Stefano Guidi, UIC

- 14:15 Understanding the influence of imbalanced loading of freight wagons on derailment resistance to improve network safety**
*Phil Shackleton*¹, Gareth Tucker¹, Bridget Eickhoff², Adam Bevan¹
 (¹University of Huddersfield, Huddersfield, United Kingdom, ²RSSB, London, United Kingdom)
- 14:30 Automating and optimizing the handling of containers inside freight stations**
*Ryuta Nakasone*¹, Shu Kaneko¹
 (¹Japan Freight Railway Company, Tokyo, Japan)
- 14:45 An effective perspective to highly increase freight efficiency in Europe**
*Giulia RUSSO*¹, Luciano Cantone², Thierry DURAND³, Andrea OTTATI⁴, Roberto TIONES⁵
 (¹UIC, Paris, France, ²University of Rome "Tor Vergata", Rome, Italy, ³SNCF, Le Mans, France, ⁴Trenitalia S.p.A., Florence, Italy, ⁵FAIVELEY, TORINO, Italy)
- 15:00 Development of an Innovative Rail-Canal System for Effective Logistics**
*Jeongguk Kim*¹, Seung-il Seo¹
 (¹Korea Railroad Research Institute, Uiwang, The Republic Of Korea)
- 15:15 Full-scale aerodynamic measurements on-board a freight train using the DLR FR8-LAB**
*James Bell*¹, Felix Werner¹, Marian Buchsieweke², Arne Henning¹
 (¹German Aerospace Center (DLR), Institute of Aerodynamics and Flow Technology, Göttingen, Germany, ²Otto-von-Guericke-University of Magdeburg, Dept. Communication and Networked Systems (ComSys), Institute for Intelligent Cooperating Systems (IKS), Magdeburg, Germany)

Hall 10b

OP.6 Energy efficient solutions

Session Chair: Stuart Hillmansen, University of Birmingham

- 14:15 Physical Modelling of a Light Rail HVAC system Using Long-Term Measurements**
*Sebastian Reimann*¹, Peter Gratzfeld¹
 (¹Karlsruhe Institut of Technology, Karlsruhe, Germany)

- 14:30 Prediction of trains' aerodynamic drag from model-scale investigations and options to reduce energy consumption through aerodynamic design**

*Jonathan Tschepe*¹, Christian Navid Nayeri²
 (¹BIT GmbH, Berlin, Germany, ²Technical University Berlin, Berlin, Germany)
- 14:45 Energy storage and power management system on 3kV lines**

*Claudio Spalvieri*¹, Marta Stellin¹, Irene Rossetta¹, Luca Pantalone¹, Stefano Rosini¹
 (¹RFI – Technical Department, Rome, Italy)
- 15:00 RECET4Rail research towards Reliable Energy and Cost-Efficient Traction System for Railway**

Marie-Line LABOUILLE¹, Irma Villar², Nando Kaminski³, Michele Compare⁴, *Marta Garcia*⁵, Jean-Pierre Fradin⁶, Antti Punkka⁷, Sylvain Noureau⁸, Mietek Bakowski⁹, Jacek Rabkowski¹⁰, Florian Legay¹¹, Enrico Zio¹²

Hall 8a

OP.7 Condition based maintenance

Session Chair: Edd Stewart, University of Birmingham

- 14:15 Optimisation of Wheelset Maintenance Strategies using a Combination of Physical and Data-driven Models**

Ruichen Wang¹, *Adam Bevan*¹, Adam Roebuck², Harsh Shah²
 (¹IRR / University of Huddersfield, Huddersfield, United Kingdom, ²Siemens Mobility Limited, London, United Kingdom)
- 14:30 CBM algorithms as a new paradigm to avoid batteries failures onboard trains during rail services**

*Alfredo Bianucci*¹, Marco Confalonieri²
 (¹Trenitalia S.p.A. (Technical Department), Florence, Italy, ²SAP Italia S.p.A., Vimercate, Italy)
- 14:45 Partial discharges analysis for insulated high voltage cable diagnostic**

Gwenaël GABORIT¹, Vincent Henry³, Guillaume REVILLOD², Guillaume Chevrier-Gros², Lionel DUVILLARET², *Erwan DUMONT*³
 (¹IMEP-LAHC, Le Bourget-du-Lac, France, ²KAPTEOS, Saint-Hélène-du-Lac, France, ³SNCF, Saint Ouen sur Seine, France)
- 15:00 Deterministic High-Speed Stability (Truck Hunting) Assessment**

*Walter Rosenberger*¹, Kenny Morrison¹
 (¹Transportation Technology Center Inc. , Pueblo, The United States of America)
- 15:15 Proposal of maintenance method for railway concrete structures using crack image analysis**

*Yuko Sato*¹, Ken Watanabe¹, Yasutaka Noma²
 (¹Railway Technology Research Institute , Tokyo, Japan, ²Hazama Ando Corporation, Ibaraki, Japan)

OP.8 Noise and air pollution countermeasures

Session Chair: Erimitsu Suzuki, Railway Technical Research Institute (RTRI)

- 14:15 Characteristics and reduction measures of micro-pressure wave in ultra-high-speed railway tunnel**
 Takanori Mizuno¹, Atsushi Honda¹, **Junichiro Kubo¹**, Hiroshi Omori¹, Kazuya Takahashi¹, Takanobu Ogawa², Yozo Fujino³
 (¹Central Japan Railway Company, Tokyo, Japan, ²Seikei University, Tokyo, Japan, ³Josai University, Saitama, Japan)
- 14:30 Assessing the acoustic performance of quiet brake blocks to mitigate rolling noise of railway vehicles**
Fabien Létourneaux¹, Jenny Böhm², Maria Starnberg³
 (¹SNCF , La Plaine Saint Denis, France, ²German Centre for Rail Traffic Research at the Federal Railway Authority, Dresden, Germany, ³DB Systemtechnik GmbH, Munich, Germany)
- 14:45 A study on the design and application of a pre-treatment filter for the outside air inlet to reduce inflow of dust for outside air in underground stations**
 Jinseon Kim¹, Seungyeon Lee¹, Seung Jin Choi¹, Jeong-rae Jung², **Hyeong-Seok Lim¹**
 (¹Korea Railroad Corporation, Daejeon, The Republic Of Korea, ²Korail Railroad Corporation, Daejeon, The Republic Of Korea)
- 15:00 Stations Air Quality Monitoring Network (AQMN)**
James Wright¹, Philbert Chan¹
 (¹RSSB, London, United Kingdom)

IP.3 Construction and structures

Session Chair: William Powrie, University of Southampton

- 14:15 Development of a Radical Track Switch System for Enhanced Performance**
Saikat Dutta¹, Tim Harrison², Anup Chalisey³, Neil Gofton³, Richard Corbin⁴, Osama Olaby¹, Christopher Ward², Roger Dixon¹
 (¹Birmingham Centre for Railway Research and Education, Birmingham, United Kingdom, ²Loughborough University, Loughborough, United Kingdom, ³RSSB, London, United Kingdom, ⁴RC-Designs, Derby, United Kingdom)
- 14:20 Renewal of electric traction structures on historical bridges in Venice lagoon**
 Claudio Spalvieri¹, **Alessio Iacomelli¹**, Mauro Di Flauro¹, Francesca Perrone², Roberto Stella³, Stefano Rosini¹
 (¹RFI – Technical Department, Rome, Italy, ²RFI – Maintenance Regional Department of Venice, Venice, Italy, ³GFC - Generale Costruzioni Ferroviarie , Rome, Italy)
- 14:25 Interoperability of BIM models as a key tool of railway facilities management**
Achraf Dsouf¹, Juan José MUNOZ VARGAS¹, Habib OSMANI¹, Juan GONZALEZ¹, Judicael Dehotin Adounvo¹, Pierre-Etienne Gautier¹, Sondes KAROU¹
 (¹French National Railway Company, Paris, France)

- 14:30 Whole Life Rail Model Damage Function for High-Performance Rail Steel: Validation and Verification**
Yousif Muhamedsalih¹, Adam Bevan¹
 (¹Institute of Railway Research, University of Huddersfield, Huddersfield, United Kingdom)
- 14:35 Proposal for Strategic Maintenance of Railway Concrete Structures Using Images Analysis**
Ken Watanabe¹, Yusuke MIYAMOTO²
 (¹Railway Technical Research Institute, Kokubunji-shi/Tokyo, Japan, ²Railway Technical Research Institute, Tokyo, Japan)
- 14:40 Can Stainless Steel Reinforcement Bar Facilitate More Sustainable Railway Bridges? A Review of Life Cycle Cost and Carbon Analysis**
Hamish Moodley¹, Simon Blainey¹, John Preston¹, Sheida Afshan¹
 (¹University of Southampton, Southampton, United Kingdom)

Hall 11b

IP.4 Safety, security and certification

Session Chair: Franck Poisson, SNCF

- 14:15 Flood Risk Management Using a Digital Twin Approach**
Mark Cheetham¹
 (¹SNCF Reseau, La Plaine St-Denis, France)
- 14:20 An automatic and robotized reference Test Facilities (RTF) for ERTMS-ETCS and ATO On-board Systems for the Italian Railway Network**
Vincenzo Calà¹, Mirko Ermini¹, Giuseppe Cadavero²
 (¹RFI (Rete Ferroviaria Italiana), Firenze, Italy, ²Rete Ferroviaria Italiana (RFI), Roma, Italy)
- 14:25 The new concept of "Safety Critical Components" on rail vehicles introduced by European legislation**
Giuseppe Ragusa¹
 (¹Trenitalia S.p.A. (Technical Department), Florence, Italy)
- 14:30 Improving Understanding of Railroad Tank Wagon Performance in Accidents Through Simulation-Based Derailment Analyses**
 Steven Kirkpatrick¹, Todd Treichel², Christopher Barkan³, ***Chen-Yu Lin***³, Leandro Iannacone³, Paul Gharzouzi³, Paolo Gardoni³
 (¹Applied Research Associates, Inc., Mountain View, The United States of America, ²Association of American Railroads, Washington, D.C., The United States of America, ³University of Illinois at Urbana-Champaign, Urbana, The United States of America)

- **14:35 Quantum Key Distribution Protocols for intrinsically secure communications on the Italian Railway Network**

Mirko Ermini¹, Vincenzo Calà¹, Giuseppe Cadavero², Philippe Velha³, Stefano Faralli³, Anna Giacobbe³, Fabrizio Di Pasquale³, Paolo Villorosi⁴, Giuseppe Vallone⁵, Luca Calderaro⁶

(¹RFI (Rete Ferroviaria Italiana), Firenze, Italy, ²Rete Ferroviaria Italiana (RFI), Roma, Italy, ³Scuola Superiore Sant'Anna, Pisa, Italy, ⁴DEI and QTech Center Università degli Studi di Padova, Padova, Italy, ⁵DEI DFA and QTech Center Università degli Studi di Padova, Padova, Italy, ⁶Università degli Studi di Padova, Padova, Italy)

- **14:40 SAFETY4RAILS EU project: Protecting railway and metro infrastructure against combined cyber-physical attacks**

Marie-Hélène Bonneau¹, Laura Petersen¹, Grigore Havarneanu¹, Stephen Crabbe²

(¹International Union of Railways (UIC), Paris, France, ²Fraunhofer Institute for High-Speed Dynamics I Fraunhofer-Institut für Kurzzeitdynamik Ernst-Mach-Institut · EMI , Efringen-Kirchen, Germany)

Day Two: Tuesday 7 June 16:15 – 17:45

Hall 10a

OP.9 Safety assessment and derailment

Session Chair: Adam Klopp, TTCI

- 16:15 Safety – Re-engineering Railway Safety through digitalization of SMS**
Frédéric HENON¹
 (¹International Union of Railways (UIC), Paris, France)
- 16:30 Failure analysis and estimation of the remaining lifetime to improve safety**
Alexis RATIER¹, Philippe Feraud¹, François CHURLAUD¹, Olivier VO VAN²
 (¹Agence d'Essai Ferroviaire (SNCF), Vitry-sur-Seine, France, ²SNCF Innovation & Research, La Plaine Saint-Denis, France)
- 16:45 Vertical Loads Measurement System (VLMS)**
 Francesco Cirillo¹, **Angelo Domenico Giancola¹**, Francesca Del Pezzo¹, Angelo Mancano¹, Francesco Ranauro¹, Stefano Rosini¹, Simone Petrali¹
 (¹RFI – Technical Department, Rome, Italy)
- 17:00 Holistic study of Formal Methods and Standardization in development, verification and validation of railway signalling system software**
Arne Borälv¹, Daniel Fredholm¹, Luis-Fernando Mejia², Javier Magro³, Daniel Schwencke⁴, Tom Werner⁵, David Mentré⁶, Randolf Bergelehner⁷, Abdul Rasheeq⁷, Ibtihel Cherif⁷, Dominik Hansen⁸
 (¹Trafikverket, Stockholm, Sweden, ²Alstom, Paris, France, ³CAFS, Madrid, Spain, ⁴German Aerospace Center (DLR), Institute of Transportation Systems, Braunschweig, Germany, ⁵Siemens, Chippenham, United Kingdom, ⁶MERCE, Rennes, France, ⁷DB Netz AG, Frankfurt am Main, Germany, ⁸Thales, Dusseldorf, Germany)

Hall 10b

OP.10 Accessibility, comfort and passenger information

Session Chair: Marc Guigon, UIC

- 16:15 Evaluating the Inclusivity of Digital Interfaces for Transport Services**
Mike Bradley¹, Joy Deane¹, Sam Waller¹, Jakob Kluge², Silvia Gaggi³, P John Clarkson¹
 (¹University of Cambridge, Cambridge, United Kingdom, ²University of Oldenburg, Oldenburg, Germany, ³Institute of Studies for the Integration of Systems, Rome, Italy)

- 16:30 Integration and Evaluation of Individual Thermal Comfort Zones in a Representative ICE Laboratory**
Daniel Schmeling¹, Daniel Schiepel¹, Mikhail Konstantinov^{1, 2}, Matthias Kühn³, Julian Lucas³, Tim Berlitz³, Marcel Jäckle⁴, Panja Goerke⁵, Oliver Zierke⁵, Sylvio Donner⁶, Riccardo Parise⁶, Ernst Friedrich⁷, Marcus Apitius⁸
 (¹German Aerospace Center (DLR), Institute of Aerodynamics and Flow Technology, Göttingen, Germany, ²Technische Universität Ilmenau, Institute of Thermodynamics and Fluid Mechanics, Ilmenau, Germany, ³Deutsche Bahn Systemtechnik GmbH, Engineering Aerodynamics and HVAC, Munich, Germany, ⁴Deutsche Bahn Systemtechnik GmbH, Air Conditioning Test Laboratory, Minden, Germany, ⁵German Aerospace Center (DLR), Institute of Aerospace Medicine, Hamburg, Germany, ⁶German Aerospace Center (DLR), Institute of Vehicle Concepts, Berlin, Germany, ⁷Deutsche Bahn AG, Center of Competence (CoC) Strategy, Innovation & New Technologies, Berlin, Germany, ⁸Deutsche Bahn AG, Principles and Testing Teclab, Berlin, Germany)
- 16:45 Going home safely: Designing and testing effective alarms to make passengers exit trains**
Guillaume Lemaitre¹, Hua-Yen Pan¹, Claire Chaufour¹
 (¹SNCF , La Plaine Saint Denis, France)
- 17:00 A Study on Service Robot Applied in Train Stations**
Takeshi Saito¹, Sei Sakairi¹, Tetsuya Mita¹, Yuki Sakakibara¹, Ryo Nishioka¹, Jun Maruyama¹
 (¹Research and Development Center of East Japan Railway Company, Nisshin-cho, Kita-ku, Saitama-shi, Saitama-Pref, Japan)

Hall 8a

OP.11 Materials and track components

Session Chair: Andy Doherty, Global Centre for Rail Excellence

- 16:15 Engineered Interspersed Concrete Sleeper Track Modulus Assessment In Ballasted Track**
Arthur de O. Lima¹, Marcus S. Dersch¹, Jaeik Lee¹, J. Riley Edwards¹
 (¹RailTEC - University of Illinois at Urbana-Champaign, Urbana, The United States of America)
- 16:30 The effect of FFU-sleeper and USP on low frequency vibration caused by freight traffic on soft soil areas**
Antti Pelho¹, Heikki Luomala¹, Timo Huhtala², Mikael Takala³
 (¹Tampere University, Tampere, Finland, ²A-Insinöörit, Espoo, Finland, ³Finnish Transport Infrastructure Agency, Helsinki, Finland)
- 16:45 In-situ Optical Monitoring of Very Early-Stage Rail Wear and Rolling Contact Fatigue Crack Initiation in Laboratory Testing**
Adam Wilby¹, David Fletcher¹, Roger Lewis¹, Jacob Corteen²
 (¹The University of Sheffield, Sheffield, United Kingdom, ²British Steel, Scunthorpe, United Kingdom)
- 17:00 Residual stress estimation in rails and welds used under heavy axle loads**
Ananyo Bandyopadhyay¹, Gary Fry¹
 (¹Transportation Technology Center Inc. , Pueblo, The United States of America)

OP.12 Reducing carbon footprint

Session Chair: Franck Poisson, SNCF

- **16:15 Carbon Accounting in Mainline Railway Geotechnical Solutions: Reducing Embodied Carbon in Conjunction with Offsetting to Reach Net Zero**
*Tracey Najafpour Navaei*¹, Simon Blainey¹, William Powrie¹, John Preston¹
 (¹University of Southampton, Southampton, United Kingdom)
- **16:30 Carbon footprint and LCA methodology to quantify, account and minimize GHG emissions along the entire life cycle of rail infrastructure**
*Nicoletta Antonias*¹, Marco Montesi¹, Gianluca Salamanno¹, Andrea Rispoli¹
 (¹Italferr SpA, Rome, Italy)
- **16:45 Life Cycle Assessment of Alternative Traction Options for Non-Electrified Regional Railway Lines**
*Marko Kapetanović*¹, Alfredo Núñez², Niels van Oort¹, Rob Goverde¹
 (¹Delft University of Technology, Faculty of Civil Engineering and Geosciences, Department of Transport and Planning, Delft, The Netherlands, ²Delft University of Technology, Faculty of Civil Engineering and Geosciences, Section of Railway Engineering, Delft, The Netherlands)
- **17:00 REUSE - Avoided CO2 from applying circular economy principles in railway industry**
 Lucie ANDERTON¹, Isabelle DE KEYZER¹, *Stanislav Lenart*², Sebastjan Meža², Alenka Mauko Pranjić², Ana Mladenović²
 (¹International Union of Railways (UIC), Paris, France, ²ZAG, Ljubljana, Slovenia)
- **17:15 Stabilization of electric supply network with the electric flexibility of on-board hvac system**
*Tony Letrouvé*¹, Abdoulaye PAM¹, Philippe Aubin², Andrea Verdicchio¹, Loic Planchette³, Saber Bayouhd², Francois Lheriau²
 (¹SNCF Innovation & Research, La Plaine Saint-Denis, France, ²Faiveley Wabtec, saint pierre des corps, France, ³SNCF VOYAGEURS - DIRECTION DU MATÉRIEL, Le mans, France)

IP.5 Condition based maintenance and automated inspection

Session Chair: Anish Poudel, AAR

- **16:15 New gEneration of adaptable Wireless sensor NEtwork for way side objeCTs in rAILway enviRONments (NEWNECTAR), a laboratory demonstrator for optimized data collection process in rail**
 Dereje Molla¹, Hakim Badis¹, **Marion Berbineau**^{2, 3}, Laurent George¹, Ali Sabra³, Hayfa Ben Thameur⁴, Iyad Dayoub^{3, 4}, Mohammad Kalaagi³, Divitha Seetharamdoo^{2, 3}, Hakim Takhedmit⁵
 (¹LIGM, Université Gustave Eiffel, Marne La Vallée, France, ²COSYS, Université Gustave Eiffel, VILLENEUVE D ASCQ, France, ³Railenium, VILLENEUVE D ASCQ, France, ⁴INSA Haut de France, Université Polytechnique Haut de France, Valenciennes, France, ⁵Esycom, Université Gustave Eiffel, Marne La Vallée, France)
- **16:20 Lifespan evaluation method and optimal maintenance method of computer based interlockings**
Satoshi HONMA¹, Koji SUGIURA¹, Hideaki ABE¹, Takayuki ONO¹
 (¹East Japan Railway Company, Tokyo, Japan)
- **16:25 Drone4Rail, Harmonized methodology for drone/UAV use for bridge inspections**
Mercedes GUTIERREZ FERRANDIZ¹, Salvatore Lorelli², G. Polimanti³, Andrea Vecchi³, Didier Vandeveld⁴, Hans-Joerg Stark⁵, Nazereno LOPEZ⁶
 (¹UIC, Paris, France, ²Deutsche Bahn AG, Berlin, Germany, ³Rete Ferroviaria Italiana (RFI), Rome, Italy, ⁴INFRABEL, Brussels, Belgium, ⁵SBB, Bern, Switzerland, ⁶RFI S.p.A., Roma, Italy)
- **16:30 Towards the automation of anomaly detection and integrated fault identification for railway switches in real operational environment**
Daniela Narezo Guzman¹, Judith Heusel², Norman Weik², Susanne Reetz², Douwe Buursma³, Arnout van den Berg³, Gerrit Schrijver³, Thorsten Neumann¹, Serge van den Broek³, Jörn Groos²
 (¹German Aerospace Center (DLR), Institute of Transportation Systems, Berlin, Germany, ²German Aerospace Center (DLR), Institute of Transportation Systems, Braunschweig, Germany, ³Strukton Rail , Utrecht, The Netherlands)
- **16:35 ROVER4RT: Automated robotic solution for inspection and vegetation management in railway tracks**
Javier Sanchez-Cubillo¹, Beñat Arejita², Johan Kildal³, Javier Del Ser^{2, 4}
 (¹ZENIALABS AUTOMATION INTELLIGENCE, Bilbao, Spain, ²University of the Basque Country (UPV/EHU), Bilbao, Spain, ³TEKNIKER, Eibar, Spain, ⁴Basque Research & Technology Alliance (BRTA), Derio, Spain)
- **16:40 Electric field measurements performed from the rolling high speed train IRIS 320**
 Gwenaël GABORIT^{1, 2}, Vincent Henry³, Guillaume REVILLOD², Guillaume Chevrier-Gros², Lionel DUVILLARET², **Erwan DUMONT**³
 (¹IMEP-LAHC, Le Bourget-du-Lac, France, ²KAPTEOS, Saint-Hélène-du-Lac, France, ³SNCF, Saint-Ouen-sur-Seine, France)

- **16:45 Improved condition monitoring of railway tracks through the analysis of on-board dynamic and track geometry measurements on High Speed Lines**
*Danilo Sorrentino*¹, Quang-Anh Ta¹, Florian Latestere¹, Ziad Abdelhalim¹, Percy Chelangat¹, Gilles Saussine¹, Aurélie Schwager-Guillemenet¹

Hall 11b

IP.6 Passenger experience

Session Chair: Yves Perreal, Thales

- **16:15 Ride Comfort Evaluation of a Passenger Train Equipped with Kneeling System**
*Chutipon Moranon*¹, Ramakrishnan Ambur²
(¹Institute for High Speed Rail and System Integration, University of Leeds, Leeds, United Kingdom, ²Birmingham Centre for Railway Research and Education, University of Birmingham, Birmingham, United Kingdom)
- **16:20 Virtual Inspection and customer acceptance for rail vehicles enabled by an efficient digital data glass solution**
*Heinrich Brunner*¹, Tilmann Kloppe², Vincent Laux³
(¹Siemens Mobility, Munich, Germany, ²Siemens Mobility, Erlangen, Germany, ³Siemens Mobility, Vienna, Austria)
- **16:25 Rail Customer Experience state of the art and medium-term challenges: A holistic approach**
Vanessa Pérez Miranda¹, Joaquin Botella², **Jörg Ostwald**³
(¹Union International des Chemins de Fer, Paris, France, ²SENER, Madrid, Spain, ³SBB, Bern, Switzerland)
- **16:30 The impact of Covid19 on rail tourism: challenges and future opportunities for the sector**
Vanessa Pérez Miranda¹, Carles Casas Esplugas^{2, 3}, Ana Garcia Pando⁴, Daria Snigir^{1, 5}
(¹International Union of Railways (UIC), Paris, France, ²Universitat Politècnica De Catalunya, Barcelona, Spain, ³Ferrocarrils de la Generalitat de Catalunya, Barcelona, Spain, ⁴AGP Consulting, Quito, Ecuador, ⁵IREST, Université Paris 1 Panthéon Sorbonne, Paris, France)
- **16:35 Waiting Time perception and real-time schedule display**
Emile Colin¹, **Guillaume Lemaître**¹, Simone Morgagni¹, Virginie van Wassenhove²
(¹SNCF, La Plaine Saint Denis, France, ²CEA Neurospin, Paris-Saclay, France)
- **16:40 Real-time intelligent recognition of transportation modes via smartphones**
Satoru Harada¹, Wisinee Wisetjindawat¹, Jessada Sresakoolchai², Junhui Huang², Sakdirat Kaewunruen², Shuichiro Sakikawa³
(¹Hitachi Europe Ltd., London, United Kingdom, ²University of Birmingham, Birmingham, United Kingdom, ³Hitachi Ltd., Tokyo, Japan)

Day Three: Wednesday 8 June 08:30 – 09:50

Hall 10a

OP.13 Rolling Stock condition based maintenance

Session Chair: Scott Cummings, TTCl

- **08:30 Introduction to DynaPan: A new automated way of hysteresis-based railway pantograph inspection and testing**
*Moussa Hamadache*¹, Stephen Kent¹, Adnan Zentani¹, Paul Weston¹, Edward Stewart¹, Clive Roberts¹, Roger Dixon¹
(¹University of Birmingham, Birmingham, United Kingdom)
- **08:45 Automatic detection of train wheels health status for CBM application**
*Chiara Triti*¹, Luca Labbadia¹, Francesco Cocchetti¹
(¹Trenitalia SPA (Technical Department), Florence, Italy)
- **09:00 Research on application of AI diagnostic imaging technology to railway vehicle inspection**
*Tatsushi Suzuki*¹, Akinao Hibino¹, Masahito Adachi¹, Yoshitaka Morishita¹
(¹Central Japan Railway Company, Aichi, Japan)
- **09:15 Development of Road Surface Defect Scanning System Using Multiple Sensing Techniques for Safe Operation of Tram**
*Jeongguk Kim*¹, Seung-II Seo¹
(¹Korea Railroad Research Institute, Uiwang, The Republic of Korea)

Hall 10b

OP.14 Renewable energy and environmentally friendly railways

Session Chair: James Wright, RSSB

- **08:30 Techno-economical study of integration of renewable energy sources next to the railroad**
*Tony Letrouvé*¹, Andrea Verdicchio¹, Jean-Baptiste Frier², Lionel Taunay²
(¹SNCF Innovation & Research, La Plaine Saint-Denis, France ²SNCF Réseau, La Plaine Saint Denis, France)
- **08:45 A Study of Integrating Renewable Energy Sources into AC railways**
*Nutthaka Chinomi*¹, Zhongbei Tian¹, Nakaret Kano², Stuart Hillmansen²
(¹University of Liverpool, Liverpool, United Kingdom, ²University of Birmingham, Birmingham, United Kingdom)

- 09:00 Optimization of charge/discharge control for diesel hybrid train with deep reinforcement learning**
 Shin YAMAMOTO¹, **Toshihide YOKOUCHI¹**, Minoru KONDO¹
 (¹Railway Technical Research Institute (RTRI), Tokyo, Japan)
- 09:15 The role of railways in reversing loss of biodiversity**
Pinar YILMAZER¹, Lucie ANDERTON^{1, 2}, Michael BELOW³, Thomas SCHUH⁴
 (¹UIC, Paris, France, ²Network Rail, Milton Keynes, United Kingdom, ³Deutsche Bahn AG, Berlin, Germany, ⁴ÖBB-Infrastruktur AG, Vienna, Austria)

Hall 8a

OP.15 Comfort and passenger information

Session Chair: Sharon Odetunde, RSSB

- 08:30 Development of a logistics service system to deliver baggage left in lockers at train stations to hotels**
Jun Maruyama¹, Tetsuya Mita¹, Sei Sakairi¹
 (¹East Japan Railway Company, Saitama, Japan)
- 08:45 Development of station congestion estimation system and efforts to provide information to customers**
Yuhei Soda¹, Sei Sakairi¹, Yusuke Konishi¹, Takeshi Kawasaki²
 (¹East Japan Railway Company, Saitama-shi Kita-ku Nisshin-cho, Japan, ²East Japan Railway Company, Saitama, Japan)
- 09:00 How does the train background noise affect passengers' activities? Determining thresholds of noise levels ensuring a good comfort for passengers**
Guillaume Lemaitre¹, Fabrice Aubin², Christophe Lambourg³, Catherine Lavandier⁴
 (¹SNCF Innovation & Research, La Plaine Saint-Denis, France ²SNCF Voyageurs, Centre d'Ingénierie du Matériel, Le Mans, France ³Arteac-lab, Marseille, France ⁴CY University, Cergy-Pontoise, France)
- 09:15 Increasing Thermal Comfort through Individual Heating Options in a German ICE Long-Distance Train**
Oliver Zierke¹, Panja Goerke¹, Julia Maier¹, Daniel Schmeling², Daniel Schiepel²
 (¹German Aerospace Center (DLR), Institute of Aerospace Medicine, Hamburg, Germany, ²German Aerospace Center (DLR), Institute of Aerodynamics and Flow Technology, Göttingen, Germany)

OP.16 Traffic management and planning

Session Chair: Clive Roberts, University of Birmingham

- 08:30 Improvements and implementation of a decision support tool for real-time rescheduling in dense railway systems**
Hugo Belhomme^{1, 2}, Stéphane Dauzère-Pérès², Mathieu Gagnon¹, François Ramond¹
 (¹SNCF Innovation & Research, La Plaine Saint-Denis, France ²Mines Saint-Etienne, Univ. Clermont Auvergne, CNRS, UMR 6158 LIMOS, CMP, Department of Manufacturing Sciences and Logistics, Gardanne, France)
- 08:45 Defining Good train regulation practice in an 'On Time' Railway**
*Aaron Barrett*¹, Luisa Moio¹
 (¹RSSB, London, United Kingdom)
- 09:00 Application of Mathematical Optimization Technique to the Tokaido Shinkansen's Trainset Utilization Planning**
*Masahide Koizumi*¹, Kazuhiko Hosokawa¹, Arito Ohta²
 (¹Cars and Crew Management Section, Transportation and Marketing Department, Shinkansen Operations Division, Central Japan Railway Company, Tokyo, Japan, ²Intelligence Research Department, Systems Research & Development Center Technology Bureau, NS Solutions Corporation, Yokohama-shi, Kanagawa, Japan)
- 09:15 Formulation and quantum resolution of a railway timetabling problem**
*Camille Grange*¹, Valentina Pozzoli¹, François Ramond¹, David De Almeida¹
 (¹SNCF Innovation & Research, La Plaine Saint-Denis, France)

IP.7 Infrastructure condition based maintenance

Session Chair: Paul Gray, RSSB

- 08:30 Ballast condition monitoring with tamping machines**
*Stefan Offenbacher*¹, Matthias Landgraf¹, Stefan Marschnig¹, Bernhard Antony², Christian Koczwar²
 (¹Graz University of Technology, Graz, Austria ²Plasser & Theurer, Vienna, Austria)
- 08:35 In-Motion Rolling Contact Damage Characterization in Rails using Electromagnetic Field Imaging**
*Anish Poudel*¹, Brian Lindeman¹, Matthew Witte¹
 (¹Transportation Technology Center, Inc. (TTCI), Pueblo, The United States of America)

- 08:40 Railway infrastructure predictive maintenance an innovative approach based on wireless multi-sensors distributed IoT devices and big data analysis**

Vincenzo Calà¹, Eugenio Fedeli², Marcella Di Mario¹, Giovanniluca De Vita¹, Nicola Testoni³, Luca De Marchi³, Mauro Mangia³, Francesco Braghin⁴, Emanuele Riva⁴

(¹Rete Ferroviaria Italiana (RFI), Firenze, Italy, ²RFI (Rete Ferroviaria Italiana), Roma, Italy, ³Alma Mater Studiorum - Università di Bologna, Bologna, Italy, ⁴Politecnico di Milano, Milano, Italy)
- 08:45 Automatic Inspection of Tunnel Drainage Systems**

Wolfgang Hofer¹, **Bernhard Zagar¹**, Romane Blanchard^{1, 2}, Tobias Schachinger²

(¹Johannes Kepler University Linz, Linz, Austria, ²OEBB-Infrastruktur AG, Vienna, Austria)
- 08:50 RailXplore Foresight Transforming raw data into valuable information for fast decision-making: Transforming raw data into valuable information for fast decision-making**

Javier Cruz^{1, 2}, Jim Thwaite^{1, 2}, Angus MacDonald-Taylor¹

(¹Siemens Mobility Limited, Chippenham, United Kingdom, ²MIET MIRSE CEng, Chippenham , United Kingdom)
- 08:55 Cost-effective and on-vehicle methods to detect broken rails without track circuit signalling using axle-box acceleration and sound pressure level**

Hiroyuki Aizawa¹, Mitsuru Hosoda¹, Ryuichi Yamamoto¹

(¹Railway Technical Research Institute (RTRI), Tokyo, Japan)
- 09:00 Intelligent data fusion for anomaly detection in Dutch railway catenary condition monitoring**

Hongrui Wang¹, Jurjen Hendriks¹, Rolf Dollevoet^{1, 2}, Arjen Zoeteman², Alfredo Núñez¹

(¹Delft University of Technology, Delft, The Netherlands, ²ProRail, Utrecht, The Netherlands)

Hall 11b

IP.8 Positioning and Detection

Session Chair: Chris Harrison, RSSB

- 08:30 Radio Based Limited Supervision & TPWS Continuous Supervision**

Andrea Palermo¹, Graeme Burden¹, Doug Watson¹, Alexander Stockill¹

(¹Thales UK, London, United Kingdom)
- 08:35 Using machine learning to predict signal aspects based on train movement data**

Peter Hughes¹, **Matthew Newall¹**

(¹University of Huddersfield, Huddersfield, United Kingdom)

- **08:40 Innovative management of shunting movements with On Sight Mode in ERTMS/ETCS L2 stand alone context**
*Francesco Di Flaviano*¹, Salvatore Buonincontri¹, Daniele Caronti¹, Gaetano Ceneri¹, Stefano Marcoccio¹, Andrea Olmi¹, Fabio Senesi¹
 (¹RFI - Technical Department, Rome, Italy)
- **08:45 Multi-function movable scotch block: application of an analytical-experimental methodology for the design of the innovative component**
 Margherita Lupi¹, Franco Iacobini¹, *Stefano Lisi*¹, Giorgio Diana², Edoardo Sabbioni², Andrea Manes², Davide Tarsitano², Marco Giglio², Riccardo Scazzosi²
 (¹RFI - Technical Department, Rome, Italy ²Politecnico di Milano - Department of Mechanics, Milan, Italy)
- **08:50 Safety in railway tunnels through Multifunction Portal ("PMF - Portale Multifunzione")**
 Francesco Cirillo¹, **Angelo Domenico Giancola**¹, Angelo Mancano¹, Simone Petralli¹, Francesco Ranauro¹, Stefano Rosini¹, Davide Testa¹
 (¹RFI – Technical Department, Rome, Italy)
- **08:55 Dependable Speed Measurement for Trains**
*Jordan Brant*¹, Hamid Alturbeh¹, Julian Stow¹
 (¹Institute of Railway Research University of Huddersfield, Huddersfield, United Kingdom)

Day Three: Wednesday 8 June 10:20 – 11:45

Hall 10a

OP.17 Electrification, OLE and catenary testing

Session Chair: Tetsuo Uzuka, Railway Technical Research Institute (RTRI)

- **10:20 Cost-effective Electrification of Low Clearance Bridges**

Thomas Andritsch^{1, 2}, Paul Lewin^{1, 2}, Neil Palmer², Richard Stainton³, Paul Naylor³

(¹University of Southampton, Southampton, United Kingdom, ²Tony Davies High Voltage Laboratory, Southampton, United Kingdom, ³Network Rail, Milton Keynes, United Kingdom)

- **10:35 Method for Detecting DC High-resistance Ground Faults in DC Traction Systems**

Hiroaki Morimoto¹, Kiyonobu Higuchi¹, Masataka Akagi¹, Tsurugi Yoshii¹

(¹Railway Technical Research Institute, Kokubunji-shi, Tokyo, Japan)

- **10:50 Development and introduction of traction substation load monitoring system for Shinkansen**

Yuya Matsuda¹, Shunji Imamura¹, Moriyuki Yokosuka¹, Hirohisa Kato¹, Masatoshi Ueura¹, Ken Kunomura¹, **Toshimasa Shimizu**¹

(¹Central Japan Railway Company, Nagoya, Japan)

- **11:05 Implementing Contact Line Monitoring System**

Takuya Matsumoto¹, Makio Kameda²

(¹KYUSHU RAILWAY COMPANY, fukuoka, Japan ²Hitachi High-Tech Fine Systems Corporation, Saitama, Japan)

Hall 10b

OP.18 Infrastructure maintenance

Session Chair: Sakdirat Kaewunruen, University of Birmingham

- **10:20 Innovative solutions for sustainable rail maintenance**

Richard Stock¹, Michael Seeleithner², Frank Mevert³, Florian Auer⁴

(¹Plasser American, Chesapeake, The United States of America, ²ROBEL Bahnbaumaschinen GmbH, Freilassing, Germany, ³Schweerbau International GmbH & Co. KG, Stadthagen, Germany, ⁴Plasser & Theurer, Vienna, Austria)

- **10:35 Real time detection and localization of broken rail**

Marc ANTONI¹, Mercedes GUTIERREZ FERRANDIZ¹, **David Iban Villalmanzo Resusta**²

(¹International Union of Railways (UIC), Paris, France, ²Administrador De Infraestructuras Ferroviarias (ADIF), Madrid, Spain)

- 10:50 What happens during the tamping process? – When “Smart-Tamper” Meets “Smart-Rock”**
 Yuliang Zhou¹, **Hai Huang**¹, Bryan Schlake¹, Bernhard Antony², Fabian Hansmann³
 (¹Penn State University, Altoona, The United States of America, ²Plasser & Theurer, Vienna, Austria, ³Plasser American, Chesapeake, The United States of America)
- 11:05 Smarter Health Monitoring of Track Switches through Digital Twin Models of Train-Track interactions**
Nikhil Pillai^{1, 2}, Jou-Yi Shih^{1, 3}, Clive Roberts^{1, 2}
 (¹University of Birmingham, Birmingham, United Kingdom, ²Birmingham Centre for Railway Research and Education, Birmingham, United Kingdom, ³Zynamic Engineering AB, Stockholm, Sweden)
- 11:20 Assessment and remediation of old railway embankments for the next 175 years**
Jeerapat Sang-iam¹, Joel Smethurst¹, William Powrie¹
 (¹University of Southampton, Southampton, United Kingdom)

Hall 8a

OP.19 Noise / vibration countermeasures

Session Chair: Eugenio Fedeli, Rete Ferroviaria Italiana S.p.A

- 10:20 Soil vibration and auralisation software tools for application in railways**
Pascal Bouvet¹, Brice Nélain¹, Martin Rissmann¹, David Thompson², Giacomo Squicciarini², Evangelos Ntotsios², Reto Pieren³, Geert Degrande⁴, Geert Lombaert⁴, Fakhraddin Seyfaddini⁴, Andreas Nüber⁵, Marta Garcia⁶
 (¹VIBRATEC, Ecully, France, ²Institute of Sound and Vibration Research, University of Southampton, Southampton, United Kingdom, ³Empa - Swiss Federal Laboratories for Materials Science and Technology | Empa · Acoustics Laboratory, Dübendorf, Switzerland, ⁴KU Leuven, Leuven, Belgium, ⁵Wölfel Engineering, Höchberg, Germany, ⁶UNIFE, Brussels, Belgium)
- 10:35 Ground vibration prediction research – The requirements, needs and challenges from the perspective of railway companies**
Rüdiger Garburg¹, Sascha Hermann²
 (¹Deutsche Bahn AG, Berlin, Germany, ²DB Systemtechnik GmbH, Berlin, Germany)
- 10:50 Prediction of rolling noise from ballast and slab track at speeds up to 360km/h**
Oliver Bewes¹, Gennaro Sica¹, David Thompson², Martin Toward²
 (¹High Speed Two Limited, London, United Kingdom, ²Institute of Sound and Vibration Research, University of Southampton, Southampton, United Kingdom)

- **11:05 The TRANSIT project: innovation towards train pass-by noise source characterisation and separation tools**

Inés López Arteaga¹, **David Thompson**², Ennes Sarradj³, Mats Abom⁴, Michael Dittrich⁵, Ester Cierco⁶, Martin Rissmann⁷, Juan Moreno⁸, Marta Garcia⁹

(¹TU Eindhoven - University of Technology, Eindhoven, The Netherlands, ²Institute of Sound and Vibration Research, University of Southampton, Southampton, United Kingdom, ³TU Berlin, Berlin, Germany, ⁴KTH Royal Institute of Technology, Stockholm, Sweden, ⁵Netherlands Organisation for Applied Scientific Research, The Hague, The Netherlands, ⁶Ingeniería para el control del ruido, Barcelona, Spain, ⁷VIBRATEC, Ecully, France, ⁸Metro Madrid, Madrid, Spain, ⁹UNIFE, Brussels, Belgium)

Hall 8b

OP.20 Disruption management and increasing capacity

Session Chair: David De Almeida, SNCF

- **10:20 Virtually Coupled Train Sets – A Comprehensive Analysis**

Moritz Schenker¹, Sebastian Stickle¹, Holger Dittus¹, Stefano Canesi², Salvatore Danilo Iovino³, Vincent Riquier⁴, Francisco Parrilla Ayuso⁵, Javier Goikoetxea⁶

(¹German Aerospace Center (DLR), Stuttgart, Germany, ²Hitachi Rail STS, Genova, Italy, ³Hitachi Rail STS, Torino, Italy, ⁴SYSTRA, Paris, France, ⁵Indra Sistemas S.A., Madrid, Spain, ⁶Construcciones y Auxiliar de Ferrocarriles, S.A., Beasain, Spain)

- **10:35 Exploring the Virtual Coupling of Railway Vehicles**

Charlotte Rawlings¹, Saikat Dutta¹, Roger Dixon¹

(¹University of Birmingham, Birmingham, United Kingdom)

- **10:50 Exploring the feasibility of running ETCS level 2 overlay over conventional signalling along the Jhansi to Bina section of Indian Railways**

Krishnan Venkateswaran^{1,2}, David Kirkwood^{1,2}, Ning Zhao², Gemma Nicholson², Clive Roberts², Pavan Kumar³

(¹University of Birmingham, Birmingham, United Kingdom, ²Birmingham Centre for Railway Research and Education, Birmingham, United Kingdom, ³RDSO, Ministry of Railways, Lucknow, India)

- **11:05 Comparing Different Train Following Control Algorithms for Platoons of Freight Trains Operating with Moving Blocks**

Tyler Dick¹, Geordie Roscoe¹

(¹University of Illinois Urbana-Champaign, Urbana, The United States of America)

- **11:20 Rescheduling rolling stock rosters as a profit optimization problem**

Ricardo Saldanha¹, Rita Portugal¹

(¹SISCOG - Sistemas Cognitivos, SA, Lisbon, Portugal)

IP.9 Infrastructure maintenance

Session Chair: Yin Gao, TTCI

- **10:20 Broken Rail Detection Using Distributed Optical Fiber Sensing Technology**
Martin Ruffel¹, Imen Benamara¹, Tarik Hammi¹, Ali Kabalan¹, Gabriel Papaiz Garbini¹, Abdelkader Hamadi¹, Walid Talaboulma¹
 (¹SNCF Réseau, La Plaine Saint Denis, France)
- **10:25 New Shinkansen Maintenance Work Safety System**
Ayaka Fukuwa¹, Taro Nakadachi¹, Masahiko Suzuki¹, Takuya Hatakeyama¹
 (¹East Japan Railway Company, Tokyo, Japan)
- **10:30 Experimentation in Bologna San Donato test ring for lightweight autonomous vehicle for railway infrastructure inspection in working areas**
Mirco Gonnelli¹, Eugenio Fedeli², Mirko Ermini¹, Carlo Alberto Avizzano³, Daniele Leonardis³, Dinojan Pedurupillai³, Massimo Satler³, Massimiliano Solazzi³, Luca Tiseni³, Antonio Frisoli³, Rita Cucchiara⁴, Simone Calderara⁴, Riccardo Gasparini⁴
 (¹Rete Ferroviaria Italiana (RFI), Firenze, Italy, ²Rete Ferroviaria Italiana (RFI), Roma, Italy, ³Scuola Superiore Sant'Anna di Pisa, Pisa, Italy, ⁴University of Modena and Reggio Emilia, Modena, Italy)
- **10:35 Improvement of a set-off device for maintenance vehicles and a train protection device for the set-off device**
Shinya Nakamura¹, Yojiro Ando¹, Yuichiro Hori¹(¹East Japan Railway Company, Tokyo, Japan)
 (¹East Japan Railway Company, Tokyo, Japan)
- **10:40 A SIL4 Interface to Remotely Handle Track Possession**
 Alberto Cirillo¹, Lorenzo Esposito¹, Innocenzo Munggiello¹, **Sergio Repetto¹**, Andrea Bondavalli², Tommaso Zoppi²
 (¹Rete Ferroviaria Italiana S.p.A., Rome, Italy, ²Department of Mathematics and Informatics, University of Florence, Florence, Italy)
- **10:45 Propagating local measurements along a railway network**
 Benoit GUYOT¹, Lina EL HOUARI², **Alain Rivero¹**
 (¹SNCF Réseau, La Plaine Saint Denis, France, ²Risk'n Tic, Rouen, France)

IP.10 Noise, vibration and energy efficiency

Session Chair: Philippe Clement, SNCF

- **10:20 Ground-borne noise & vibration mitigation and the effect on rail roughness and airborne noise**
*Jamie Wilkes*¹, David Thompson²
 (¹Network Rail Infrastructure Ltd, Milton Keynes, United Kingdom, ²Institute of Sound and Vibration Research (ISVR), University of Southampton, Southampton, United Kingdom)
- **10:25 Definition of a new protocol for the qualification of aerodynamic noise on high-speed trains**
 Claire Chaufour¹, Mercedes GUTIERREZ FERRANDIZ², *Gennaro Sica*³
 (¹SNCF, Saint-Denis, France, ²UIC, Paris, France, ³HS2 Ltd, London, United Kingdom)
- **10:30 Computational Fluid Dynamics Analysis on the Mitigation of the Aerodynamic Force by Wind Fences**
*Yuhei Noguchi*¹, Minoru Suzuki¹
 (¹Railway Technical Research Institute, Tokyo, Japan)
- **10:35 Automatic device to start and stop an Electrical Substation depending on trains traffic**
*ILIES GHERRAM*¹, Thomas BAUSSERON¹
 (¹SNCF Reseau, La Plaine St-Denis, France)
- **10:40 Energy Demand Evaluation of a Novel Individual Heating System using Infrared Panels for Long Distance and Regional Trains**
*Riccardo Parise*¹, Sylvio Donner¹, Daniel Schiepel², Daniel Schmeling², Heribert Hellstern³, Marcel Konrad¹, Holger Dittus³, Mikhail Konstantynov², Matthias Kühn⁴, Julian Lucas⁴, Tim Berlitz⁴, Marcel Jäckle⁵
 (¹German Aerospace Center (DLR), Institute of Vehicle Concepts, Berlin, Germany, ²German Aerospace Center (DLR), Institute of Aerodynamics and Flow Technology, Göttingen, Germany, ³German Aerospace Center (DLR), Institute of Vehicle Concepts, Stuttgart, Germany, ⁴Deutsche Bahn Systemtechnik GmbH, Engineering Aerodynamics and HVAC, Munich, Germany, ⁵Deutsche Bahn Systemtechnik GmbH, Air Conditioning Test Laboratory, Minden, Germany)
- **10:45 A real-time method for eco-driving pattern generation in urban railway system**
*Piera Stella*¹, Vincenzo Galdi¹, Vito Calderaro¹, Antonio Piccolo¹, Luigi Fratelli², Giuseppe Graber²
 (¹Università degli Studi di Salerno, Salerno, Italy, ²Hitachi Rail STS, Napoli, Italy)

Day Three: Wednesday 8 June 12:00 – 13:30

Hall 10a

OP.21 Wheel rail interaction and maintenance

Session Chair: Julian Stow, University of Huddersfield

- 12:00 Long freight trains & Long-term rail surface damage: Towards digital twins that enable predictive maintenance of track**
 Visakh V Krishna¹, Qing Wu², Saeed Hossein-Nia¹, Maksym Spiryagin², **Sebastian Stichel**¹
 (¹KTH Royal Institute of Technology, Stockholm, Sweden, ²Central Queensland University, Rockhampton, Australia)
- 12:15 GOTCHA Wheelset Damage Management on the UK Class 390 Pendolino**
Simon Groom^{1, 2}, Peter Williams³, Fraser Doshi-Keeble^{3, 4}
 (¹ALSTOM, Wolverhampton, United Kingdom, ²University of Birmingham, Birmingham, United Kingdom, ³Avanti West Coast, Birmingham, United Kingdom, ⁴University of Bath, Bath, United Kingdom)
- 12:30 Laboratory investigation of effects of a friction modifier on wheel-rail dynamic contact**
Pan Zhang¹, Zhen Yang¹, Jan Moraal¹, Rolf Dollevoet¹, Arjen Zoeteman², Zili Li¹
 (¹Delft University of Technology, Section of Railway Engineering, Delft, The Netherlands, ²ProRail B.V., Utrecht, The Netherlands)
- 12:45 Experimental simulation of wheel-rail contact for optimized lifetime of the infrastructure in the rail network**
Andreas Trausmuth¹, Roman Schmid², Günter Dinhobl², Ewald Badisch¹
 (¹AC2T research GmbH, Wiener Neustadt, Austria, ²OEBB-Infrastruktur AG, Vienna, Austria)
- 13:00 A Study on Dynamic Response Character of High-Speed Railway Joint**
Xiaodi Xu¹, Shanchao Sun¹, Jinzhao Liu¹, Liubin Niu¹, Chengliang Xia¹, Zhiming Liang¹
 (¹China Academy of Railway Sciences Co. Ltd, Beijing, China)

OP.22 Autonomous operations

Session Chair: Christian Chavanel, UIC

- 12:00 Testing Strategy of the RFI Unmanned Railway Vehicle**
Eugenio Fedeli¹, Dario D'Avino², Salvatore De Simone², Giovanniluca De Vita², Marcella Di Mario², Domenico Ernesto Garrubba², Diana Serra², Giuseppe Francesco Lamanna¹, Arturo Amendola², Francesco Ripamonti³, Davide Tarsitano³, Lorenzo Barruffo⁴
 (¹RFI (Rete Ferroviaria Italiana), Roma, Italy, ²RFI (Rete Ferroviaria Italiana), Firenze, Italy, ³Politecnico di Milano – Department of Mechanical Engineering, Milano, Italy, ⁴RFI (Rete Ferroviaria Italiana), NAPOLI, Italy)
- 12:15 Shift2Rail TAURO: Technologies for the Autonomous Rail Operation**
Javier Goikoetxea¹, Carlos Zubieta², Angelo Grasso³, Benoît Bienfait⁴
 (¹Construcciones y Auxiliar de Ferrocarriles, S.A. (CAF), Beasain, Spain, ²CAF Signalling, Donostia, Spain, ³Faively Transport Italia S.p.A, Piossasco, Italy, ⁴Alstom Belgium SA, Charleroi, Belgium)
- 12:30 TC-Rail: Railways Remote Driving further experiments**
Émilie Masson¹, Philippe Richard¹, Abderraouf Boussif¹, Quentin Gadmer¹, Philippe David², Eric Robert³, Christophe Vitry³
 (¹IRT RAILENIUM, Famars, France, ²SNCF, Paris, France, ³Thales, Paris, France)
- 12:45 Safety-critical high-performance computing platforms for CV&AI-enhanced autonomous train operation**
Mikel Labayan^{1, 2}, Carles Hernández³, Fernando Eizaguirre⁴, Naiara Aginako²
 (¹CAF Signalling, Donostia, Spain, ²University of the Basque Country, Donostia, Spain, ³Universitat Politècnica de València, Valencia, Spain, ⁴Ikerlan Technology Research Centre, Arrasate/Mondragon, Spain)

OP.23 Data to improve maintenance

Session Chair: Emmanuel Laurans, SNCF

- 12:00 Using wheel impact load detector data for the identification of vehicle defects in freight wagons**
Phil Shackleton¹, Krzysztof Sztrauch¹, Bridget Eickhoff², Adam Bevan¹
 (¹University of Huddersfield, Huddersfield, United Kingdom, ²RSSB, London, United Kingdom)
- 12:15 The RFI Trackside Maintenance Management System**
Sergio Repetto¹, Eugenio Fedeli¹, Ciro Ianniello¹, Rosa Lanzarone¹, Arturo Amendola²
 (¹Rete Ferroviaria Italiana (RFI), Rome, Italy, ²RFI Consultant, Salerno, Italy)

- 12:30 Health state characterization using clustering algorithms for railway fleet maintenance**
Fabien Turgis¹, Pierre Audier², Valentin Nemoz², Rémy Marion³
 (¹IKOS Consulting, Levallois-Perret, France, ²SNCF, Saint Pierre des Corps, France, ³SNCF, Saint-Pierre des Corps, France)
- 12:45 Installing a Condition Monitoring System onto an Existing Metro Fleet**
Ian Thompson¹
 (¹SENER, Madrid, Spain)
- 13:00 Track geometry monitoring using smartphones on board commercial trains**
Franck Dadié¹, Stéphane Neveu¹, Julien Causse¹, Danilo Sorrentino¹, Gilles Saussine¹
 (¹SNCF Reseau, La Plaine St-Denis, France)

Hall 8b

OP.24 Safety, security and certification

Session Chair: Pasquale Saienni, Italian National Safety Authority

- 12:00 Building trust and confidence in AI for the Autonomous train**
 Cyril Cappi^{1, 2}, **Laurent Gardes¹**
 (¹SNCF, Paris, France, ²IRT Saint-Exupéry, Toulouse, France)
- 12:15 Trustworthy AI for safe autonomy of smart railways: directions and lessons learnt from other sectors**
Lorenzo De Donato¹, Francesco Flammini^{2, 3}, Stefano Marrone¹, Roberto Nardone⁴, Valeria Vittorini¹
 (¹Università di Napoli Federico II, Napoli, Italy, ²Mälardalen University, Västerås, Sweden, ³Linnaeus University, Växjö, Sweden, ⁴Università di Napoli Parthenope, Napoli, Italy)
- 12:30 The UIC SAFIRST Crosswinds Project**
Terry Johnson¹, Eliane Allain², Jose Conrado Martinez ACEVEDO³
 (¹RSSB, London, United Kingdom, ²SNCF, Saint-Pierre-des-Corps, France, ³Administrador De Infraestructuras Ferroviarias (ADIF), Madrid, Spain)
- 12:45 Benchmarking Safety of Connected Railway Systems: An International Case Study of the United States and Canada**
Chen-Yu Lin¹, Theodore Gerstein¹, Christopher Barkan¹
 (¹Rail Transportation and Engineering Center (RailTEC), University of Illinois at Urbana-Champaign, urbana, The United States of America)

- **13:00 Transformation of cyber/safety and security assessment**

George Bearfield^{1, 2}, Richard Thomas³, Simon Parkinson⁴, Coen van Gulijk^{1, 5, 6}

(¹Institute of Railway Research / University of Huddersfield, Huddersfield, United Kingdom, ²Rock Rail, London, United Kingdom, ³School of Computer Science / University of Birmingham, Birmingham, United Kingdom, ⁴School of Computing & Engineering/ University of Huddersfield, Huddersfield, United Kingdom, ⁵Delft University of Technology, Delft, The Netherlands, ⁶TNO, Leiden, The Netherlands)

Hall 11a

IP.11 Infrastructure maintenance and asset management

Session Chair: Ananyo Banerjee, TTCI

- **12:00 Use of 3D Laser Scanning, Deep Convolutional Neural Networks (DCNNs), & Change Detection Technology for Railway Track Safety Inspections**

J. Riley Edwards¹, Richard Fox-Ivey², **Arthur de O. Lima**¹, John Laurent², Marcus S. Dersch¹, Thanh Nguyen², Ryan Harrington¹, Ian Germoglio Barbosa¹

(¹University of Illinois at Urbana Champaign, Urbana, The United States of America, ²Pavemetrics, Quebec City, Canada)

- **12:05 Detection and prediction of earthwork failures using track geometry measurement data**

Bahar Salavati Vie Le-Sage¹, Loïc Saulnier¹, Ludovic Brand¹

(¹SNCF, Saint-Denis, France)

- **12:10 Cast Crossing design review and pattern modifications**

Bleddyn Davies¹

(¹Network Rail, Milton Keynes, United Kingdom)

- **12:15 Towards a simulation-based framework to inform the maintenance and reuse of ballast in railway tracks**

François Nader¹, Patrick Pizette^{2, 3}, Nicolin Govender^{2, 3, 4}, Daniel Nicolas Wilke⁵, Jean-François FERELLEC⁶

(¹IRT RAILENIUM, Famars, France, ²IMT Lille Douai, Lille, France, ³Univ. Lille, Institut Mines-Télécom, Univ. Artois, Junia, ULR 4515 - LGCgE - Laboratoire de Génie Civil et géoEnvironnement, Lille, France, ⁴Research Center Pharmaceutical Engineering GmbH, Graz, Austria, ⁵Department of Mechanical and Aeronautical Engineering, University of Pretoria, Pretoria, South Africa, ⁶SNCF Réseau, DGI-VA-CIR, La plaine Saint Denis Cedex, France)

- **12:20 Decision Support System for Optimal Track Maintenance Scheduling to Extend Track Maintenance Cycle, considering the Combination of Ballast Tamping and Rail Grinding**

Mami Matsumoto¹, Masashi Miwa¹

(¹Railway Technical Research Institute, Tokyo, Japan)

- 12:25 Harmonized Methodology for Infrastructure Lifetime Assessment. The UIC MILA Project**
 Francisco Cabrera Jerónimo¹, Mercedes GUTIERREZ FERRANDIZ², Clara Zamorano³, Alejandro De Benito Andrés³
 (¹ADIF, Madrid, Spain, ²International Union of Railways (UIC), Paris, France, ³Universidad Politécnica de Madrid, Madrid, Spain)
- 12:30 Consideration of intervention-free periods when determining intervention programs**
 Marcel Burkhalter¹, Bryan T. Adey¹
 (¹Institute of Construction and Infrastructure Management, ETH Zurich, Zurich, Switzerland)

Hall 11b

IP.12 Traffic and disruption management

Session Chair: Aaron Barrett, RSSB

- 12:00 Integrated Mobility Management for Freight Business Services**
 Mahnam Saeednia¹, Rolf Goossmann¹, Cem ORMESHERHUSSEIN², Scott Heath²
 (¹HaCon Ingenieurgesellschaft mbH, Hannover, Germany, ²Thales UK, London, United Kingdom)
- 12:05 Timetable and dwelling time optimization for automatic subway lines regarding the passenger demand**
 Nicolas Germain¹, Denis Mulard¹, Franck Butterlin-Fillon¹, Eric Robert¹, Stephane Lorin¹
 (¹Thales SIX GTS France, Paris, France)
- 12:10 IRS 90940 - Data exchange with Driver Advisory Systems (DAS) following the SFERA protocol (Smart communications For Efficient Railway Activities)**
 Chloé Lima-Vanzeler¹, Wim van Klaarbergen², Jeroen Workum³, Bart Van der Spiegel⁴, Nicolas Raynal⁵, Thomas Sutter⁶, Tibor Weidner⁷, Theo Vis², Harm Jonker², Sébastien Dislaire⁸, Alain Wenmaekers⁴, **Daniele Arena**⁵, Jan Hoogenraad², Thijs Assies³
 (¹SNCF Voyageurs, La Plaine Saint-Denis, France, ²NS, Utrecht, The Netherlands, ³ProRail B.V., Utrecht, The Netherlands, ⁴INFRABEL, Brussels, Belgium, ⁵UIC, Paris, France, ⁶SBB, Bern, Switzerland, ⁷Deutsche Bahn AG, Berlin, Germany, ⁸SNCF Réseau, La Plaine Saint Denis, France)
- 12:15 Modelling traffic management decisions using a hybrid machine learning and simulation approach**
 Joanna Knight¹, Andy Keane¹, Ondrej Hovorka¹
 (¹University of Southampton, Southampton, United Kingdom)
- 12:20 Train Control system for Low Traffic Density Lines Minimising Wayside Signalling**
 Alessandro Mascis¹, David Cregan²
 (¹Wabtec Corporation, Roma, Italy, ²Wabtec Corporation, Stuttgart, Germany)
- 12:25 Complex Intermodal Network Optimization**
 Giovanni Luca Giacco¹, Paolo Dell' Olmo²
 (¹Trenitalia S.p.A., Rome, Italy, ²University of Rome Sapienza Italy, Rome, Italy)

Day Three: Wednesday 8 June 16:30 – 18:00

Hall 10a

OP.25 Pantograph / catenary interaction

Session Chair: Giampaolo Mancini, Italcertifer S.p.A

- **16:30 Hybrid Simulation of Pantograph/Catenary Systems using High-Speed Pantograph Testing Machine**
Shigeyuki Kobayashi¹, Tatsuya Koyama¹, Satoshi Harada¹
(¹Railway Technical Research Institute, Tokyo, Japan)
- **16:45 Supporting Railway Electrification Projects with an Integrated Pantograph-Catenary Dynamic Analysis Tool**
Pedro Antunes¹, Joao Pombo¹, Jorge Ambrosio², Jose Rebelo¹, Jose Santos¹
(¹Institute of Railway Research / University of Huddersfield, Huddersfield, United Kingdom, ²DMEC - Instituto Superior Técnico - Universidade de Lisboa, Lisboa, Portugal)
- **17:00 Advanced Studies for Improved Current Collection Performance at Catenary Gradients**
Jose Rebelo¹, Joao Pombo¹, Pedro Antunes¹, Jose Santos¹, Hugo Magalhaes¹, Jorge Ambrosio²
(¹Institute of Railway Research, University of Huddersfield, Huddersfield, United Kingdom, ²IDMEC - Instituto Superior Técnico - Universidade de Lisboa, Lisboa, Portugal)
- **17:15 Vehicle-infrastructure interaction monitoring from train in traffic**
Stefano Derosa¹, Gunnstein Thomas Frøseth¹, Albert Lau¹, Anders Rønnquist¹
(¹Norwegian University of Science and Technology , Trondheim, Norway)
- **17:30 Intelligent shocks detector on catenary infrastructure**
Thomas SCHREVERE¹, Adrien Pedron², *Marwa Ben Taleb Ali³*, Gérard Auditeau², Gérard Blanvillain²

Hall 10b

OP.26 Condition based maintenance

Session Chair: Francesco Romano, Racumen

- **16:30 Development of Hand Brake Detection System**
Yoshitaka Kanda¹, Hiroyuki Matada¹, Tosiaki Tanaka¹
(¹Japan Freight Railway Company, Tokyo, Japan)

- **16:45 Rolling Stock Door Condition Monitoring and Automated Failure Mode Detection**

Christoph Schuessler¹, Martin Klimmek¹, Adam Kish¹, Domenic McGee¹

(¹Siemens Mobility Limited, London, United Kingdom)

- **17:00 A Framework for Locomotive Bogie Condition-based Maintenance (LOCATE)**

Farouk Balouchi¹, Adam Bevan¹

(¹Institute of Railway Research / University of Huddersfield, Huddersfield, United Kingdom)

- **17:15 Camera Optimization Study for Wayside Machine Vision Systems**

Anish Poudel¹, Matthew Witte¹, Abe Meddah¹, Brian Lindeman¹

(¹Transportation Technology Center, Inc. (TTCI), Pueblo, The United States of America)

Hall 8a

OP.27 Autonomous operations and train detection

Session Chair: H el ene Arfaoui Kaynak, SNCF

- **16:30 VOLIERA: a multi-sensor localization framework for ERTMS applications**

Sara Baldoni¹, **Michele Brizzi**¹, Federica Battisti², Luca Pallotta¹, Agostino Ruggeri³, Gianluigi Lauro⁴, Giusy Emmanuele⁵, Vincenzo Morazio⁵, Massimiliano Ciaffi⁵, Fabio Senesi⁵, Fabrizio Memmi⁶, Alessandro Valentini⁶, Stefano Neri⁶, Alessandro Neri^{1, 3}

(¹Roma Tre University, Roma, Italy, ²University of Padova, Padua, Italy, ³Radiolabs, Roma, Italy, ⁴Hitachi Rail STS, Napoli, Italy, ⁵RFI S.p.A., Roma, Italy, ⁶Trenitalia S.p.A., ROMA, Italy)

- **16:45 A simulation framework for the operation of automated small rail vehicles in rural areas**

Stephan Zieger¹, Nils Nie en¹

(¹RWTH Aachen University, Aachen, Germany)

- **17:00 Long-Distance High-Speed Railway Monitoring Using Distributed Optical Fiber Sensing Technology**

Ali Kabalan¹, Tarik Hammi¹, Gabriel Papaiz Garbini¹, Martin Ruffel¹, Abdelkader Hamadi¹, Walid Talaboulma¹

(¹SNCF R seau, La Plaine Saint Denis, France)

- **17:15 Intelligent Video Gate – Automated Detection of Wagons and Intermodal Loading Units for Image Processing and Sharing and Exploitation of Data**

Behzad Kordnejad¹, Martin Kjellin², Martin Aronsson³, Guillermo Rius Garc a⁴, Santiago Castro Vilabella⁴, Rico Wohlrath⁵, Ingrid Nordmark⁶, Roald Lengu⁷, Mats  kerfeldt⁸, Jan Bergstrand⁸

(¹KTH Kungliga Tekniska H gskolan, Stockholm, Sweden, ²Rise Research Institutes of Sweden, SVERIGE, Sweden, ³RISE Research Institutes of Sweden, Stockholm, Sweden, ⁴Indra Sistemas S.A., Madrid, Spain, ⁵DB Cargo AG, Mainz, Germany, ⁶TFK TransportForsk, Stockholm, Sweden, ⁷Hitachi Rail, Genova, Italy, ⁸Trafikverket, -, Sweden)

- **17:30 Remote driving and command of trains: The Shft2Rail approach**

Javier Goikoetxea¹, Georg Hemzal², Andrea Mazzone³

(¹Construcciones y Auxiliar de Ferrocarriles, S.A. (CAF), Beasain, Spain, ²Thales Deutschland GmbH, Berlin, Germany, ³Alstom Schweiz AG, Zurich, Switzerland)

Hall 8b

OP.28 Testing, acceptance and electromagnetic compatibility

Session Chair: Kazuki Nakamura, Railway Technical Research Institute (RTRI)

- **16:30 Assessment of a Remote Diagnostic system through EMC modelling**

Juan José MUNOZ VARGAS¹, Ahmad HAIDAR², Clément REBOUL¹, Emmanuel KABBAJ¹, François CRUSSON³

(¹SNCF Réseau, La Plaine Saint Denis, France, ²ALTRAN, Paris, France, ³SNCF VOYAGEURS - DIRECTION DU MATÉRIEL, Le mans, France)

- **16:45 The Standardization of Experimental Protocol for Safety assessment of EMF (STEPS EMF) - A feasibility study for standardization of research designs and protocols for safety assessment of extremely high-frequency electromagnetic fields**

Masateru Ikehata¹, Sachiko Yoshie¹, Akira Ushiyama², Kenji Hattori³, Keiji Wada⁴, Yukihisa Suzuki⁴

(¹Railway Technical Research Institute (RTRI), Tokyo, Japan, ²National Institute of Public Health, Wako, Saitama, Japan, ³Meiji Pharmaceutical University, Tokyo, Japan, ⁴Tokyo Metropolitan University, Hachioji, Tokyo, Japan)

- **17:00 Towards zero on-site testing in TCMS: Case study of Simulation and Virtualization Framework in CONNECTA-2**

Imanol de Arriba¹, **Miguel Angel Sicilia²**, Fabian Schneider³, Jan Svanda⁴, Vitali Schneider⁴

(¹CAF R&D, Iturrioz 26, 20200, Beasain, Spain, ²CETEST, Lazkaibar s/n, 20200, Beasain, Spain, ³Alstom Group, Am Rathenaupark, 16761, Hennigsdorf, Germany, ⁴Siemens Mobility GmbH, Siemenspromenade 4, 91058, Erlangen, Germany)

- **17:15 Deep Hazardous Events Detection in Top-Down Fish-Eye Images for Railway Applications**

Olivier Laurentin¹, Anthony Fleury², Sébastien Ambellouis³, Ankur Mahtani¹, Sanaa Chafik¹

(¹FCS Railenium, Famars, France, ²IMT Lille Douai, Lille, France, ³Gustave Eiffel Université, Villeneuve d'Ascq, France)

IP.13 Social value and new markets

Session Chair: Luisa Moisio, RSSB

- **16:30 Do Adaptive Learning tools add value to the Railway?**
*Mark Lowten*¹
 (¹Thales UK, London, United Kingdom)
- **16:35 Measuring and monetising social impacts in GB rail - the Common Social Impact Framework for Rail and Rail Social Value Tool - Summary of research**
*Liz Holford*¹
 (¹Network Rail Infrastructure Ltd, Milton Keynes, United Kingdom)
- **16:40 Innovative Sustainability studies supporting an integrated Stakeholder Engagement process to enable the capability of rail infrastructures to generate shared value for territories and communities involved by projects**
*Nicoletta Antonias*¹, Giusy Elena Caci¹, Almona Tani¹, Romana Paglino¹
 (¹Italferr SpA, Rome, Italy)
- **16:45 Inclusive Stations: Impact of Homelessness on Railways**
*Lucie ANDERTON*¹, Clement GAUTIER¹, Virginie PAPILLAULT¹
 (¹International Union of Railways (UIC), Paris, France)
- **16:50 LinX4Rail: Towards the European Railway System Architecture**
 Pierre-Etienne Gautier¹, *Marc Sango*², Jean-Baptiste Simonnet², Fabien Létourneaux², Christophe Cheron², Judicael Dehotin Adounvo¹
 (¹SNCF Réseau, La Plaine Saint Denis, France, ²SNCF Innovation & Research, La Plaine Saint-Denis, France)
- **16:55 Introducing The Birmingham Rail Innovation Process: a framework for unlocking innovation in the rail sector**
*Alexander BURROWS*¹, Marcelo Blumenfeld¹, Clive Roberts¹

IP.14 Zero carbon and energy efficiency

Session Chair: Hiroaki Morimoto, Railway Technical Research Institute (RTRI)

- 16:30 Designing and delivering rail decarbonisation strategies: assessing the Birmingham Decarbonisation Maturity Matrix**
 Alexander BURROWS¹, **Marcelo Blumenfeld**¹, Stuart Hillmansen¹
 (¹University of Birmingham, Birmingham, United Kingdom)
- 16:35 Battery train: an optimal decarbonization solution**
Bogdan Vulturescu¹, Matthieu Renault²
 (¹SNCF , La Plaine Saint Denis, France, ²SNCF VOYAGEURS - DIRECTION DU MATÉRIEL, Le mans, France)
- 16:40 Alternative powertrains for shunting locomotives – analysis of feasibility and limitations**
Johannes Pagenkopf¹, Marcel Konrad¹, Mathias Böhm¹, Victoria Carolin Jäger¹, Holger Dittus²
 (¹DLR Institute of Vehicle Concepts, Berlin, Germany, ²DLR Institute of Vehicle Concepts, Stuttgart, Germany)
- 16:45 Re-using recovered ballast: a laboratory investigation**
Akash Gupta¹, Taufan Abadi¹, Madhusudhan B. N.¹, Louis Le Pen¹, Antonios Zervos¹, William Powrie¹
 (¹University of Southampton, Southampton, United Kingdom)
- 16:50 Isolated Energy Storage System for DC Railway Electrification**
Joseph Fabre^{1, 2}, Philippe Ladoux², Hervé Caron³, Tony Letrouvé⁴
 (¹SCLE-SFE, TOULOUSE, France, ²LAPLACE – Laboratoire PLAsma et Conversion d'Énergie, Toulouse, France, ³SNCF Réseau, La Plaine Saint Denis, France, ⁴SNCF Innovation & Research, La Plaine Saint-Denis, France)
- 16:55 Measuring-Simulative Analysis of a Local Transport Network to Increase Energy Efficiency by Using Wayside Energy Storage Devices**
Philip Otto¹, Peter Gratzfeld¹
 (¹Karlsruhe Institute of Technology (KIT), Institute of Vehicle System Technology, Karlsruhe, Germany)
- 17:00 Energy Efficient Architecture of Power Supply for Field Devices and Controllers of the RFI Computer-Based Interlocking**
Giuseppe Panariello¹, Dario Di Ruzza¹, Mauro Canigliula¹, Simone Palazzo², Giovanni Busatto², Enzo De Santis²
 (¹RFI S.p.A., Roma, Italy, ²Università degli studi di Cassino e del Lazio Meridionale, Cassino, Italy)

Day Four: Thursday 9 June 08:30 – 09:50

Hall 10a

OP.29 Passenger flow, information and ticketing

Session Chair: Jincheng Ni, SNCF

- 08:30 Agent-based quantification of passenger movement at the platform-train interface subject to social distancing during the COVID-19 pandemic**
 Samuel Hayes¹, **David Fletcher¹**, John Charlton¹, Paul Richmond¹
 (¹The University of Sheffield, Sheffield, United Kingdom)
- 08:45 Wide-area passenger flow evaluation by integrating smartphone location big data and railway operation data**
Yusuke Konishi¹, Ryo Nishioka², Sei Sakairi¹
 (¹East Japan Railway Company, Saitama, Japan, ²East Japan Railway Company, Tokyo, Japan)
- 09:00 Digital Twins and Data Analysis for Crowd Management in High-Capacity Stations**
 Boussad Addad¹, Bertrand Duqueroie¹, **Stephane Lorin¹**, Aneta Tumilowicz², Claudio Cavalletti³, Artur Fojud⁴
 (¹Thales SIX GTS France, Paris, France, ²NETWORK RAIL, London, United Kingdom, ³Hitachi Rail STS, Genova, Italy, ⁴Polish State Railways (PKP), Warsaw, Poland)
- 09:15 Sharing Is Caring: Redefining the Smart Ticket to Facilitate Technical Innovation Within Smart Ticketing Infrastructures**
Joseph Preece¹, John Easton¹
 (¹University of Birmingham, Birmingham, United Kingdom)
- 09:30 How UIC standardisation facilitates the digitalisation of Passenger Rail Distribution**
David SARFATTI¹
 (¹International Union of Railways (UIC), Paris, France)

OP.30 Safety, security and certification

Session Chair: Simone Morgagni, SNCF

- 08:30 Use of numerical tools dedicated to fire safety engineering for the rolling stock**
*Guillaume Craveur*¹
 (¹SNCF, Le Mans, France)
- 08:45 Puncture Resistance of Railroad Tank Wagons Used in the Transportation of Hazardous Materials - Comparison of requirements and performance between the EU and the USA**
*Przemyslaw Rakoczy*¹
 (¹Railway Research Institute, Warsaw, Poland)
- 09:00 “The handover management of the Metro Transportation System of Riyadh, KSA – From Construction to Operation & Maintenance of a new mega infrastructure- The experience of an Independent Safety Assessor”**
*Antonio Castano*¹, Marco Corvino¹, Giampaolo Mancini¹, Carmine Zappacosta¹, Marco Magnarosa¹, Luca Beccastrini¹, Andrea Gatti², Alessandro Gaetani²
 (¹Italcertifer spa (Gruppo Ferrovie dello Stato), Firenze, Italy, ²Italcertifer S.P.A. Gruppo Ferrovie dello Stato Italiane, Florence, Italy)
- 09:15 From Nobel Prize(s) to Safety Risk Management: How to Identify Latent Failure Conditions in the Railway Safety Risk Management Practices” “How to Identify Latent Failure Conditions in the Railway Safety Risk Management Practices”**
Sanjeev Kumar Appicharla^{1, 2}
 (¹IET, London, United Kingdom ²INCOSE, Somerset, United Kingdom)
- 09:30 Development of a new Safety Risk Model**
*Chris Harrison*¹, Jonathan Gregory¹, Xiaocheng Ge¹
 (¹RSSB, London, United Kingdom)

OP.31 Signalling and communications systems

Session Chair: Fabio Senesi, Rete Ferroviaria Italiana S.p.A

- 08:30 Development of Millimeter Wave Radio Equipment Which Can Realize High-Capacity Wireless Communication for the Shinkansen**
*Tomoyuki Tange*¹, Yoshihiro Matsumura¹, Takeshi Nishiyama¹, Eishi Sasaki¹, Tomoki Arakawa², Hiroyuki Igura²
 (¹Central Japan Railway Company, Nagoya, Japan ²NEC Corporation, Tokyo, Japan)

- 08:45 Vital Architectures of the RFI Computer-Based Interlocking Standard Platform**
 Giuseppe Panariello¹, **Mario Barbareschi**¹, Ciro Donnarumma¹, Salvatore De Simone¹
 (¹RFI S.p.A., Roma, Italy)
- 09:00 Communication platform for testing of novel technologies for railway traffic management systems**
Gabriele Cecchetti¹, Cristian Uliano², Anna Lina Ruscelli¹, Jeronimo Padilla³, Fabio Manzoni⁴, Esteban Moreno⁵, Airy Magnien⁶, Renzo Canepa⁷, Simone Petralli⁷, Jose Bertolin⁸
- 09:15 SNCF paving the way towards FRMCS adoption: a new era for railway communications**
Sébastien Perrin¹, Stéphane Guillemaut¹, Jérôme Madec², David Sanz¹, Pierre-Yves Petton³, Pascal Deliege³
 (¹SNCF Réseau, La Plaine Saint Denis, France, ²SNCF Réseau, Saint Denis, France, ³SNCF, Saint-Denis, France)
- 09:30 On-Board Train Integrity as enabler for ETCS L3**
Insaf Sassi¹, Salvatore Danilo Iovino², Nicola Ricevuto³, Alessa Isberner⁴, Benedikt SCHEIER⁵, Gorka De Miguel Aramburu⁶, Francisco Parrilla Ayuso⁷, Francesco Inzirillo⁸, Peter Gurnik⁹
 (¹IRT RAILENIUM, Famars, France, ²Hitachi Rail STS, Torino, Italy, ³Hitachi Rail STS, Napoli, Italy, ⁴German Aerospace Center (DLR), Berlin, Germany, ⁵German Aerospace Center (DLR), Braunschweig, Germany ⁶CEIT, San Sebastian, Spain ⁷Indra Sistemas S.A., Madrid, Spain ⁸Mermecc S.p.A (MMC), Monopoli, Italy ⁹AŽD Praha s.r.o, Prague, The Czech Republic)

Hall 8b

OP.32 Rolling stock maintenance and design

Session Chair: Valery Versailles, SNCF

- 08:30 Tilt Control System using Active Torsion-Bar with Improved Fail-safe Performance**
Akihito Kazato¹, Takashi Kojima¹, Kotaro Ishiguri¹, Tomoyoshi Ide²
 (¹Railway Technical Research Institute, Tokyo, Japan, ²Kawasaki Railcar Manufacturing Co., Ltd., Hyogo, Japan)
- 08:45 Mechanical, thermal and electric measurements on an electric motor for a braking rheostat cooling system**
Leonardo Cecchi¹, Sega Valentino¹, Salvatore Rizzo¹, David Russo¹, Enrico Marella¹, Lorenzo Flaccomio¹, Matteo Nobili¹
 (¹Trenitalia, Florence, Italy)
- 09:00 Prediction of axle fatigue life based on field measurements**
Michele Maglio¹, Elena Kabo¹, Anders Ekberg¹, Pär Söderström², Daniele Regazzi³, Steven Cervello³
 (¹CHARMEC - Chalmers University of Technology, Göteborg, Sweden, ²SJ AB, Stockholm, Sweden, ³Lucchini RS, Lovere, Italy)

- **09:15 Extension of the life of rolling stock based on a better understanding of physical phenomena**
Loic Ancian¹, Julien Fondrat¹, Nicolas Vincent¹, Philippe Négrier², Jean-Christophe Renard², Brice Nélain¹, **Pascal Bouvet¹**
(¹VIBRATEC, Ecully, France; ²Sytral, Lyon, France)

Hall 11a

IP.15 Asset management and interaction

Session Chair: Anup Chalisey, RSSB

- **08:30 Implementing track geometry deterioration modelling into asset management practices**
Mikko Sauni¹, Heikki Luomala¹, Pauli Kolisoja¹
(¹Tampere University, Tampere, Finland)
- **08:35 Game-changing infrastructure inspection and maintenance: embedding AI processing of data captured from trains**
Rebeka Sellick MEng CEng FIMechE FIET¹, Aaron Hoye BSc², Nicholas Smith³, James Sweeney CEng MSc(Eng) MIMechE⁴, Damon Goulding BA⁵
(¹Cordel.ai Ltd, London, United Kingdom, ²Cordel.ai, Newcastle, Australia, ³Cordel.ai Group, London, United Kingdom, ⁴Network Rail, Milton Keynes, United Kingdom, ⁵Australian Rail Track Corporation, Hilton, Australia)
- **08:40 Remote Monitoring of Railway Bridges: An overview of the research activities in RFI. An overview of the activities currently being carried out by RFI: expected output and preliminary results.**
Franco Iacobini¹, **Andrea Vecchi¹**, Alberto Mauro¹, Riccardo Aiuti¹
(¹RFI - Technical Department, Rome, Italy)
- **08:45 Digital continuity of heterogeneous data using a digital twin for infrastructure's asset management**
Moussa ISSA¹, Guillaume Ducellier², Sebastien REMY¹
(¹UTT, Troyes/champagne-ardenne , France, ²UTT, Troyes/Champagne-ardenne, France)
- **08:50 A Machine Learning Approach for Real Time Wheel/Rail Interface Friction Estimation**
Michael Watson¹, Alan Martin¹, Morinoye Folorunso¹, **Jacob Whittle¹**, Graham Sutherland², Roger Lewis¹
(¹The University of Sheffield, Sheffield, United Kingdom, ²Ikon Risk Consulting, Cambridge, The United States of America)
- **08:55 Fuzzy Logic Artificial Intelligence Hybrid Approach to Mitigation of Climate Change Driven Track Buckling**
Iwo Slodczyk¹, David Fletcher¹, Inna Gitman², Brian Whitney³
(¹The University of Sheffield, Sheffield, United Kingdom; ²University of Twente, Enschede, The Netherlands, ³Network Rail Infrastructure Ltd, Milton Keynes, United Kingdom)

IP.16 Passenger movements and multi-modal travel

Session Chair: Martin Howell, Worldline / Zipabout

- **08:30 Shift2Rail IP4 – Building an interoperable multimodal ecosystem**
Marco Ferreira¹, Juan Castro², Souheir Mili³, Anna Perras⁴
 (¹Thales Portugal SA, Lisbon, Portugal, ²Indra Sistemas S.A., Madrid, Spain, ³CS Group, Toulouse , France, ⁴HaCon Ingenieurgesellschaft mbH, Hannover, Germany)
- **08:35 A Passenger Flow Simulation in Railway Station with Applying Movie Processing and OD Flow Estimation Model**
Munenori Shibata¹, Mitsutaka Isizuki¹, Ginga Tsushima¹, Masakazu Yamamoto¹
 (¹Railway Technical Research Institute, Tokyo, Japan)
- **08:40 Developing a 5G-enabled crowd management and passenger navigation solution for post-COVID-19 multi-modal travel**
 John Easton¹, **Joseph Preece**¹, Mohamed Samra¹, Richard Thomas¹, Fredi Nonyelu²
 (¹University of Birmingham, Birmingham, United Kingdom, ²Briteyellow, Cranfield, United Kingdom)
- **08:45 Evaluating safety signage systems in train stations: a qualitative and quantitative methodology**
Elise Grison¹, Simone Morgagni¹, Samuel Aupetit², Sara Escaich²
 (¹SNCF Direction of Innovation and Research, Paris, France, ²Ergocentre, Orléan, France)
- **08:50 RIDE2RAIL: Integrating ridesharing for attractive multimodal rail journeys**
David Golightly¹, Marco Comerio², Cristian Consonni³, Carlo Vaghi⁴, Gabrieli Pistilli⁴, Giuseppe Rizzi⁵, Guido DiPasquale⁵, Roberto Palacin¹, Ludovico Boratto³, Mario Scrocca²
 (¹Newcastle University, Newcastle, United Kingdom, ²CEFRIEL, Milan, Italy, ³eurecat, barcelona, Spain, ⁴FIT Consulting, Milano, Italy, ⁵UITP, Brussels, Belgium)
- **08:55 One-Station-Ahead Forecasting of Dwell Time, Arrival Delay and Passenger Flows on Trains Equipped with Automatic Passenger Counting (APC) Device**
Rémi Coulaud¹, ², Christine Keribin², Gilles Stoltz²
 (¹SNCF Transilien, Saint-Denis, France, ²Université Paris-Saclay, CNRS, Inria, Laboratoire de mathématiques d'Orsay, Orsay, France)
- **09:00 A Study on Station Congestion Monitoring System for Smart Service Operation Using Mobile Robot**
Yuki Sakakibara¹, Takeshi Saito¹, Kazuo Ishima², Sei Sakairi¹, Tetsuya Mita¹
 (¹East Japan Railway Company, Saitama-shi Kita-ku Nisshin-cho, Japan, ²JR East Consultants Company, Tokyo, Japan)

Day Four: Thursday 9 June 12:00 – 13:30

Hall 10a

OP.33 Rolling stock design

Session Chair: Marco Sacchi, Hitachi Rail Italy S.p.A

- 12:00 Improvement of the Wireless Power Transfer System for Railway Vehicles**
*Hiroshi Yoda*¹, Keigo Ukita¹, Takayuki Kashiwagi¹, Yasuaki Sakamoto¹
 (¹Railway Technical Research Institute, Tokyo, Japan)
- 12:15 Optimal Vibration-Absorber Design: A Case Study on Railway Trailing Arm Bush**
*Cenxiao Qu*¹, Yuan Li¹, Jason Zheng Jiang¹, Simon Neild¹, Gareth Tucker², Malcolm Smith³, Neil Houghton³, Andrew Gleeson⁴, Sharon Odetunde⁴
 (¹University of Bristol, Bristol, United Kingdom, ²University of Huddersfield, Huddersfield, United Kingdom, ³University of Cambridge, Cambridge, United Kingdom, ⁴RSSB, London, United Kingdom)
- 12:30 Long Travel Draft System Energy Management**
*Adam Klopp*¹, Jack Schultz¹, Matt DeGeorge¹
 (¹Transportation Technology Center Inc. , Pueblo, The United States of America)
- 12:45 Development of double helical gear unit for Tokaido-Shinkansen achieving both reliability improvement and maintenance workload reduction**
*Yoshinori Minami*¹
 (¹Central Japan Railway Company, Aichi, JAPAN, Japan)
- 13:00 Extending the lifetime of journal bearings for high-speed trains**
*Riccardo Licciardello*¹, Gintautas Bureika², Bert Rosenheinrich³, Olalla Sánchez-Sobrado⁴, Patrick Schneider⁵, Sina Shahidzadeh Arabani⁶, Cristian Ulianov⁷, Philipp Wirth³

Hall 10b

OP.34 Optimising asset use

Session Chair: Viabhav Puri, RSSB

- **12:00 User Needs for the Development of New Methodologies and R&D Tools for Building a Railway Digital Map and for the Experimental Performance Evaluation of On-Board Subsystems**

Giusy Emmanuele¹, Massimiliano Ciaffi¹, Omar Garcia Crespillo², Alessandro Neri³, Alessia Vennarini³, Agostino Ruggeri³, Juliette Marais⁴, Susana Herranz de ANDRES⁵, Jorge Ignacio IGLESIAS DIAZ⁵, Daniel MOLINA MARINAS⁵, Ricardo CAMPO CASCALLANA⁵, Antonio Águila Martínez-Casariago⁶, Jose Conrado Martinez ACEVEDO⁷, Fabio Senesi¹, Salvatore Sabina⁸

(¹Rete Ferroviaria Italiana (RFI), Rome, Italy, ²Institute of Communication and Navigation, German Aerospace Center (DLR), Oberpfaffenhofen, Germany, ³Radiolabs (RDL), Rome, Italy, ⁴COSYS-LEOST, Univ Gustave Eiffel, IFSTTAR, Univ Lille, Villeneuve d'Ascq, France, ⁵Centro de Estudio Y experimentacion Obras Publicas (CEDEX), Madrid, Spain, ⁶Ingeniería y Economía del Transporte SME MP SA (INECO), Madrid, Spain, ⁷Administrador De Infraestructuras Ferroviarias (ADIF), Madrid, Spain, ⁸Hitachi Rail STS (STS), Genova, Italy)

- **12:15 Further development of the Red Aspect Approaches to Signals (RAATS) toolkit**

Chris Harrison¹, Xiaocheng Ge¹, Julian Stow², Rawia El Rashidy², Matthew Newall²

(¹RSSB, London, United Kingdom, ²Institute of Railway Research, University of Huddersfield, Huddersfield, United Kingdom)

- **12:30 Optimising the Design, Maintenance and Operation of Branch Lines**

Julian Stow¹, Andrew Smith², Chris Nash², Manuel Ojeda Cabral², Anthony Whiteing²

(¹University of Huddersfield, Huddersfield, United Kingdom, ²Institute of Transport Studies, University of Leeds, Leeds, United Kingdom)

- **12:45 Realising more from rolling stock and infrastructure assets using Differential Permissible Speeds**

Paul Gray¹

(RSSB, United Kingdom¹)

Hall 8a

OP.35 Disruption and capacity management

Session Chair: Francois Ramond, SNCF

- **12:00 Real-time Crew Rescheduling with Pre-learned Scheduling Constraints and Disruption Impact**

Jie Yuan¹, Daniel Jones¹, Gemma Nicholson¹

(¹University of Birmingham, Birmingham, United Kingdom)

- 12:15 Evaluating the Effectiveness of Virtual and Moving Block Control Systems on a Long and Complex North American Freight Rail Corridor**
Geordie Roscoe¹, Tyler Dick¹
 (¹RailTEC - University of Illinois at Urbana-Champaign, Urbana, The United States of America)
- 12:30 SaviRPM – modelling rail performance**
Jonathan Hyde¹, Aidan Slingsby², Helen Wilkinson¹, Chris Rees¹, Eleanor Baker¹, Robert Staunton³, Giulia Lorenzini³
 (¹Risk Solutions, Warrington, United Kingdom, ²City, University of London, London, United Kingdom, ³RSSB, London, United Kingdom)
- 12:45 Comparison of Evaluation Methods of Train Delay to Improve Punctuality**
Taketoshi Kunimatsu¹, Aiko Kunisaki¹, Kosuke Nakabasami¹
 (¹Railway Technical Research Institute (RTRI), Tokyo, Japan)
- 13:00 Simulating the Punctuality Impacts of Early Freight Train Departures**
Ingrid Johansson¹, Hans Sipilä¹, Carl-William Palmqvist^{1,2}
 (¹KTH Royal Institute of Technology, Stockholm, Sweden ²Lund University, Lund, Sweden)

Hall 8b

OP.36 Safety operations and human factors

Session Chair: Philippa Murphy, RSSB

- 12:00 Using virtual reality to evaluate the effects of two safety systems at pedestrian track crossings on human behaviour**
Elise Grison¹, Simone Morgagni¹, Samuel Aupetit², Sara Escaich²
 (¹SNCF Direction of Innovation and Research, Paris, France, ²Ergocentre, Orléan, France)
- 12:15 Physiological investigation of train drivers' operations for performance and safety optimisation**
Allan ARMOUGUM¹, Marine LEVEILLE¹, Olivier SALVON², Tom ROUSSEAU³, Nicolas Renoir¹
 (¹SNCF, Direction Technologies, Innovation & Projets Groupe, la Plaine Saint Denis, France, ²SNCF Voyageurs, Traction TGV Sud-Est, UP Voyages BFC, Dijon, France, ³SNCF, Direction Technologies, Innovation & Projets Groupe, La Plaine Saint Denis, France)
- 12:30 Research on how to upgrade rail safety focusing on “things that go right” as well as “things that go wrong”**
Kazumasa OYAMA¹, Jun SAKANIWA¹, Masato KURATANI¹, Hiroaki SATO², Ken KUSUKAMI¹
 (¹East Japan Railway Company, Tokyo, Japan, ²JR East Transportation Service, Tokyo, Japan)

- **12:45 Adaptive Deep Knowledge Tracing Across Domains in Rail**

Rui XUE¹, Guohua LI², Xiaoning MA²

(¹China Academy of Railway Sciences Co. Ltd, Beijing, China, ²China Academy of Railway Sciences Co. Ltd., Beijing, China)

- **13:00 Reducing human errors using virtual reality: simulation of an inter-professional context to reinforce non-technical skills**

Nicolas Renoir¹, Olivier SALVON², Catherine LE GOFF³, Pierre GIBBE⁴, Stella DUVENCI LANGA⁵, Michaël HERNANDEZ⁶, Fabien Létourneaux¹

(¹SNCF Innovation & Research, La Plaine Saint-Denis, France, ²SNCF Voyageurs, La Plaine Saint-Denis, France, ³SNCF Réseau, La Plaine Saint-Denis, France, ⁴Université de l'Ingénierie, La Plaine Saint-Denis, France, ⁵SNCF Réseau, La Plaine Saint Denis, France, ⁶SNCF Railway Test Agency, Vitry sur Seine, France)

Hall 11a

IP.17 Rolling stock design and light weighting

Session Chair: Simon Iwnicki, University of Huddersfield

- **12:00 Wireless communications in future TCMS: Automatic Train Inauguration over Wireless Train Backbone**

Igor Lopez¹, Hector Hernandez²

(¹R&D Department, Construcciones y Auxiliar de Ferrocarriles, Beasain, Spain, ²R&D Division, Software Department 3, Moxa Networking, Unterschleissheim, Germany)

- **12:05 Verification of lateral force reduction effect by the steering bogie system with active yaw damper**

Ayumi Amano¹, Yasuhiro Umehara¹, Takashi Kojima¹, Takayuki Tanaka¹, Takatoshi Hondo¹, Yasuyori Sato², Hisako Negishi²

(¹Railway Technical Research Institute, Tokyo, Japan, ²East Japan Railway Company, Tokyo, Japan)

- **12:10 Test in commercial service of a laminate composite structural part for a Electric Multi Unit rolling stock**

Daniel Chavance^{1, 2}, Patrick Jumin^{3, 4}, Tanguy Choupin^{5, 6}, **Sylvain Livonnet^{2, 7}**

(¹SNCF, VITRY SUR SEINE, France, ²SNCF-AEF, Paris, France, ³SNCF, Le Mans, France, ⁴CIM, Le Mans, France, ⁵SNCF, Saint-Denis, France, ⁶DTIPG, Paris, France, ⁷SNCF, Paris, France)

- **12:15 Automated Derivation of CAD Designs from Topology Optimization Results**

Christian Gomes Alves¹, Yannick Barthel¹, Matthias Halsner¹

(¹German Aerospace Center (DLR), Stuttgart, Germany)

- **12:20 Impact resistance of fibre reinforced composite railway freight tank wagons**

George Edward Street¹, Preetum Jayantilal Mistry¹, Michael Sylvester Johnson¹

(¹University of Nottingham, Nottingham, United Kingdom)

- **12:25 Analysis, Development and Control of Dual Three-Phase Permanent Magnet Synchronous Motor for Fuel Cell and Battery Trains**

Nursaid Polater¹, Pietro Tricoli¹

(¹University of Birmingham, Birmingham, United Kingdom)

Hall 11b

IP.18 Competition and demand

Session Chair: Alexander Burrows, University of Birmingham

- **12:00 The journey towards whole system decision making**

Andy KIRWAN¹, Jude Carey², Jan COCQUYT³, Donatella Fochesato⁴, Clara Grajal Marino⁵, Vivianne KARLSSON⁶, Richard Mair⁷, Vesa Männistö⁸

(¹Network Rail, London, United Kingdom, ²Irish Rail, Dublin, Ireland, ³INFRABEL, Antwerp, Belgium, ⁴RFI S.p.A., Roma, Italy, ⁵ADIF, Madrid, Spain, ⁶Trafikverket, Stockholm, Sweden, ⁷OEBB, Vienna, Austria, ⁸Väylävirasto, Helsinki, Finland)

- **12:05 Transport Demand in a Post-Pandemic Age: Challenges and Opportunities for Rail**

John Armstrong¹, Simon Blainey¹, John Preston¹

(¹University of Southampton, Southampton, United Kingdom)

- **12:10 Substitution path between air and rail in Europe: a measure of demand drivers**

Isabelle Laplace¹, **Chantal Latge-Roucolle¹**, Nathalie Lenoir¹, Pierre Arich¹, Annika Paul², Tanja Bolic³, Sebastien Parenty⁴

(¹ENAC (The French Civil Aviation University), Paris, France, ²Bauhaus Lufthart, Taufkirchen, Germany, ³University of Westminster, London, United Kingdom, ⁴ENAC (The French Civil Aviation University), Toulouse, France)

- **12:15 Seats allocation optimization for high-speed train services**

Valentina Pozzoli¹, **François Ramond¹**, David De Almeida¹, Joanne Champeaux², Gwendeline Denos Hellot²

(¹SNCF Innovation and Research, Paris, France, ²SNCF Voyages , Paris, France)

- **12:20 An evaluation approach to capacity enhancement of Virtual Coupling Operations**

Alican Erdem¹, Marcelo Blumenfeld¹, Lei Chen¹, Clive Roberts¹

(¹Birmingham Centre for Railway Research and Education, University of Birmingham, Birmingham, United Kingdom)

- **12:25 Success factors in public-private partnership of high-speed railway infrastructures: elements for improvement**

Mario González-Medrano¹, José-María Rotellar-García¹

(¹Universidad Francisco de Vitoria, Madrid, Spain)

Day Four: Thursday 9 June 14:45 – 16:15

Hall 10a

OP.37 Level crossing safety

Session Chair: Michael Woods, RSSB

- 14:45 Improving safety by connecting level crossings with cars - Proof Of Concept: Advanced Driver Assistance System Simulation**
*Parinaz Bazeghi Kisomi*¹, Francis Bedel¹, Luc Feuvrier², Benoît Herail³
 (¹International Union of Railways (UIC), Paris, France, ²Dassault Systèmes , Vélizy, France, ³Dassault Systèmes , Paris, France)
- 15:00 Safety considerations for railway crossings in a post-COVID world**
*Gregoire Larue*¹, Christopher Watling^{1,2}
 (¹Queensland University of Technology QUT, Brisbane, Australia, ²The University of Southern Queensland, School of Psychology and Wellbeing, Ipswich, Australia)
- 15:15 Efforts to Use Environmentally Friendly Recycled Batteries**
*Masashi Higuchi*¹, Koji Sugiura¹
 (¹East Japan Railway Company, Tokyo, Japan)

Hall 10b

OP.38 Disaster and extreme event countermeasures

Session Chair: Lucie Anderton, UIC

- 14:45 Development of the Evaluation Method of the Risk of Debris Flow and its Introduction into Train Operation Control**
*Hiroki Kawakami*¹, Hiroki Hayashi¹, Motohiro Ohki¹
 (¹Central Japan Railway Company, Nagoya, Japan)
- 15:00 System dynamics based risk coupling model of railway systems in India under flood hazard using spatio-temporal satellite data based InSAR coherence technique**
 Dheeraj Joshi^{1, 2}, *Ram Avtar*³, Alok Kansal², Ajay Goyal², Naresh Lalwani², Manjul Mathur², Prashant Mishra⁴, Shikha Saini², Vivek Joshi⁵, Chandi Prasad Nanda⁵
 (¹The University of Tokyo, Tokyo, Japan, ²Indian Railways, New Delhi, India, ³Hokkaido University, Sapporo, Japan, ⁴High Speed Rail Innovation Centre, New Delhi, India, ⁵National Rail & Transportation Institute, Vadodara, India)

- 15:15 Experimental Test Results of Radar Detection System for Monitoring of Railway Lines under High Risk of Landslides installed in Scala di Giocca**
*Eugenio Fedeli*¹, Antonio Rossetti², Mirco Gonnelli³, Luca Luciani⁴, Davide Tullio⁵, Marco Lunari⁴
 (¹Rete Ferroviaria Italiana (RFI), Roma, Italy, ²Rete Ferroviaria Italiana (RFI), Bologna, Italy, ³Rete Ferroviaria Italiana (RFI), Firenze, Italy, ⁴Sysco SPA, Roma, Italy, ⁵Radar Systems srl, Roma, Italy)
- 15:30 Numerical modelling of slab track long-term performance and its deterioration due to traffic and extreme weather scenarios**
*Samuel Matias*¹, Patrícia Ferreira¹
 (¹Instituto Superior Técnico, Lisbon, Portugal)
- 15:45 Quantifying the impact of heat and climate change on the London Underground infrastructure**
*Sarah Greenham*¹, Andrew Quinn¹, Emma Ferranti¹
 (¹University of Birmingham, Birmingham, United Kingdom)

Hall 8a

OP.39 Rolling stock design

Session Chair: Gareth Tucker, University of Huddersfield

- 14:45 Development of Battery-Powered Self-Traction System for N700S Shinkansen High Speed Train**
*Kenji Sato*¹, Takafumi Fukushima¹, Hirokazu Kato¹
 (¹Central Japan Railway Company, Aichi, Japan)
- 15:00 MonoCab – Simulation-based development of a running gear concept for monorail vehicles**
*Dominic Stork*¹, Sönke Lück¹, Martin Griese², Rolf Naumann¹, Thomas Schulte²
 (¹FH Bielefeld University of Applied Sciences, Interaktion 1, 33619 Bielefeld,, Bielefeld, Germany, ²Ostwestfalen-Lippe University of Applied Sciences and Arts, 32657 Lemgo, Germany)
- 15:15 Improved system reliability of rolling stock 25kV AC traction through an encapsulated earth screened approach**
*Thomas Moore*¹, Tony Yang², Robert Phillipotts¹, Wesley Gilbert²
 (¹TE Connectivity, Swindon, United Kingdom ²TE Connectivity, Shanghai, China)
- 15:30 Following stage of development for next-generation Shinkansen test train ALFA-X**
*Sunghun KIM*¹, ², Osamu KAWAKAMI¹, Masaaki HARA¹, Takayuki MATSUMOTO¹
 (¹Research and Development Center of East Japan Railway Company, Nisshin-cho, Kita-ku, Saitama-shi, Saitama-pref, Japan ²Railway Technical Research Institute, Tokyo, Japan)

OP.40 Lightweight vehicles

Session Chair: Clemente Guerriero, Trenitalia S.p.A

- 14:45 The design and development of a lightweight composite railway axle**
Preetum Jayantilal Mistry¹, Michael Sylvester Johnson¹, Stefano Bruni², Andrea Bernasconi², Michele Carboni², Steven Cervello³
 (¹University of Nottingham, Nottingham, United Kingdom ²Politecnico di Milano – Department of Mechanical Engineering, Milano, Italy ³Lucchini RS, Lovere, Italy)
- 15:00 Methodical development of a lightweight car body for a high-speed train**
Gregor Malzacher¹, Masakazu Takagaki², Christian Gomes Alves¹
 (¹German Aerospace Center (DLR), Stuttgart, Germany, ²Railway Technical Research Institute (RTRI), Tokyo, Japan)
- 15:15 Lightweight single axle running gear frame**
Eduardo DE LA GUERRA¹, Francisco García¹, Marta Cerdeira¹, Víctor Meroño¹, Javier Fernández¹
 (¹TALGO, Madrid, Spain)
- 15:30 Lightweight Design Concept Methodology of the Extended Market Wagon : A Shift2Rail Project**
 LEVENT KIRKAYAK¹, Davd Krüger¹, Gregor Malzacher¹, Christian Gomes Alves¹, Gerhard Kopp¹, **Nicolai Schmauder¹**
 (¹DLR Institute of Vehicle Concepts, Stuttgart, Germany)

IP.19 Signalling and communications systems

Session Chair: TBC

- 14:45 Study of applicability of 5G technology to train control systems**
Kazuki Nakamura¹, Takayasu Kitano¹, Shogo Ogawa¹, Keiichi Takeuchi¹, Kunihiro Kawasaki¹, Taishi Ohmi², Kenzaburo Fujishima², Takashi Kunifuji², Keisuke Bekki²
 (¹Railway Technical Research Institute, Kokubunji-shi/Tokyo, Japan, ²Hitachi, Ltd., Hitachinaka-shi/Ibaraki, Japan)
- 14:50 Model-Driven Design and Validation of CBI Applications**
Arturo Amendola¹, Alessandro Arenella¹, Giuseppe Scaglione¹, Matteo Tessi¹, Roberto Cavada², Alessandro Cimatti², Angelo Susi², Vittorio Cortellessa³, Mirco Franzago¹, Francesco Basciani³, Alfonso Pierantonio³, Davide Cingolani³
 (¹Rete Ferroviaria Italiana (RFI), Rome, Italy, ²Fondazione Bruno Kessler (FBK), Trento, Italy, ³Università degli Studi dell'Aquila (UnivAq), L'Aquila, Italy)
- 14:55 Development of a system that supports the design of the logic of interlocking devices**
Yoichi Sugiyama¹, Satoshi Sekine¹
 (¹Railway Technical Research Institute, Kokubunji-shi, Tokyo, Japan)

- 15:00 5G Field Trials in a High-Speed Railway Train Running at 360km/h Using 5G testbed**
 Kenichiro Kamohara¹, Fumitoshi Abe¹, **Reiji Ishima¹**, Nobuhide Nonaka², Satoshi Suyama², Takahiro Asai²
 (¹East Japan Railway Company, Tokyo, Japan, ²NTT DOCOMO, INC., Tokyo, Japan)
- 15:05 The next interlocking generation 'ERTMS-oriented'**
 Fabio Senesi¹, Salvatore Buonincontri¹, Daniele Caronti², Alessandra Casini¹, Lucia Maria Cozzolino¹, Alessandro Spinozzi¹, Andrea Olmi¹, **Nazzareno Filippini¹**, Stefano Rosini¹
 (¹RFI - Technical Department, Rome, Italy, ²RFI Technical Department, Rome, Italy)
- 15:10 Public 5G Application Project to the Railway Operation**
Masaki Ota¹
 (¹West Japan Railway Company, Osaka, Japan)
- 15:15 5GRAIL paves the way to the Future Railway Mobile Communication System (FRMCS)**
 Vassiliki Nikolopoulou¹, Stefanos Gogos², **Dan Mandoc¹**
 (¹UIC, Paris, France, ²UNIFE, Brussels, Belgium)
- 15:20 Safe and Continuous Train Localisation with the Aid of European GNSS**
 Pierrick GRANDJEAN¹, **KhaoulaLost Lassoued²**, Valentin Barreau², Vivien Fouquet³
 (¹Airbus Defense & Space SA, Toulouse, France, ²SNCF Innovation & Research, La Plaine Saint-Denis, France, ³Airbus Defense and Space SAS, Toulouse, France)

Hall 11b

IP.20 Safety and security

Session Chair: Simon Fletcher, UIC

- 14:45 Virtual certification : a key issue for rolling stock development**
 Franck POISSON¹, Philippe Laporte², **Mac Lan Nguyen-Tajan³**
 (¹EURAILTEST, PARIS, France, ²SNCF-Voyageurs, LE MANS, France, ³SNCF-Voyageurs, Vitry-sur-Seine, France)
- 14:50 A review of an NSA's supervision activities & audit outcomes to enhance its monitoring of railway organisation safety management systems**
Shane O'Duffy¹, HONGSIN KIM², Richard Popplestone³
 (¹Commission for Railway Regulation, Dublin, Ireland, ²University of Birmingham, Birmingham, United Kingdom, ³Risktec Solutions Ltd., Warrington, United Kingdom)

- **14:55 Optimal Strategies for Dangerous-Goods Wagon Placement in Freight Trains:A Probabilistic Modeling Approach**
*Chen-Yu Lin*¹, Xinhao Liu¹, Christopher Barkan¹
 (¹Rail Transportation and Engineering Center (RailTEC), University of Illinois at Urbana-Champaign, urbana, The United States of America)
- **15:00 Cybersecurity in Railways: a practical application of CENELEC TS 50701**
*Davide Amato*¹, Giulio Magnanini², Attilio Ciancabilla², Francesco Sperotto³
 (¹Sadel S.p.A., Castel Maggiore (BO), Italy, ²RFI S.p.A., Roma, Italy, ³HaslerRail Italia S.r.l., Villafranca di Verona, Italy)
- **15:05 Cyber Security in the Rail Sector – An Integrated Approach**
 Tom Chothia¹, Mihai Ordean¹, *Richard Thomas*¹
 (¹University of Birmingham, Birmingham, United Kingdom)
- **15:10 Formal Method modeling for complexity management and safety control of the railway communication systems**
*Meriem ELHOSNI*¹, Rachid BABA ALLAL², Jonathan STEIN³, Bertrand Taquin², Dimitri Vorchin³, David Cauvin¹, Cédric Sauvetre³
 (¹SNCF RESEAU, Paris, France, ²SNCF RESEAU, La plaine Saint Denis, France, ³SNCF Reseau, La Plaine St-Denis, France)
- **15:15 Improvements on safety standards and train availability due to algorithms implementation for traction motors**
*Alfredo Biancucci*¹, Salvatore Rizzo²
 (¹Trenitalia S.p.A. (Technical Department), Florence, Italy, ²Trenitalia S.p.A. (Technical Department), Firenze, Italy)