Deliverable 2.3

D2.3 Dynamic map and catalogue of ongoing and future PhD topics suitable to ERJU Flagship Areas

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List of Acronyms

Acronyms		Meaning
A4R	–	Academics4Rail EU Project
AI	–	Artificial Intelligence
ERJU	–	Europe's Rail Joint Undertaking
ERRAC	–	European Railway Research Advisory Council
EURNEX	–	European Rail Research Network of Excellence
LCC	–	Life-Cycle Costs
Maglev	–	Magnetic Levitation
MAWP	–	Multi-Annual Work Program
ML	–	Machine Learning
PhD	–	Doctor of Philosophy
S2R	–	Shift2Rail EU Collaboration Programme
TRL	–	Technology Readiness Levels
UIC	–	International Union of Railways (*Union Internationale des Chemins de Fer*)

Executive Summary

Academics4Rail aims to develop a stable and durable scientific community that can share and exchange scientific knowledge with ERJU and ERRAC at strategic technical areas. The scientific community intends to collect information and share expertise with the purpose of optimising the railway research programmes, providing insights of funds use, existing themes for research and identify scientific necessities for the future.

In Task 2.2 of A4R, key gaps in current rail research efforts are identified, findings from the UIC 12 capabilities assessment and academic surveys on future research area are highlighted, and strategic actions to address these challenges are outlined.

In connection with the outcomes of Task 2.2, a rail research mapping is developed here including a survey on ongoing PhD topics funded by ERJU/Horizon Europe, research councils, academia and industry. The survey also includes the identification of research necessities at national and regional levels. The collected PhD datasets are then post-processed to understand the current research landscape and to identify gaps in line with UIC 12 rail capabilities document, ERRAC rail strategic research & innovation agenda, EURNEX 10 poles for railway research, UK rail technical strategy, information from railway stakeholders and academic experts, and research priorities identified at regional level. The work concludes with the proposal of PhD themes for the future, aiming to contribute to the ERJU flagship areas by leveraging on most current and planned technology developments, as well as transferability from other sectors.

1 Introduction

The focus of WP2 in A4R is to setup an observatory of past, ongoing and planned research activities in Shift2Rail and EU-Rail as a common basis for the identification of critical knowledge gaps not covered by the present MAWP. These gaps will be the basis for the identification of future research topics. It includes a framework, with ERRAC and the ERJU, to involve the academic community into the process of translating the high-level MAWP into relevant research activity proposals and to define research needs not covered by the MAWP yet.

D2.2 of A4R analyses the state of European railway research and provides guidelines on how to assess research activities in Europe, integrating insights from several institutions, railway stakeholders, academic experts and inputs on future research areas. It also outlines strategic research priorities to address the research gaps, with a focus on how to integrate emerging research fields into future railway funding initiatives.

In connection with the outcomes of Task 2.2, in this work a mapping will be developed, gathering information about existing PhD topics, research necessities and identification of PhD themes with a relevant European and scientific weight that worth future funding. The aim is to address the knowledge gaps identified in the European railway sector, fostering its sustained development, innovation and competitiveness in line with the ERJU flagship areas:

1) European rail traffic management and supporting rail's key role in a multimodal transport system
2) Digital and Automated Train Operations
3) Sustainable and Digital Assets
4) Competitive Digital Green Rail Freight
5) Smart Solutions for Low Density Traffic Lines (cost-efficient regional railways)
6) Transversal topics: data and digital enablers
7) Exploratory research and paradigm shifts
8) System pillar

2 Survey on Ongoing PhD Topics and Research Priorities

A survey was conducted here to collect information on ongoing PhDs and identification of rail research priorities at national/regional levels. The details of this mapping exercise and the main findings are presented in the following.

2.1 Online Survey

An online survey was created to gather information about rail related PhDs and to identify research priorities at regional level. The data collected in the survey are listed below:

- PhD student name (optional);
- Institution;
- Country;
- Title of the thesis;
- Keywords;
- Brief description / Abstract;
- Entity funding the PhD;
- List of rail priority themes identified in the country / region.

A database of 360 entries was created with contacts involved in rail research and teaching activities worldwide. It was built with the contribution of academic contacts from A4R consortium, EURNEX partners and PhDs currently funded by ERJU. Two email campaigns were then organized inviting colleagues to participate in the online survey.

2.2 Survey Results on Rail Related PhDs

After the two email campaigns, the online survey was concluded with 261 replies, in which several participants provided information about more than one PhD hosted by their institutions. The total number of rail related PhDs for which information was gathered was 329. The distribution of these PhDs by countries is listed in Table 1.

Table 1: Number of PhDs identified by country

Country	No. PhDs	%
United Kingdom	76	23.1
Czech Republic	35	10.6
France	33	10.0
Italy	25	7.6
China	16	4.9
Austria	15	4.6
Sweden	15	4.6
Brazil	13	4.0
Germany	13	4.0
Spain	13	4.0
Poland	12	3.6
Portugal	12	3.6
Netherlands	10	3.0
Slovakia	7	2.1
Croatia	5	1.5
Switzerland	5	1.5
Ukraine	5	1.5
Denmark	3	0.9

Thailand	3	0.9
India	2	0.6
Indonesia	2	0.6
Lithuania	2	0.6
Serbia	2	0.6
Belgium	1	0.3
Japan	1	0.3
Romania	1	0.3
Slovenia	1	0.3
Turkey	1	0.3
Total	**329**	**100.0**

From the information collected for each PhD topic, the words that are more common in the PhD titles are represented with larger font size in Figure 1. The same information is provided for the most common words in PhD keywords and in their description/abstract in Figure 2 and Figure 3, respectively.

Figure 1: Most common words in PhD titles

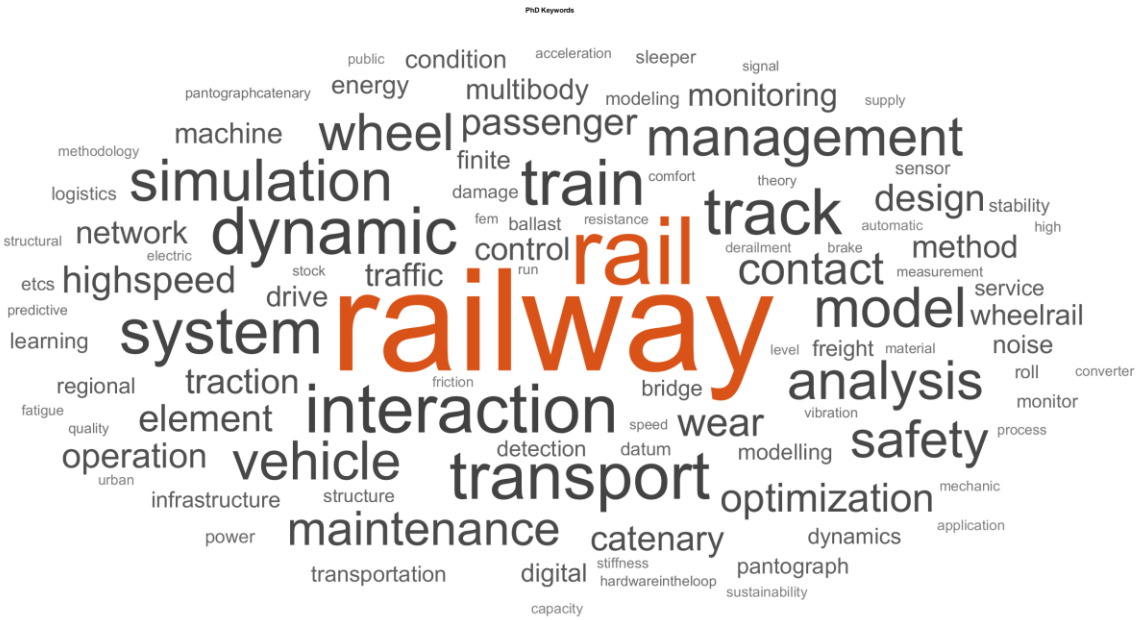

Figure 2: Most common words in PhD keywords

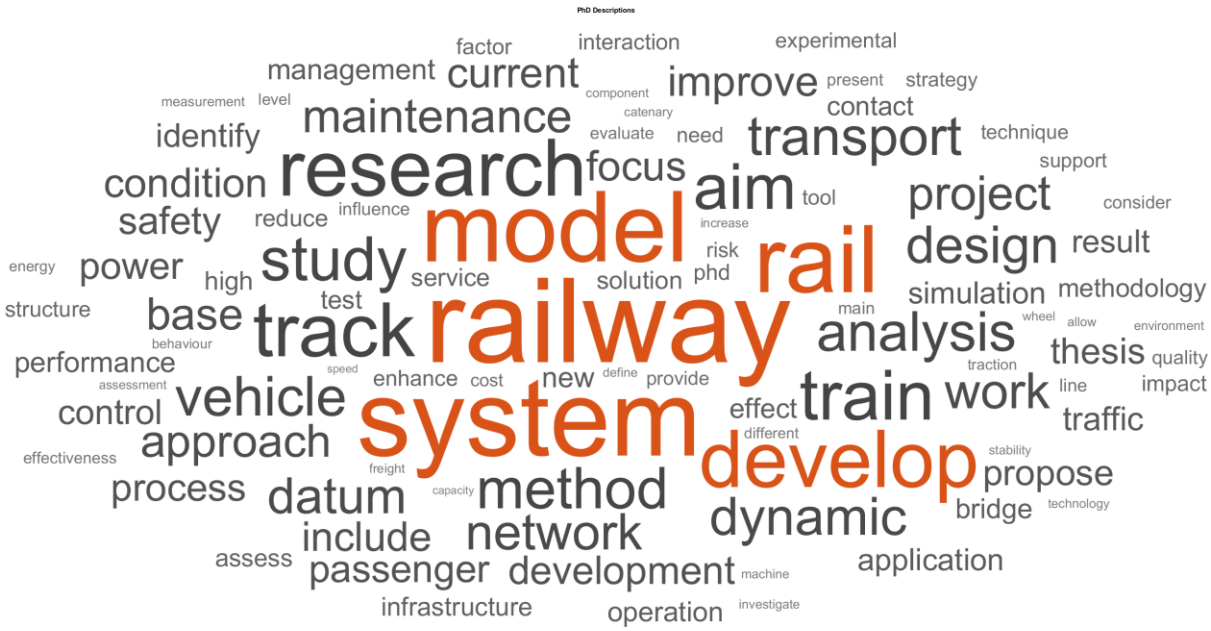

Figure 3: Most common words in PhD description/abstract

2.3 Survey Results on Research Priority Areas

During the online survey, the participants were also requested to provide information on the research priorities in their country/region. The number of replies to this question was 124, significantly lower than the ones obtained for the PhDs. The reasons for this are:

- Some survey participants added information about more than one PhD but only provided information about one research priority.
- Several others added information about the PhDs but didn't identify any research priority area.

From these replies, 271 research priority areas were identified and their numbers for each country are listed in Table 2. If two or more survey participants identify the same research priority areas in the same country, these duplications are not considered in the mapping.

Table 2: Number of research priority areas identified by country

Country	No. of Priorities
Italy	27
United Kingdom	20
Poland	19
Germany	18
Czech Republic	17
Spain	15
Sweden	13
Brazil	12
China	11
France	11
Netherlands	11
Slovakia	11
Croatia	10
Austria	9
Portugal	9
Lithuania	7
Ukraine	7
India	5
Serbia	5
Belgium	4
Malaysia	4
Switzerland	4
Estonia	3
Greece	3
Indonesia	3
Japan	3
Slovenia	3
Thailand	3
Turkey	3
Denmark	1
Total	**271**

The words that are more common in the research priority areas identified are represented with larger font size in Figure 4.

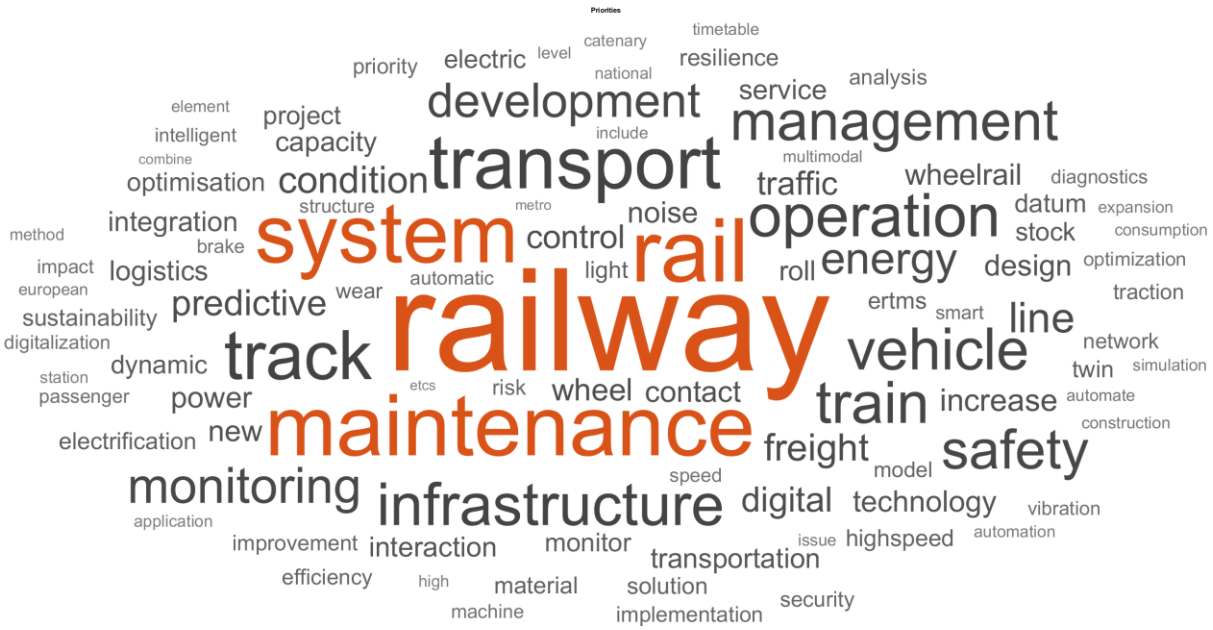

Figure 4: Most common words in research priority areas identified at regional level

3 Data Analysis

The analysis of the data gathered during the online survey and the main findings of this mapping exercise are presented in the following.

3.1 PhD Topics Categorised by Main Areas and Topics

In a first analysis, it is proposed here to categorise the PhDs according to the main rail research areas listed in Table 3. The last two columns in the table represent the number and percentage of PhDs that fall in each of these areas.

Table 3: Main rail research areas used to categorise the PhDs

Main Areas	No. PhDs	%
Railway Infrastructure	77	23.4
Signalling, Traffic Management and Control Systems	20	6.1
Rolling Stock	29	8.8
Freight Transport and Logistics	12	3.6
Operations & System Performance	49	14.9
Electrification & Power Supply	33	10.0
Environment & Energy Efficiency	33	10.0
Maintenance, Monitoring and Asset Management	34	10.3
Safety, Security and Risk Management	21	6.4
Passenger Services, Intelligent Mobility and Human Factors	18	5.5
Hyperloop and Maglev Systems	0	0.0
Rail 5.0	3	0.9

A deeper analysis into the data collected during the survey allows to categorise the PhDs according to several topics associated to the main rail research areas identified above. The results are presented in Table 4.

Table 4: Topics used to categorise the PhDs

Area	Topics	No. PhDs	%
Railway Infrastructure	Wheel-rail interaction	29	8.8
	Ballast, slab and transition zones	10	3.0
	Trackbed, geotechnics and embankments	2	0.6
	Rails, defects and joints	14	4.3
	Sleepers, ties and fastening systems	6	1.8
	Bridges, tunnels and civil eng. structures	8	2.4
	Drainage systems	2	0.6
	Turnouts, switches and crossings	6	1.8
Signalling, Traffic Management and Control Systems	Signalling equipment	0	0.0
	Train detection and control systems	4	1.2
	European Rail Traffic Management System (ERTMS)	2	0.6
	Wireless communication technologies (train-to-x)	0	0.0
	Future Railway Mobile Communication System (FRMCS)	1	0.3
	Communication and localization systems	13	4.0
Rolling Stock	Train design, manufacturing and innovative materials	7	2.1
	Dynamic modelling, gauging and simulation	10	3.0
	Locomotives, running gears and carbodies	3	0.9
	Couplers and buffers	1	0.3
	Braking systems	5	1.5
	Aerodynamics	1	0.3
	Comfort, ergonomics and interior design	1	0.3
	Passive safety and crashworthiness	1	0.3

Freight Transport and Logistics	Freight vehicles	4	1.2
	Technologies to increase freight capacity	1	0.3
	Stations and terminals	1	0.3
	Intermodal traffic and logistics	6	1.8
Operations & System Performance	Interoperability and Trans European Transport Network	5	1.5
	Transport strategy & economics	13	4.0
	Optimizing railway operations	9	2.7
	Track access charges	1	0.3
	Traffic control, network simulation, monitoring and management	14	4.3
	Timetabling and scheduling	5	1.5
	Driverless trains, remote driving and driving assistance	2	0.6
Electrification & Power Supply	Pantograph-overhead contact system interaction dynamics	18	5.5
	Electrification systems, substations and energy compensation	13	4.0
	Protection systems (section insulators and switching equipment)	0	0.0
	Cost-efficient electrification	2	0.6
Environment & Energy Efficiency	Noise and vibration reduction	5	1.5
	Railway transport decarbonization and sustainable rail transport	12	3.6
	Energy sources and smart grids	6	1.8
	Hybrid traction and power trains	3	0.9
	Climate change adaptation and resilience	4	1.2
	Energy management / savings and system recovery	3	0.9
Maintenance, Monitoring and Asset Management	Predictive and efficient maintenance processes	13	4.0
	Monitoring data, advanced data analytics and AI to support maintenance decisions	19	5.8
	Diagnostics (to minimize faults in service), prognostics (to reduce maintenance costs) and life-cycle cost optimization	2	0.6
	Maintenance planning and scheduling (cheaper and less disruptive maintenance)	0	0.0
Safety, Security and Risk Management	Level crossings safety systems	3	0.9
	On-board and way-side communication and safety systems	6	1.8
	Cybersecurity and communication interference mitigation	3	0.9
	Fault minimization and protection technologies	9	2.7
Passenger Services, Intelligent Mobility and Human Factors	Ticketing and fare systems	1	0.3
	Customer service and human-machine interfaces	8	2.4
	Passenger and freight information systems	0	0.0
	Railway workforce (drivers, conductors, staff, etc)	5	1.5
	Equality and diversity	4	1.2
Hyperloop and Maglev	Hyperloop technologies	0	0.0
	Maglev systems	0	0.0
Rail 5.0	AI and machine learning methods in railway systems	3	0.9

In order to understand the difference in terms of the most popular PhD topics running within Europe and outside Europe, the top 10 PhD topics ongoing in each region are presented in Table 5. The topics are listed from the most frequent ones (top) to the least common (bottom). The last two columns in the table represent the number and percentage of PhDs that are running in each one of the 10 most popular topics for each region.

The countries considered in this study are the ones that replied to the survey, as follows:

- Within Europe: Austria, Belgium, Croatia, Czech Republic, Denmark, France, Germany, Italy, Lithuania, Netherlands, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom.
- Outside Europe: Brazil, China, India, Indonesia, Japan, Thailand, Turkey.

Table 5: Top 10 PhD topics running within and outside Europe

Region	Topics	No. PhDs	%
Within Europe	Wheel-rail interaction	25	8.6
	Monitoring data, advanced data analytics and AI to support maintenance decisions	16	5.5
	Pantograph-overhead contact system interaction dynamics	15	5.2
	Traffic control, network simulation, monitoring and management	14	4.8
	Communication and Localization Systems	13	4.5
	Predictive and efficient maintenance processes	13	4.5
	Transport strategy & economics	13	4.5
	Electrification systems, substations and energy compensation	12	4.1
	Rails, defects and joints	12	4.1
	Railway transport decarbonization and sustainable rail transport	10	3.4
Outside Europe	Ballast, slab and transition zones	7	18.4
	Sleepers, ties and fastening systems	5	13.2
	Wheel-rail interaction	4	10.5
	Dynamic modelling, gauging and simulation	3	7.9
	Monitoring data, advanced data analytics and AI to support maintenance decisions	3	7.9
	Pantograph-overhead contact system interaction dynamics	3	7.9
	Noise and vibration reduction	2	5.3
	Rails, defects and joints	2	5.3
	Railway transport decarbonization and sustainable rail transport	2	5.3
	Turnouts, Switches and Crossings	2	5.3

3.2 Research Priority Areas Identified at Regional Level

The categorisation of the research priorities according to the main rail research areas is listed in Table 6. The last two columns in the table represent the number and percentage of research priorities that fall in each one of the main areas.

Table 6: Research priorities categorised by their main areas

Main Areas	No.	%
Railway Infrastructure	29	10.7
Signalling, Traffic Management and Control Systems	16	5.9
Rolling Stock	28	10.3
Freight Transport and Logistics	18	6.6
Operations & System Performance	52	19.2
Electrification & Power Supply	7	2.6
Environment & Energy Efficiency	39	14.4
Maintenance, Monitoring and Asset Management	45	16.6
Safety, Security and Risk Management	18	6.6
Passenger Services, Intelligent Mobility and Human Factors	10	3.7
Hyperloop and Maglev Systems	0	0.0
Rail 5.0	9	3.3

The analysis of the data collected during the survey about the research priorities in each country allows to categorise them according to the railway related topics considered in section 3.1. The results are presented in Table 7, where last two columns represent the number and percentage of research priorities that fall in each one of the topics.

Table 7: Research priorities categorised by their topics

Area	Topic Priorities	No.	%
Railway Infrastructure	Wheel-rail interaction	13	4.8
	Ballast, slab and transition zones	3	1.1
	Trackbed, geotechnics and embankments	0	0.0
	Rails, defects and joints	5	1.8
	Sleepers, ties and fastening systems	4	1.5
	Bridges, tunnels and civil eng. structures	2	0.7
	Drainage systems	0	0.0
	Turnouts, switches and crossings	2	0.7
Signalling, Traffic Management and Control Systems	Signalling equipment	0	0.0
	Train detection and control systems	0	0.0
	European Rail Traffic Management System (ERTMS)	9	3.3
	Wireless communication technologies (train-to-x)	1	0.4
	Future Railway Mobile Communication System (FRMCS)	6	2.2
	Communication and localization systems	0	0.0
Rolling Stock	Train design, manufacturing and innovative materials	10	3.7
	Dynamic modelling, gauging and simulation	8	3.0
	Locomotives, running gears and carbodies	0	0.0
	Couplers and buffers	1	0.4
	Braking systems	4	1.5
	Aerodynamics	3	1.1
	Comfort, ergonomics and interior design	2	0.7
	Passive safety and crashworthiness	0	0.0
Freight Transport and Logistics	Freight vehicles	2	0.7
	Technologies to increase freight capacity	6	2.2
	Stations and terminals	1	0.4
	Intermodal traffic and logistics	9	3.3
Operations & System Performance	Interoperability and Trans European Transport Network	9	3.3
	Transport strategy & economics	9	3.3
	Optimizing railway operations	8	3.0
	Track access charges	0	0.0
	Traffic control, network simulation, monitoring and management	17	6.3
	Timetabling and scheduling	3	1.1
	Driverless trains, remote driving and driving assistance	6	2.2
Electrification & Power Supply	Pantograph-overhead contact system interaction dynamics	1	0.4
	Electrification systems, substations and energy compensation	5	1.8
	Protection systems (section insulators and switching equipment)	0	0.0
	Cost-efficient electrification	1	0.4
Environment & Energy Efficiency	Noise and vibration reduction	8	3.0
	Railway transport decarbonization and sustainable rail transport	15	5.5
	Energy sources and smart grids	2	0.7
	Hybrid traction and power trains	4	1.5
	Climate change adaptation and resilience	7	2.6
	Energy management / savings and system recovery	3	1.1
Maintenance, Monitoring and Asset Management	Predictive and efficient maintenance processes	15	5.5
	Monitoring data, advanced data analytics and AI to support maintenance decisions	12	4.4
	Diagnostics (to minimize faults in service), prognostics (to reduce maintenance costs) and life-cycle cost optimization	5	1.8
	Maintenance planning and scheduling (cheaper and less disruptive maintenance)	13	4.8
Safety, Security and Risk Management	Level crossings safety systems	2	0.7
	On-board and way-side communication and safety systems	2	0.7
	Cybersecurity and communication interference mitigation	3	1.1
	Fault minimization and protection technologies	11	4.1
Passenger Services, Intelligent	Ticketing and fare systems	0	0.0
	Customer service and human-machine interfaces	4	1.5
	Passenger and freight information systems	1	0.4

Mobility and Human Factors	Railway workforce (drivers, conductors, staff, etc)	3	1.1
	Equality and diversity	2	0.7
Hyperloop and Maglev	Hyperloop technologies	0	0.0
	Maglev systems	0	0.0
Rail 5.0	AI and machine learning methods in railway systems	9	3.3

As it was done for the PhD topics, aiming to understand the difference in terms of the most popular research priorities identified within and outside Europe, the information collected is summarized in Table 8. In this table, the top 10 research priorities identified in each region are listed from the most frequent ones (top) to the least common topics (bottom).

Table 8: Top 10 research priorities identified within and outside Europe

Region	Topic Priorities	No.	%
Within Europe	Traffic control, network simulation, monitoring and management	16	7.0
	Predictive and efficient maintenance processes	14	6.2
	Railway transport decarbonization and sustainable rail transport	12	5.3
	Maintenance planning and scheduling (cheaper and less disruptive maintenance)	11	4.8
	Wheel-rail interaction	9	4.0
	European Rail Traffic Management System (ERTMS)	9	4.0
	Interoperability and Trans European Transport Network (TEN-T)	8	3.5
	Optimizing railway operations	8	3.5
	Monitoring data, advanced data analytics and AI to support maintenance decisions	8	3.5
	Fault minimization and protection technologies	8	3.5
Outside Europe	Wheel-rail interaction	4	9.1
	Monitoring data, advanced data analytics and AI to support maintenance decisions	4	9.1
	Train design, manufacturing and innovative materials	3	6.8
	Dynamic modelling, gauging and simulation	3	6.8
	Railway transport decarbonization and sustainable rail transport	3	6.8
	Fault minimization and protection technologies	3	6.8
	AI and machine learning methods in railway systems	3	6.8
	Intermodal traffic and logistics	2	4.5
	Transport strategy & economics	2	4.5
	Diagnostics (to minimize faults in service), prognostics (to reduce maintenance costs) and life-cycle cost optimization	2	4.5

4 Identified Research Gaps and Priorities

After analysing the information about ongoing PhDs, another purpose of this work is to identify the research gaps in current research efforts that should be addressed in future research activities. In line with the work developed in A4R D2.2 [1], the research necessities and priorities are identified based on the following sources and listed in Table 9:

- ERJU flagship areas;
- UIC 12 rail capabilities document [2];
- ERRAC rail strategic research & innovation agenda [3];
- EURNEX 10 poles for railway research topics;
- UK Rail Technical Strategy [4].

Table 9: Identified research gaps and priorities identified by European institutions

Institution	Research Needs / Priorities
ERJU flagship areas	• European rail traffic management and supporting rail's key role in a multimodal transport system • Digital and Automated Train Operations • Sustainable and Digital Assets • Competitive Digital Green Rail Freight • Smart Solutions for Low Density Traffic Lines (cost-efficient regional railways) • Transversal topics: data and digital enablers • Exploratory research and paradigm shifts • System pillar
UIC 12 rail capabilities	• Automated train operations • Mobility as a service • Logistics on demand • More value from data • Optimum energy use • Service timed to the second • Lower cost railway • Guaranteed asset health and availability • Intelligent trains • Stations and smart city mobility • Environmental and social sustainability • Rapid and reliable R&D delivery
ERRAC rail strategic research & innovation agenda	• Resilience, net-zero and competitiveness • Understanding systems interdependencies • People-centric railways • System optimisation • Multimodality • Sustainability • Inclusive and personalised service
EURNEX 10 poles for railway research	• Strategy & economics • Operation & system performance • Rolling stock • Product qualification methods • Intelligent mobility • Safety & security • Environment & energy efficiency • Infrastructure & signalling • Human factors, cognitive engineering and social sciences • Training & education
UK rail technical strategy	• Easy to use for all • Freight friendly

	• Low emissions • Optimised train operations • Efficient and reliable assets

Based on direct contacts with railway stakeholders and academic experts, several other research priorities and necessities in current research efforts are identified. These are listed in Table 10.

Table 10: Identified research gaps and priorities identified by stakeholders and academia

Area	Research Needs / Priorities
Buildings and Civils	• Earthworks stabilisation, testing/simulation and degradation modelling • Embankment track quality indicator testing and prediction • Structural health monitoring: Testing and validation • Bridge fatigue assessment and modelling • Tunnel assessment: Modelling, testing and validation • Climate vulnerability assessment on critical assets affected by extreme or prolonged weather (rain, wind, hot weather) • Water catchment analysis and flood control • Air quality assessment and measurement of control effectiveness
Track	• Rail squat degradation assessment and evaluation to drive changes in track standards controls • Enhanced modelling of rail defect types • Devices to guide derailed trains: Assessment of effectiveness • Assessment of track buckle detection effectiveness and application in standards • Development and validation of risk tool to assess impact of climate change on track asset safety and reliability • Optimised track materials for lower whole life cost and carbon emissions • Field trials and validation of automated vehicle-bound system to detect the presence of gauge corner lubrication
Electrification & Power Supply	• Assessment and analysis of OCL: Further Electrification efficiencies • OCL temperature assessment and failure mode verification • Electrical resonance testing and pre and post energisation • Power converter: Grid to OCL conversion assessment to reduce energy demand • Alternative fuels, hydrogen ecosystems, off-grid electrification
Level Crossings	• Human Behaviour assessment at level crossings • Assessment of impact of user discipline at user worked crossings to drive reductions in near misses
Freight Service	• Freight information systems • Cross-modal and cross-border freight logistics
Passenger Services, Mobility and Human Factors	• Cross-operated, cross-borders and cross modals services • Human factors, cognitive engineering and social sciences • Railway talents • Regulatory compliance and harmonization of standards
Operations	• Adhesion monitoring and treatment: Assessment of effectiveness of treatment • Holistic system-of-systems modelling and optimization (track–train–traffic control–power supply). • AI-driven predictive systems, autonomous response mechanisms, digital twins for entire networks. • Smart freight logistics, automated terminals, freight–passenger infrastructure coexistence optimization • Freight car fleet management • Cross Border Traffic in EU • Night Train Operation

	• Integrated passenger transport system • Timetable optimisation • Information system (for passengers and freight) • Unique language standard • Track capacity calculation • Transport policy with focus on railway • KPIs for infrastructure managers • KPIs for railway undertakings • KPIs for railway network • Quality of service (QoS) • Public Service Obligation Contract (PSO)
Internet and Communications	• Internet-enabled freight systems, modular and smart containerization • Railway terminal redesign for fast cross-docking, dynamic re-routing • Real-time, decentralized flow management (freight cloud platforms) • Modular train compositions based on smart loading units • Blockchain, IoT, AI for visibility, trust, contracting between transport providers

5 Conclusions

Research is essential to sustain Europe's leadership in railway innovation, contributing to increase its competitiveness and to address the decarbonization and digital transformation challenges. Therefore, it is imperative that research activities align with the goals and needs of the broader railway sector.

Current ERJU funding tends to prioritize applied research projects with mid/high TRL, limiting the fundamental and multidisciplinary research that is essential for innovation. Strategic, long-term support to these research activities at lower TRL is crucial to foster disruptive technological advancements. Modern system-level railway challenges require multidisciplinary approaches involving engineering, data science, environment and policy development, among others, which need to be supported by cross-sector collaboration. The potential gap in some fundamental research areas need to be identified to propose for funding PhD topics with a relevant European and scientific weight. Furthermore, these PhDs disseminate their findings through publications, generating new ideas and innovative concepts, and can be used to promote the collaboration among academic institutions, research centres and industry.

The aim of the work presented here is to conduct a mapping on rail related PhD topics and identify research necessities. Notice that the data presented here is the one resulting from the survey. This information is used to map and catalogue ongoing PhDs and prioritise research topics. By engaging with the railway community, the aim is to increase the knowledge in these priority themes, improve the long-term development and competitiveness of the European railway sector and reinforce the cooperation between academia and industry.

5.1 Mapping of Main Areas and Topics Covered by Ongoing PhDs

The main findings obtained from the PhD survey are presented in the following.

a) The PhD survey reveals that the areas more covered by research activities (Table 3) are:
- Railway infrastructure, with 23.4 % of the total number of PhDs;
- Operations & system performance, with 14.9%.

b) It is also noted that the areas less involved in research activities (Table 3) are:
- Freight Transport and Logistics, with 3.6 % of the total PhDs;
- Rail 5.0, with only 0.9%;
- Hyperloop and Maglev systems, with no PhDs identified.

c) A deeper analysis into the survey data reveals that there are several research topics that don't have any PhDs running (Table 4), namely:
- Signalling equipment;
- Wireless communication technologies (train-to-x);
- Protection systems (section insulators and switching equipment);
- Maintenance planning and scheduling (cheaper and less disruptive maintenance);
- Passenger and freight information systems.

There is also a number of other topics with just one PhD covering that subject.

d) Looking at the most popular PhD topics running within and outside Europe (Table 5), it is observed that these are different. However, one common aspect is that they tend to cover the same core areas, namely:
- Railway infrastructure;
- Rolling stock;
- Maintenance, monitoring and asset management;
- Electrification & power supply;

- Environment & energy efficiency.

5.2 Identified Research Priority Areas

The main findings from the online survey in terms of the identified research priority areas are presented in the following.

a) The most popular research topics identified during the survey reveal that the areas with higher priority (Table 6) are:

- Operations & System Performance, with 19.2 % of the total number of research priorities;
- Maintenance, Monitoring and Asset Management, with 16.6 %;
- Environment & Energy Efficiency, with 14.4 %.

b) It is also noted that the areas with lower research priorities identified (Table 6) are:

- Passenger Services, Intelligent Mobility and Human Factors, with 3.7 %;
- Rail 5.0, with 3.3 %;
- Electrification & Power Supply, with 2.6 %;
- Hyperloop and Maglev Systems, with no priorities identified.

c) A deeper analysis into the survey data reveals that there are several research topics that were not identified as research priorities (Table 7), namely:

- Trackbed, geotechnics and embankments
- Drainage systems
- Signalling equipment
- Train detection and control systems
- Communication and localization systems
- Locomotives, running gears and carbodies
- Passive safety and crashworthiness
- Track access charges
- Protection systems (section insulators and switching equipment)
- Ticketing and fare systems
- Hyperloop technologies
- Maglev systems

d) Looking at the most popular research priorities identified within and outside Europe (Table 8), it is observed that there are differences. However, there are a few research topics that are common priorities in both regions, namely:

- Wheel-rail interaction;
- Railway transport decarbonization and sustainable rail transport;
- Monitoring data, advanced data analytics and AI to support maintenance decisions;
- Fault minimization and protection technologies.

5.3 Proposed PhD Themes for the Future Flagship Areas

The work presented here provides an understanding on the current research landscape, future innovation areas and the priorities identified by several institutions, railway stakeholders and academic experts. In line with these findings, several PhD themes are proposed for the future, aiming to address the scientific needs of the railway sector and societal demands, promoting innovation and technology development. The proposed research themes are presented in the following.

a) Hyperloop and Maglev Systems
These technologies are not addressed in the ongoing PhDs, despite their growing global

interest. The lack of dedicated funding and research focus on these topics places Europe at a disadvantage in shaping the future of high-speed rail.

b) AI Integration in Railway Systems
Use of modern computer science techniques to address complex railway challenges. For example, the use of AI tools to support decision-making and automation in areas such as:

- Maintenance scheduling, to extend asset life and reduce LCC;
- Automated train operations and multimodal traffic management, which requires inputs from rail, road, nautical and air transport operations;
- Intelligent trains, including the integration of human factors;
- Railway safety and security.

c) Use of Emerging Technologies to Extract More Value from Data
Enhance railway efficiency and reliability by using ML algorithms to learn patterns from monitoring systems datasets and improve performance over time without being explicitly programmed. For example, these tools can be used for:

- Diagnostics, avoiding faults in service;
- Prognostics, supporting predictive and cost-effective maintenance.

d) Freight Transport
Despite its importance in terms of transportation of goods, logistic needs and optimum energy use, research prioritizing freight is still underrepresented, with only 3.6 % of the total number of PhDs. This indicates a lack of visibility or appeal in freight-related research initiatives. Such landscape should be changed by enhancing the research focus in this area to avoid long-term systemic challenges in the European freight sector.

e) Environment and Sustainability
Rail transport is already one of the most energy-efficient modes of transportation. But, to improve service resilience, address net-zero challenges and enhance competitiveness with respect to other modes of transportation, it is necessary to develop more research and innovation. Areas of importance include:

- Low-cost electrification;
- More efficient electrical grids, e.g., integrating solar or wind power into railway operations;
- Energy harvesting and regenerative braking;
- Use of lighter and eco-friendly materials.

f) Other Research Fields
Other areas that are insufficiently explored, with fragmented research and development, are listed in the following:

- Data handling and sharing, treating datasets as strategic assets, which access to researchers should be facilitated;
- Advanced manufacturing and novel materials;
- Railway training and education;
- Optimised train operations, service integration and interoperability;
- Multimodal transport integration easy to use for all;
- Railway strategy and economics;
- Energy efficiency;
- Digital twin technologies;
- Efficiency and resilience of railway assets.

Addressing the above-mentioned gaps is essential to maintain Europe's position as a global leader in railway research and development. A concerted commitment to advance fundamental studies, promoting multidisciplinary collaboration and investing in cutting-edge technologies

will keep EU at the forefront of railway innovation. These challenges require sustained investment and cross-sector collaboration to realize their potential, delivering sustainable, efficient and resilient transport solutions for the future.

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[3] ERRAC. Railway Research and Innovation Agenda (RRIA). Brussels, Belgium: 2024.

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Appendix: Mapping Results of Ongoing PhD Topics and Research Priorities

Response 1 Country	United Kingdom
Response 1 Priority Topics	Electrification and zero-carbon
Response 1 PhD 1 Title	Development of Pantograph-Catenary Dynamic Analysis and Modelling Methodologies for Realistic Railway Operations
Response 1 PhD 1 Keywords	Pantograph-Catenary Interaction, Discrete Features, Current Collection Performance, Contact Forces, Finite Element
Response 1 PhD 1 Description	The aim of this PhD proposal is the development of numerical tools and advanced methodologies to be employed in the experimental and numerical analysis of pantograph-OLE interaction. By improving the capabilities of the computational tools, allowing to increase the realism and accuracy of numerical models, its usability by the industry is also enhanced. This includes the development of modelling solutions for the dynamic analysis of geometric and mechanical discrete features of catenary systems, and the validation of such methodologies with in-line test data. These discrete features are implemented in the computational tool PantoCat, and include gradients, neutral sections, section insulators, crossovers, contenaries and overbridges.
Response 2 Country	United Kingdom
Response 2 Priority Topics	Cost-effective electrification, leaves on the line, Cost-effective freight, Light rail and metro systems, smart maintenance, decarbonisation...
Response 2 PhD 1 Title	Development of Methodologies for Pantograph-Catenary Testing, Modelling and Real-Time Dynamic Analysis
Response 2 PhD 1 Keywords	Pantograph-catenary interaction, experimental testing, Hardware-in-the-loop
Response 2 PhD 1 Description	The scope of the thesis encompasses the development of pantograph simulation and testing tools to support railway electrification, employing the Pantograph Huddersfield Experimental Rig (PANTHER). Aiming to develop methodologies to study pantograph current collection performance. This includes its coupling with the Overhead Line Equipment (OLE). PANTHER is a high-performance test bench for the evaluation of pantograph dynamic behaviour. The test bench is equipped with state-of-the-art computational capabilities that control the identification of innovative pantograph models, and enable real-time Hardware-in-the-Loop simulations at speeds of over 400 km/h. The numerical tools and methods developed in this research are set to allow the testing facility to achieve its full range of capabilities.
Response 3 Country	Italy
Response 3 Priority Topics	Vehicle - track interaction Wheel - rail interaction Monitoring Maintenance Automatic Train Operation Traffic Management
Response 3 PhD 1 Title	Optimization of the vehicle track interaction
Response 3 PhD 2 Title	Development of monitoring systems
Response 3 PhD 3 Title	Development of Automatic Train Operation systems

Response 3 PhD 4 Title	Optimization of wheel - rail interaction
Response 3 PhD 5 Title	Artificial Intelligence in railway systems
Response 4 Country	UK
Response 4 Priority Topics	Rolling stock maintenance scheduling and automated planning, Predictive rolling stock maintenance, Digital twins for rolling stock maintenance, Digital twins for railways system,
Response 4 PhD 1 Title	The Effect of Railway Wheel Condition on Passenger Comfort
Response 4 PhD 1 Keywords	passenger comfort analysis, predictive maintenance, ride quality
Response 5 Country	Germany
Response 5 Priority Topics	ERTMS/ETCS, digitalisation, automatic train operation, remote train operation, EMU/BEMU, aerodynamics, combined transport, DAC, local lines, small railbusses, etc.
Response 6 Country	Japan
Response 6 Priority Topics	Safety, vehicle dynamics, wheel/rail contact
Response 6 PhD 1 Title	train vibration, track maintenance
Response 6 PhD 1 Keywords	regional railway, smartphone
Response 6 PhD 1 Description	To develop low cost maintenance and management for regional railways
Response 7 Country	France
Response 7 Priority Topics	Maintenance optimisation, infrastructure management, Operating versus maintenance
Response 7 PhD 1 Title	Dynamic optimisation of the maintenance of a transport network. Integration of costs and logistic constraints.
Response 7 PhD 1 Keywords	Maintenance optimisation, Rolling stock maintenance

Response 7 PhD 1 Description	Due to critical environmental issues, there has been a notable rise in the popularity of railway transport, resulting in a sustained growth in demand for both passenger and freight services. Consequently, in order to effectively meet this growing demand, it is clear that optimizing resource utilization or expanding the capacity of the railway system is crucial. Due to the significant investment required for capacity extension, it is essential to first explore the optimization of rolling stock utilization. A train is composed of a vast number of systems, including many critical ones (e.g., breaks and doors), that require regular maintenance. Given the complex composition of trains and the strict legislation governing their operation, the maintenance of rolling stock stands out as the primary factor limiting their availability. In addition to regular preventive maintenance, the pressure on resources is further intensified by the activities arising from predictiveor condition-based maintenance methods. Due to the specifics of preventive maintenance, each activity must be carried out cyclically, ensuring completion before a pre-determined deadline. For logistical reasons this deadline can not always be respected which results in the train being taken out of service. More precisely, maintenance intervals are defined by manufacturers based on mileage or time for the various train components. If these intervals are not respected, train units could not be authorized to run thereby decreasing the rate of available trains to meet operational demands corresponding to timetables. Furthermore, preventive maintenance intervals are defined taking into account the balance between the cost of actually performing the activity, the total cost of a failure and its probability of occurrence. Stochastic approaches are often used to describe the failure behaviour of components based on their degradation. They allow to take into account the failure rate of the entities to improve the estimation of the failure cost. Usually, the definition of preventive maintenance date for each activity considers only the minimisation of its maintenance cost, ignoring elements related to planning especially regarding the scheduling of the whole set of activities cycles and the logistical requirement to perform them. Hence, there is a need to consider the temporal and spacial organization of the whole maintenance activities that search for a global planning considering the resource availability, the exploitation constraints (a minimum number of trains in service), the maintenance depots capacity (a maximum number of trains in maintenance at the same time) and the distant depots. More precisely, the main aim of this PHD is to propose an optimization framework that provides a scheduling solution for cyclical preventive maintenance activities related to rolling stock, taking into account railway constraints and the stochastic nature of the maintenance cost.
Response 8 Country	Estonia
Response 8 Priority Topics	Construction of a new railway line (Rail Baltica) ERMTS Single European Railway Area Railway Higher Education Railway Infrastructure Management Railway Transport, Multimodal Connections
Response 9 Country	Brazil
Response 9 Priority Topics	- Design of energy efficient railway heavy haul wagons - Energy harvesting systems for instrumented heavy haul vehicles - Quantifying the energy spent on railway operations - New representative models for longitudinal dynamics of railway vehicles - Comfort and safety in passenger vehicles for shared lines - Nondestructive inspection techniques of railway parts of railway vehicles - Automatization of the maintenance procedures employed in maintenance shops - Intelligent condition-based maintenance applied to heavy haul railways
Response 9 PhD 1 Title	Comfort and safety in passenger vehicles for shared lines
Response 9 PhD 1 Keywords	Comfort criteria, railway vehicles, truck design, railway safety
Response 9 PhD 1 Description	The work aims to develop better criteria for evaluating the comfort of passengers in lines built for freight, proposing design changes to improve it while keeping passengers and operational safety.
Response 9 PhD 2 Title	New Vibration Energy harvesting systems for instrumented heavy haul railway vehicles
Response 9 PhD 2 Keywords	Energy harvesting, railway, instrumented railway vehicles

Response 9 PhD 2 Description	The work seeks to produce robust energy capturers that can be installed in freight cars as a tool for maintaining the track and of the wagons
Response 9 PhD 3 Title	Design of energy efficient railway heavy haul wagons
Response 9 PhD 3 Keywords	Energy efficiency, railway wagons, design of railway vehicles
Response 9 PhD 3 Description	The work aims to develop new designs or adaptations to existing designs for railway freight wagons, with the aim of reducing the overall energy consumption of the train.
Response 9 PhD 4 Title	Quantifying the energy spent on railway wagons
Response 9 PhD 4 Keywords	Energy expenditure, railway wagons, railway vehicle design
Response 9 PhD 4 Description	The work aims to identify the different sources of unnecessary energy expenditure in railway wagons, allowing the proposal of alternatives to minimize losses.
Response 9 PhD 5 Title	New representative models for longitudinal dynamics of railway vehicles
Response 9 PhD 5 Keywords	longitudinal train dynamics, railway vechicles, modelling dynamic efforts
Response 9 PhD 5 Description	The work aims to develop representative models of the operating conditions of long trains on heavy haul railways, allowing the optimization of the driving procedure to minimize the efforts transmitted between the wagons.
Response 10 Country	Italy
Response 10 Priority Topics	Predictive maintenance apllied to vehicles and infrastructures, on board monitoring, wisede monitoring, model-based and data-driven algorithms for diagnostics and prognostics
Response 11 Country	Liechtenstein
Response 12 Country	Santos
Response 12 Priority Topics	The transportation of iron ore in Brazil suffers from bad weather as it is a tropical country. I coordinate a project focused on draining iron ore wagons, financed by VALE S.A. We created a test bench and developed research into the effects of compaction and saturation on the formation of free water during transportation, as well as adhesion to the wagon's internal sheet metal.
Response 13 Country	UK
Response 13 Priority Topics	Rail demand and revenue forecasting Non-market valuation, e.g. value of travel time and delay Economic appraisal
Response 13 PhD 1 Title	Line plan and timetable planning and economic assessment of Indonesia semi high-speed rail network
Response 13 PhD 1 Keywords	Line planning, timetable planning
Response 13 PhD 1 Description	n/k

Response 13 PhD 2 Title	The economics of rail transport: cost-benefit assessment of innovation and econometric modelling of supply and demand side relationships
Response 13 PhD 2 Keywords	Rail innovation, cost-benefit analysis
Response 13 PhD 2 Description	n/k
Response 13 PhD 3 Title	New technologies, travel modes and passenger needs: Understanding and predicting the future of rail travel
Response 13 PhD 3 Keywords	new technologies, accessibility to rail
Response 13 PhD 3 Description	n/k
Response 13 PhD 4 Title	The economics of rail passenger responses to delays: delay perception, satisfaction, valuation and compensation
Response 13 PhD 4 Keywords	rail delays, passenger satisfaction
Response 13 PhD 4 Description	n/k
Response 14 Country	Lithuania
Response 14 Priority Topics	Railway infrastructure maintenance, rolling-stock exploitation, monitoring of catenary-pantograph heath, smart rail vehicles
Response 15 Country	Germany
Response 15 Priority Topics	Energy efficiency in railways, thermal management, thermal comfort, energy management alternative and hybrid drives hydrogen in railways battery trains
Response 15 PhD 1 Title	Development, modeling and evaluation of climate zone-adapted thermal management concepts for rail vehicles with alternative drives
Response 15 PhD 1 Keywords	Thermal management, H2 trains, battery trains
Response 15 PhD 1 Description	This Phd deals with development, modeling and evaluation of climate zone-adapted thermal management concepts for rail vehicles with alternative drives
Response 15 PhD 2 Title	Development and demonstration of metal hydride based HVAC system (preliminary title)
Response 15 PhD 2 Keywords	Hydrogen traction systems, HVAC, thermal management
Response 15 PhD 2 Description	This PhD deals with the development of a metal hydride based air conditioning system that uses the normally wasted pressure energy of hydrogen tanks for cooling and heating. The system is developed and demonstrated in lab environment, and other practical demo is intended.
Response 16 Country	GREECE

Response 16 Priority Topics	Achievement of safety, interoperability, regulatory issues (various companies-one operator) interconnection with other modes of transport
Response 17 Country	Sweden
Response 18 Country	Italy
Response 18 Priority Topics	infrastructure maintenance (track and overhead contact line) safety and optimisation of train's operation development of monitoring and diagnostics of infrastructure from on-board train measurement
Response 18 PhD 1 Title	Indirect Structural Health Monitoring applied to railway bridges
Response 18 PhD 1 Keywords	indirect monitoring, train-bridge interaction, diagnostics of railway bridge
Response 18 PhD 1 Description	analysis of the feasibility of indirect structural diagnositcs of railway bridge from on board measurements on train travelling on railway bridge.
Response 18 PhD 2 Title	A Simulation Environment for Moving Block and Fixed block Signalling Systems
Response 18 PhD 2 Keywords	Railway signalling, ERTMS/ETCS, Hardware n the loop
Response 18 PhD 2 Description	Aim of the thesis is to built a dynamic model for traffic operation, considering train longitudinal dynamics and its interaction with singalling system. Three aspects are investigated: i) simulation of perfomance of traffic regulation on a built-in SW, ii) implementation in a real time computing machine, iii) prospect of an HiL system for co-simulation with a phisical signalling sub-system.
Response 19 Country	Germany
Response 19 Priority Topics	n/a
Response 20 Country	Brazil
Response 20 Priority Topics	- wheel-rail contact effects on rails (wear, RCF) - management of wheel-rail contact
Response 20 PhD 1 Title	Optimization of rail geometric profile
Response 20 PhD 2 Title	Development of contact computational methods between rational surfaces for wheel-rail application
Response 21 Country	Italy
Response 21 Priority Topics	Trustworthy Artificial Intelligence for Railway Applications Smart-Monitoring of Level Crossings for Predictive Maintenance Safe Autonomous Train Driving
Response 21 PhD 1 Title	Early Detection of Unknown Attacks with Algorithms for Structured Data
Response 21 PhD 1 Keywords	Safety, Resilient Computing, Railway Security

Response 21 PhD 1 Description	Design and Evaluation of Secure Systems and Applications for the Railway Domain
Response 22 Country	Spain
Response 22 Priority Topics	rail fastening stiffness rail welding carbon footprint climate change
Response 23 Country	BRAZIL
Response 23 Priority Topics	DYNAMICS, SAFETY, VIRUTAL REALITY, MODELLING, SIMULATION, PERFORMANCE EVALUATION
Response 23 PhD 1 Title	Integrated approach for fatigue assessment of freight train suspension systems
Response 23 PhD 1 Keywords	DYNAMICS, RAILWAY
Response 23 PhD 1 Description	Integrated approach for fatigue assessment of freight train suspension systems
Response 23 PhD 2 Title	On board system for condition monitoring of railway track
Response 23 PhD 2 Keywords	DYNAMICS, MONITORING, RAILWAY
Response 23 PhD 2 Description	On board system for condition monitoring of railway track
Response 24 Country	Spain
Response 24 Priority Topics	Wheel-Rail contact Rail Corrugation Laser cladding for the railway industry RCF Safety against derailments New brakes for high speed trains Light weight vehicles Tribology Communications Signalling
Response 24 PhD 1 Title	Additive Manufacturing to reprofiling railway wheels worn by use
Response 24 PhD 1 Keywords	Additive Manufacturing, railway wheels
Response 24 PhD 1 Description	study of the feasibility of an alternative approach to current wheel reprofiling procedures using underfloor wheel lathes, by incorporating Additive Manufacturing
Response 24 PhD 2 Title	Jose Antonio Postigo
Response 24 PhD 2 Keywords	Topology Optimization for general type of structures and mechanical systems
Response 24 PhD 2 Description	Topology optimization is a valuable tool in additive manufacturing, but its application requires careful consideration of various constraints to refine the optimization outcome. I

Response 25 Country	Slovakia
Response 25 Priority Topics	timetables optimisation, railway construction, railway reconstruction, interlocking systems, electrification, automated train operation, predictive maintenance, effective freight transportation
Response 25 PhD 5 Description	we don't have PhD study programmes directly related to railways - our study programmes are Applied Informatics; Management - our PhD students can contribute in interdisciplinary research but currently their thesis are not related directly to railways (IT, AI, management, organisation)
Response 26 Country	China
Response 26 Priority Topics	AI -aided safety monitoring and assessment; noise and vibration; vehicle/track state monitoring and assessment
Response 26 PhD 1 Title	STUDY ON HIGH-SPEED RAILWAY ENVIRONMENTAL VIBRATION GENERATED FROM PILE-PLANK STURCTURE ENHANCED EMBANKMENT
Response 26 PhD 1 Keywords	High-speed railway; environmental vibration; periodic structure theory; pile-plank structure; fictitious pile method; Floquet transform; 2.5D FEM
Response 26 PhD 1 Description	This thesis advances the modeling of pile-plank structure enhanced track-ground system, exploring the influence of pile-plank structures on train-induced environmental vibration, and making improvements on the pile-plank structure, which is of great significance for the application of this structure.
Response 26 PhD 2 Title	A STUDY ON THE BOUNDARY ELEMENT MODEL FOR SOUND RADIATION FROM AN INFINITELY LONG PERIODIC STRUCTURE
Response 26 PhD 2 Keywords	sound radiation, periodic structure, boundary integral equation, boundary element method, Floquet-transform, periodic boundary element method
Response 26 PhD 2 Description	This paper will take the infinitely long periodic structure as the research object, starting with the acoustic Helmholtz equation, and derive the integral equation in the Floquet domain for the periodic structure through the classical acoustic integral equation. This transforms the sound radiation problem of the infinitely long periodic structure into a study on a single period unit, significantly reducing the size of the computational model. Then, the boundary element method is used to solve the boundary integral equation after the Floquet transformation. The acoustic boundary element method (model) of periodic structure is established.
Response 27 Country	Slovenia
Response 27 Priority Topics	ballast stone aggregate degradation & use of secondary materials for the purpose of railway ballast methodologies for assessing the condition and remaining service life of prestressed concrete sleepers structural health monitoring and technologies for monitoring of railway track conditions subgrade soil improving technologies, use of geosynthetics
Response 27 PhD 1 Title	Bio-and Alkali-activated stabilization of soft subgrade ground
Response 27 PhD 1 Keywords	soft soil, Microbial Induced Calcite Precipitation (MICP), Alkali-activated (AA) stabilization techniques, Fungal Mycelium (FM) soil stabilization
Response 27 PhD 1 Description	Determination of AA materials process parameters, recipe for the MICP and FM fiber treatment for soil stabilization with desired properties. Evaluation of eventual environmental hazard from AA, MICP and FM treatment of soils. Durability testing of treated soils. Life cycle assessment of AA, MICP, FM treatment compared to convention stabilization techniques.
Response 28 Country	Germany

Response 28 Priority Topics	wheel-rail interaction, noise abatement, capacity enhancement, reliability improvement
Response 28 PhD 1 Title	several
Response 28 PhD 1 Keywords	small wheels, stability, auxiliary innovation
Response 28 PhD 1 Description	double deck train with 2 decks also at bogie location
Response 29 Country	Poland
Response 29 Priority Topics	- Interactions between the 3 kV DC and 25 kV 50 Hz traction power systems - Influence of the 25 kV 50 Hz traction power system on railway signalling devices, including automation at level crossings - Impact of different electric traction systems on ERTMS equipment. - Implementation of ETCS L1 on secondary railway lines - Cyber-protection of remote railway traffic control and signalling equipment
Response 29 PhD 1 Title	I am a researcher and I am not pursuing a doctoral programme
Response 30 Country	France
Response 30 PhD 1 Title	Biomechanical analysis of human motor behaviors and patterns while crossing pedestrian track
Response 30 PhD 1 Keywords	Locomotion, Security system, Interaction with the environment, 3D movement analysis, Railway domain, Gait stop,
Response 30 PhD 1 Description	The objective of the TVP project (level tracks crossing by the public) is to lead to the identification, development and prototyping of one or more new solutions to reduce feared events (ER) at TVP. By combining a behavioral analysis and a biomechanical analysis, built around the data produced within the complete experimental platform (reproduction of body movements in free fields, kinematic analysis, attention management, eye search patterns, muscular efforts, interaction with the environment and other travellers), the project therefore has scientific and technical objectives of several kinds: o Design, around the analysis of the literature and levers already identified, new concepts of security systems, o Validate in the upstream phase the feasibility and effectiveness of the device concepts envisaged, o Model and test in an ecological situation one or more new generation security system concepts, check their integrability in the infrastructure system and in relation to the needs of rail traffic, o Achieve a demonstrator compatible with the railway field of the concept(s) selected which will be deployed on the private test site of Vaires sur Marne. This PhD thesis aims to meet the theoretical and experimental needs of the TVP project with a biomechanical approach. The main objective of this thesis is then to analyze the behaviors and motor patterns mainly of a biomechanical nature (kinematics, dynamics, EMG), during a track crossing exposure (TVP) in order to characterize and quantify the crossings judged at risks for users. The goal here is to reveal the relevant and useful biomarkers for the virtual situation and thus better understand the behavior of the user in order to reduce the consequences. The second objective is to compare the different devices implemented via mixed reality (platform of a 1:1 scale platform coupled with a virtual reality environment) from a motor control point of view. All the biomechanical measurements will thus make it possible to characterize user profiles and thus highlight the role of the various signaling devices.
Response 31 Country	Italy
Response 31 Priority Topics	Increase competitiveness of freight rail transport Manage consumption and emssions for freight rail transport Manage winds generated by freight trains (slisptrem) as they pass near bystanders, define suitable TSIs

Response 32 Country	Germany
Response 32 Priority Topics	- wheel/rail interaction (polygonization, RCF, wear, profile optimization, material optimization) - light weight design (using FRP in railway vehicle structures) - innovative running gears (integrated, independent wheels, mechatronically steered) - standardization and modularization of rail vehicles and/or their components - condition monitoring and digital twin as means for predictive maintenance and 100% availability - cyber security and digitalization, i.e. ERTMS and Digital Control Centers - assisted, automated and autonomous operation - battery powered trains, thermal management, drives with hight efficiency
Response 32 PhD 1 Title	Determination of The Influence of Rolling on The Wear of Rail Wheels Using The Example of A Light Rail Vehicle
Response 32 PhD 1 Keywords	adhesion, slip, wear, wheel/rail
Response 32 PhD 1 Description	n/a
Response 32 PhD 2 Title	Assessment of the accuracy and limits of coal paper compared to pressure measuring film at Hertz's bodies and in the cycle-rail contact
Response 32 PhD 2 Keywords	wheel/rail contact, Hertz, pressure measurement film, coal paper
Response 32 PhD 2 Description	n/a
Response 32 PhD 3 Title	Shunting-on-Demand: Right of needs shunting on a flat area with an autonomous two-way vehicle
Response 32 PhD 3 Keywords	Autonomous driving, shunting
Response 32 PhD 3 Description	n/a
Response 32 PhD 4 Title	Method for Predicting and Analysing Wheel Profile Wear for the Application of numerical Optimizations
Response 32 PhD 4 Keywords	wheel/rail wear, digital twin
Response 32 PhD 4 Description	n/a
Response 32 PhD 5 Title	Improving the Running Behaviour of a Novel Leightweight Freight Bogie
Response 32 PhD 5 Keywords	Light Weight Design, Running behavior, multi-body simulation, freight transport
Response 32 PhD 5 Description	n/a
Response 33 Country	Slovakia
Response 33 Priority Topics	public services, maintenance, financing, capacity
Response 33 PhD 1 Title	PROPOSAL OF THE METHODOLOGY FOR DETERMINATION OF TRANSPORT SERVICES TO INCREASE THE COMPETITIVENESS OF RAIL FREIGHT TRANSPORT USING REGIONAL LINES

Response 33 PhD 1 Keywords	freight, regional lines, services
Response 33 PhD 2 Title	Methodology for assessing the impact of alternative drives on technological processes in railway passenger transport
Response 33 PhD 2 Keywords	alternative vehicles, technology, passenger transport
Response 33 PhD 3 Title	Alternative drives vs. electrification of railway lines - economic and non-economic aspects
Response 33 PhD 3 Keywords	electrification, alternatives drives, soc-econ.aspects
Response 34 Country	Poland
Response 34 Priority Topics	1. Management of rail transport of the forces performing tasks on NATO's eastern flank 2. Development of rail transport infrastructure in Poland in the context of military needs 3. Military aspect of the improvement of railway transport infrastructure in Poland 4. Development of railway transport in Poland as an important element of improving the state security system 5. Cyber-security management in the Polish rail transport sector 6. The concept of improving the organisation of the security system of the railway infrastructure of the Republic of Poland 7. Business continuity management as a key element of the railway transport safety system 8. Use of the artificial intelligence in the diagnostics and maintenance of the track superstructure. 9. Diagnosis of rail permanent way superstructure elements using UAV (Unmanned Aerial Vehicles). 10. Thermovision as a diagnostic tool for railway turnout heating systems. 11. Portable diagnostic and condition monitoring systems for jointless track. 12. Tools and diagnostic method for hotspot detection in railway brake friction pair components. 13. Improvement and expansion of open GIS databases in the field of railway infrastructure. 14. Use of 4G/5G mobile technology in railway communication and data transmission systems. 15. Satellite-based control of the location of railway vehicles 16. Harmonisation of the signalling system on the Rail Baltica line 17. Principles of cyber-protection of signalling equipment 18. Resistance of railway signalling equipment to external factors 19. Application of the acoustic emission method in the assessment of the construction of railway infrastructure elements, pre-tensioned concrete sleepers, pile foundations, in order to increase the level of railway safety
Response 34 PhD 1 Title	Ocena wpływu hałasu generowanego przez pojazdy kolejowe zwiększonych prędkości na otoczenie, Assessment of the impact of noise from increased speed rail vehicles on the surrounding area
Response 34 PhD 1 Keywords	noise, high speed rail, vehicles
Response 34 PhD 1 Description	Please contact with autor kpolak@ikolej.pl
Response 34 PhD 2 Title	The method of risk analysis in investments introducing changes in the control-command and signalling subsystem
Response 34 PhD 2 Keywords	railway, signalling subsystem, risk analysis

Response 34 PhD 2 Description	In recent years, rail transport in Poland, and in the world, has undergone dynamic development. Numerous large investments are being carried out, involving insufficient number of competent, experienced workers, and new contractors, and haste, which may translate into poor quality of the work and low safety level. At the same time, growing emphasis on risk analysis is present in railway transport, ultimately aiming at increasing rail safety performance. However, the risk analyses required by law are frequently limited to the impact on railway traffic safety and do not include the use of the risk analyses for supervising appropriate implementation of railway investments, especially since there are no methods in this respect that take into account the specificity of the rail traffic control systems, the impact of which on safety is particularly significant. Therefore, this work presents original proprietary method and tool that can be utilized to support investment processes conducted by the rail traffic control industry and to increase the safety of the investments, including rail traffic safety to the extent that it depends on the investments. The doctoral thesis covers issues related to risk analyses, indicating factors and circumstances causing risks. Available risk assessment methods, which support both safety impact analyses, and risk evaluation of the investments involving railway traffic control systems are also presented. Dissertation also discusses criteria and conditions influencing selection of an appropriate method for the proper assessment of the future effects of investment-related decisions. It focuses mainly on identification and analysis of the risk factors, which are the basis for the creation of the control charts and software tool, that can be used for risk analyses during investment projects' implementation risks assessments. Own proprietary method has been presented, which allows to isolate single input variables and determine to what extent they influence safety and efficiency of the investment being analysed. The scope of the dissertation covers topics described in nine chapters. The first part of the work (chapter 1) presents the aim and the scope of the work, as well as identification of the research problem. Then (chapters 2 and 3), a short description of railway investments in Poland together with advancement of selected investments are presented. Also in these chapters numerous issues related to risks and risk analyses methods that are used to support investment processes as well as selected risk management issues are presented. The following chapters (chapters 4, 5) describe results of surveys and workshop meetings that were conducted with designers and manufacturers of traffic control systems. Criteria and weights for individual risks were defined, broken down into stakeholders and investment stages. Chapter 6 contains description of the original proprietary risk analysis method and the designed software tool that will be used to eliminate the risk at various stages of the railway investments. Chapters 7 and 8 describe implementation of the method and its verification by using the designed tool for analysing and supporting four investment processes at the design stage. Original author's method presented in the dissertation supports investment processes in terms of detecting possible hazards, which translates into increase of the safety level of investments. Method and software tool verification results have already confirmed effectiveness of the proposed and detailed method. Last part of the work (chapter 9) contains summary with conclusions and directions foreseen for further research
Response 34 PhD 3 Title	Multi-criteria risk assessment for risks caused by human factors in the rail transport system
Response 34 PhD 3 Keywords	rail transport system
Response 34 PhD 3 Description	Dissertation presents an original method defined by author for supporting selecting employees to work as traffic controllers, taking into account both factors affecting the occurrence of human errors and factors affecting consequences of such errors. The proposed expert method was developed using information collected and organized as a result of numerous analyses, including the analysis of publications in the field of human factors in different areas of the railroad transport, the analysis of standards and legal acts in the field of risk management, the analysis of the education system at school and after school during professional life, as well as the analysis of documents presenting post-accident assessments used to improve railroad transport safety. Some concepts used in air transport were also utilized. The concept of the multi-criteria method was defined on the basis of accumulated knowledge. Concept of the method for assessing risks caused by human factor in the railroad transport system. Concept dedicated for assessing positions directly related to the railroad traffic safety. The proposed method was then defined in details, on the basis of concept, for traffic controllers, as such position is considered to be representative also for other positions influencing railroad traffic safety. The developed method allows, among others, to select employees to perform duties at a traffic post or a group of traffic posts, taking into account working conditions and competences of particular employees. It enables elimination of subjective decisions and decisions not well supported by proper analysis, being taken by persons responsible for managing employees working as traffic controllers. Implementation of such system could have a significant impact on safety, as each individual decision in this area made on the basis of subjective decision-maker's opinion could lead to increased risk and worsen the level of railroad traffic safety. Dissertation's conclusions include suggestions regarding possible further development of the method itself as well as suggestions regarding types of work activities associated with railroad traffic safety, which could be covered.

Response 34 PhD 4 Title	-no
Response 34 PhD 4 Keywords	-no
Response 34 PhD 4 Description	-no
Response 34 PhD 5 Title	no
Response 34 PhD 5 Keywords	no
Response 34 PhD 5 Description	no
Response 35 Country	Austria
Response 35 Priority Topics	Predictive maintenance (track), turnouts, track closures for maintenance, resilience
Response 35 PhD 1 Title	Short-waved effects due to rail surface issues and their influence on track behaviour
Response 35 PhD 1 Keywords	rail, track, ballast, predictive maintenance
Response 35 PhD 1 Description	Proper asset management of the railway infrastructure is essential to meet the requirements of railway operation today. This work deals with a neglected aspect of track condition: irregularities in the rail surface caused by various phenomena and summarised under the term "short-wave effects". After appropriate data processing, data from the rail surface measurement system is suited to detect and quantify short-wave effects. Rail surface data has been collected by the Austrian track recording vehi-cle on a network-wide basis since 2005, providing a solid foundation of data for statistical evaluations. A macro level evaluation reveals that even short-wave effects with relatively small amplitudes of 0.1 mm contribute to an accelerated deterioration of track geometry. When severe short-wave effects are present, track geometry exhibits amplitudes that are 50-120 % higher than the average for the respective track section. To more deeply understand this issue, further analyses are required at a micro level. The corresponding evaluation includes over 2,000 welded joints distributed over five lines with differing superstructure components and vehicle collectives. Vehicle and track characteristics are incorporated in the assess-ment with the aid of four load application models. The resulting dataset is used to quantify and statis-tically demonstrate the impact of short-wave effects, to identify track and vehicle characteristics that either amplify or attenuate the impact, and to define intervention thresholds for short-wave effects. In a second micro-level assessment, another factor resulting in short-wave effects, the turnout frog, is analysed in detail and a monitoring regime is proposed, mainly based on network-wide available data. Finally, the possibility of quantifying other effects such as insulated rail joints, squats and corrugation is highlighted. Several potential strategies are presented to counteract the negative impact of short-wave effects, targeting track maintenance, track renewal, track design and track access charges. All strategies in-volve some form of additional investment to improve system performance. Future work should aim at economic evaluations of the proposed strategies in order to define the most appropriate strategy in terms of life cycle costs and availability. Implementing one or more of the strategies described makes it possible to optimise asset management. Regimes that are currently reactive, preventive, or predic-tive can be moved to a proactive regime where the root causes of poor system behaviour are ad-dressed before symptoms become apparent.
Response 35 PhD 2 Title	Effective Railway Track Tamping: Evaluating Short-Term and Long-Term Impacts on Track Geometry and Monitoring Ballast Condition
Response 35 PhD 2 Keywords	Track , ballast, tamping, maintenance

Response 35 PhD 2 Description	Levelling–lifting–lining–tamping represents the most important type of maintenance for ballasted tracks. In this process, a tamping machine lifts the track panel to a specified height, aligns it laterally and then fills the void beneath the sleepers with ballast and compacts it. Various aspects of this process are based on empirical guidelines and the subjective assessment of the local (ballast) condition by the machine operator. This thesis examines the influence of two key tamping parameters and two relevant external factors on the effectiveness of tamping processes. Furthermore, it develops a methodology for assessing the prevailing ballast condition during the tamping process. Two indicators are defined to evaluate the effectiveness of the tamping process: Short-term effectiveness (ΔQs–t) describes the relative immediate improvement in track geometry quality (standard deviation of the longitudinal level D1, calculated with a 25 m sliding window) due to tamping. Long-term effectiveness (ΔQl–t) is defined as the ratio of deterioration rates (linear regression) before and after tamping. In order to enable a precise correlation between the indicators and the applied tamping parameter values, the infrastructure data of the tamping sections is carefully prepared and then linked to the acceptance records of the tamping operations. This is achieved by synchronising the longitudinal level signal of the post-measuring with the longitudinal level signal of the first measurement of the track recording vehicle after the tamping operation. The analysis of the influence of lifting demonstrates that the target range for lift of approximately 20 to 60 mm (for maintenance tamping), defined based on past experience, can be considered reasonable. However, a specification of this relatively broad range depending on the prevailing track geometry quality are identified. In the case of tracks exhibiting high geometric quality, the application of lower lifts (approximately 20–25 mm) is significantly more effective than larger lifts. Conversely, larger lifts in the range of approximately 40–45 mm are more effective in the case of poor track geometry quality. The analysis of the number of tamping processes and the squeezing time reveals two principal conclusions. First, double tamping achieves a higher short-term effectiveness than single tamping, which corresponds to a higher reduction of existing track geometry error. Secondly, a sufficiently long continuous squeezing movement (≥ 0.8 s for double tamping) is required to achieve a high long-term effectiveness, i.e., a stable track geometry. A comparative study of tamping operations only and integrated maintenance (tamping and timely rail grinding or milling) reveals a significant increase in long-term effectiveness of the maintenance procedure through complementary rail maintenance. From a technical perspective, track geometry correction should therefore be carried out as integrated maintenance. Furthermore, the empirically known reduction in tamping effectiveness with increasing ballast fouling is statistically substantiated and quantified to some extent. The condition of the ballast bed has a considerable influence on the anticipated effectiveness of tamping, as well as on the tamping process itself. In consideration of the local ballast condition, tamping parameters (such as the squeezing pressure) are adapted by machine personnel to achieve an optimal tamping result. In order to obtain objective and sleeper-specific information about the condition of the ballast, measurement data recorded during the tamping process is analysed, resulting in the establishment of a ballast condition indicator. The Ballast Coefficient (βBallast) represents the resistance of the ballast to penetration by the tamping tines and thus provides an indication of the degree of fouling of the ballast.
Response 35 PhD 3 Title	A vehicle based empirical-analytical Track Deterioration Model
Response 35 PhD 3 Keywords	track, deterioration, vehicle-track interaction
Response 35 PhD 3 Description	Vehicle-triggered effects of track deterioration with focus on ballast deterioration.
Response 35 PhD 4 Title	About Rail Damage - Influence of the vehicle on rail wear mechanisms
Response 35 PhD 4 Keywords	track, deterioration, vehicle-track-interaction
Response 35 PhD 4 Description	What does trigger the wera of rails? The influence of infrastructure properties, the rail steel grade and the vehicle colllective
Response 35 PhD 5 Title	Costs of operational hindrances
Response 35 PhD 5 Keywords	track closures, costs, maintenance windows
Response 35 PhD 5 Description	

Response 36 Country	Italia
Response 36 Priority Topics	AI, security, safety, trustworthiness
Response 37 Country	Czech Republic
Response 37 Priority Topics	High-speed lines Track capacity, ETCS Digitalisation, BIM FRMCS Electrification of railway lines and alternative power sources Circular Economy Noise and Vibrations
Response 37 PhD 1 Title	Rail wear in curves of small radius
Response 37 PhD 1 Keywords	Rai infrastructure, rail wear, wheel-rail interaction, lubrication
Response 37 PhD 1 Description	Rail wear in small radius curves, analysis and evaluation of the influence of track layout, the influence of traffic parameters, the influence of the type of permanent way structure.
Response 37 PhD 2 Title	Use of secondary raw materials in the railway substructure
Response 37 PhD 2 Keywords	railway substructure, circular economy, secondary raw materials
Response 37 PhD 2 Description	Use of secondary raw materials in the railway substructure, design and assessment of the sleeper substructure, loading of the superstructure components and its transfer to the railway substructure.
Response 37 PhD 3 Title	Implementation of BIM processes in high-speed lines projects
Response 37 PhD 3 Keywords	High-speed lines, BIM, project management
Response 37 PhD 3 Description	Implementation of BIM processes in high-speed lines projects. Asset and project management.
Response 37 PhD 4 Title	Train speed in railway stations
Response 37 PhD 4 Keywords	Railway infrastructure, switches and crossings, train acceleration and braking, ETCS
Response 37 PhD 4 Description	The analysis of train speed in switches and crossings in railway stations in connection with ETCS implementation. Emerging principles for station design.
Response 37 PhD 5 Title	Digital twin method as a basis for monitoring and analysis of a railway line section for maintenance management
Response 37 PhD 5 Keywords	Railway infrastructure, digital twins, monitoring, maintenance management
Response 37 PhD 5 Description	Use of machine learning methods, specifically fuzzy logic. This method will be used to evaluate measured data from real structures or economic data.

Response 38 Country	UK
Response 38 Priority Topics	Air-rail Links; Urban freight by rail; Optimising timetables and plans for metro systems using AI and ML; Optimal organisational structures of metro systems; Simulation modelling of metro operations and passenger behaviour; Shift to rail in urban and suburban settings; crowd management and baggage handling; new interior designs for rail vehicles; Next generation rail skills development using innovative education and training methods.
Response 38 PhD 1 Title	Next-Generation Education and Training methods for Rail
Response 38 PhD 1 Keywords	Rail Education, Rail Training methods, Evaluation, Rail Curriculum, Programming, AL
Response 38 PhD 1 Description	Motivation The European rail sector stands at a critical juncture, facing a multifaceted challenge that threatens its long-term sustainability and competitiveness. The growing societal interest in sustainable transportation and the pursuit of the United Nations Sustainable Development Goals underscore the importance of a robust and efficient rail system. The impending retirement of a significant portion of the workforce, coupled with the rapid advancement of digitalization and automation technologies, has created a skills mismatch that urgently needs to be addressed. This challenge is further compounded by the fact that current education and training practices within the rail industry are not fully aligned with the rapidly evolving needs of the sector. The motivation behind this research stems from the recognition that a skilled and adaptable workforce is the cornerstone of a thriving rail industry. As technology continues to reshape the landscape, traditional roles may become obsolete, while new opportunities emerge. It is imperative to equip the current and future workforce with the necessary skills and competencies to navigate these changes effectively. Aim The overarching aim of this research is to develop innovative tools, equipped with artificial intelligence (AI) and computer-based applications, to evaluate and improve the methods of education and training in the rail sector. By addressing the existing gaps and challenges, the research seeks to align education and training practices with the rapidly evolving needs of the industry, ensuring a skilled and adaptable workforce capable of meeting the demands of the future. Objectives The objectives of this research are driven by the pressing challenges facing the rail education and training sector, which include: - Alignment with Industry Needs: Current education and training practices often lag behind the rapidly evolving requirements of the rail industry. It is crucial to bridge this gap to ensure that programs remain relevant and equip the workforce with the skills demanded by the sector. - Integration of Advanced Technologies: The incorporation of advanced technologies, such as VR-based training, presents significant hurdles, including issues related to infrastructure, accessibility, and the specialized training required for educators. Overcoming these challenges is essential to harness the full potential of technology in enhancing education and training methods. - Effectiveness Measurement: The effectiveness of existing practices, particularly in traditional classroom settings, lacks a standardized measurement framework. This poses difficulties in accurately assessing the impact of these practices on skill development. Developing robust evaluation methods is essential to gauge the efficacy of education and training initiatives accurately. - Standardization and Collaboration: The lack of standardization in curricula and training programs across the rail education landscape hampers seamless collaboration and the exchange of skills. Establishing a unified approach is imperative to ensure consistency and coherence in education and training offerings across different contexts. To address these challenges, the research will develop innovative tools equipped with AI and computer-based applications to evaluate and enhance education and training methods in the rail sector. By adopting integrated competence-based approaches led by young rail trainees, the research seeks to provide diverse avenues for skill development and foster an understanding of multidisciplinary concepts, innovative solutions, and emerging policies and practices at all levels of management - strategic, tactical, and operational. Furthermore, the research will incorporate post-event analysis to identify lessons learned and proactively develop training methods for future use.
Response 38 PhD 2 Title	Enhancing Air-Rail links using Simulation modelling, AI and ML
Response 38 PhD 2 Keywords	Air-Rail Links, Simulation Modelling, AL, Passenger Behaviour

Response 38 PhD 2 Description	Synopsis: The project focuses on addressing the evolving passenger needs in the context of Air-Rail links. It tackles passenger behavioural issues, aiming to optimize multi-modal mobility systems using AI and machine learning. The project will create transport simulation models to study and enhance passenger flow, particularly around key transport hubs in Birmingham (Birmingham International Airport, Birmingham New Street, and Snow Hill rail stations). The models will optimize scheduling, reduce inefficiencies, and shorten journey times while enhancing the overall passenger experience. AI and machine learning will also be applied to handle disruptions and propose solutions for service recovery, as well as simulate various "what-if" scenarios for integrating different modes of transportation. Aims: 1. Simulation Model Development: Build a model that simulates passenger flow based on data from Birmingham Airport and Birmingham's key rail transportation hubs to evaluate performance metrics such as passenger experience and energy consumption. 2. Transport System Resilience Testing: Evaluate the resilience of the system to disruptions using the simulation model. 3. AI and Machine Learning Implementation: Apply AI and machine learning techniques to improve transport system performance, enhance passenger experience, optimize recovery from disruptions, and generate alternative solutions to enhance decision-making and integration of transport modes, Air-Rail in particular.
Response 39 Country	United Kingdom
Response 39 Priority Topics	Switches and crossings system analysis, design and validation; S&C monitoring, operation, control and maintenance; track design, maintenance and operation; planning, design, and monitoring of bridge and tunnel.
Response 39 PhD 1 Title	Enhancing Railway Crossing Panel Resilience: Structural Design Optimization
Response 39 PhD 1 Keywords	structural analysis, optimisation, S&C design, vehicle dynamic simulation
Response 39 PhD 1 Description	This research aims to enhance railway crossing designs by systematically addressing dynamic load amplification caused by wheel load transfer. Utilizing advanced modelling and optimization techniques, the study will develop a comprehensive approach to improve load distribution and attenuation at crossings. By integrating finite element analysis, machine learning algorithms, and innovative design methods, this research aims to fundamentally transform our understanding of the resilience and performance of crossing panels.
Response 40 Country	Portugal
Response 40 Priority Topics	Maintenance of rolling stock
Response 40 PhD 1 Title	Augmented Reality System for Railway Maintenance
Response 40 PhD 1 Description	Development of an AR system to aid in rolling stock maintenance and training tasks
Response 41 Country	China
Response 41 Priority Topics	High speed, safety, punctuality, energy conservation
Response 41 PhD 1 Title	Research on Suppression Mechanism of Low-Frequency Instability in the Vehicle-Grid System of High-Speed Railways Based on the Dynamic Power Compensation

Response 41 PhD 1 Keywords	Admittance reshaping; Admittance decomposition; Dynamic compensation; dq impedance modeling; High-speed railway; Vehicle-grid system; Low-frequency oscillation.
Response 41 PhD 1 Description	Recently, with the rapid development of the high-speed railway in China, the AC-DC-AC drive electric multiple units (EMUs) and HXD high-power locomotives (hereafter called vehicles) have been put into operation at high density. The electrical interaction between the traction power grid (hereafter called grid) and vehicle converters can easily lead to the low-frequency instability phenomenon, which results in the traction blockade of vehicles and seriously threatens the security and stability of the railway system. At present, the suppression methods for the low-frequency oscillations (LFOs) in vehicle-grid electrical coupling systems (hereafter called vehicle-grid systems) mainly focus on the optimization of the control parameters and control strategies of vehicles, while there are few studies on the dynamic reactive/interharmonic power compensation for the grid. Moreover, the research on the LFO suppression method based on dynamic power compensation has not been systematically carried out, and the corresponding suppression mechanism is also unclear. Therefore, the LFO appears when multiple CRH5 EMUs are energized is taken for instance. Based on the research idea of “Dynamic compensator designing→Analysis of LFO suppression effect→dq impedance modeling and verification→Investigation into LFO suppression mechanism→Optimization of the dynamic compensator”, the study on the suppression mechanism of dynamic power compensation on the low-frequency instability in the vehicle-grid system of high-speed railway is conducted. The main works of this thesis are summarized in the following. (1) The design of dynamic compensation devices and the analysis for the corresponding LFO suppression effect. When the LFO occurs, a large amount of reactive power and interharmonic currents appear in the traction power grid, so the straight hanging cascaded H-bridge multilevel static synchronous compensator (STATCOM) and active power filter (APF) are successively designed to realize the dynamic reactive power/inter harmonic compensation. Specifically, the STATCOM aims to provide the reactive power compensation, while the APF aims to provide the interharmonic compensation or simultaneously provide additional reactive power compensation; Then, based on the Matlab/Simulink software, the simulation models of the CRH5 EMUs, grid, STATCOM, and APF are established. The LFO suppression effect of the compensators and the electrical performance of the system under different compensation modes are compared. Finally, the large-scale hardware-in-the-loop (HIL) simulation platform is established, which can reflect the real operation condition of the vehicle-grid system. The low-frequency instability phenomenon caused by the connection of eight CRH5 EMUs to the grid is reproduced. Further, the effectiveness of the compensator in eliminating this type of instability is verified. (2) The dq impedance modeling and verification of dynamic compensation device. The CRH5 EMU adopts dq current control, and most of the control system of the designed STATCOM and APF also acts on the dq coordinate system, so the dq small-signal impedance modeling method is adopted in this thesis. Considering the main circuit, phase-locked loop (PLL), DC voltage control loop and current control loop, the dq impedance model of STATCOM and APF are respectively deduced. In particular, for the APF current controller in the αβ coordinate system, the method for transforming it to the dq coordinate system is proposed. Then, to improve the efficiency of dq impedance measurement of a single-phase AC system, a simple dq impedance measuring approach is proposed. It avoids the need to inject the additional voltage disturbing signal to the system when the perturbation frequency is greater than the fundamental frequency. Through the impedance measuring, the accuracy of the established dq impedance model in low frequency is effectively verified. Meanwhile, the factors leading to the deviation in the APF impeda
Response 41 PhD 2 Title	Study on the Current Collection Quality and Service Life of the Double Pantographs and Catenary System with Small Encumbrance in High-speed Railways
Response 41 PhD 2 Keywords	High-speed railway; catenary; small encumbrance; compression stiffness test; nonlinear characteristics; double-pantographs operation; high-cycle fatigue; stress distribution.

Response 41 PhD 2 Description	The catenary system is the only power source of the high-speed electrified railway. The train collects electric energy by sliding pantographs mounted on the train roof at high speed. The dynamic contact force between the pantograph and catenary directly determines the current collection quality. Due to the large span and the high maintenance difficulty, the catenary system needs to have a long design life. In the catenary system, the height difference between the contact wire and the messenger wire at the support of the cantilever is called the encumbrance. The use of a small encumbrance catenary can reduce the tunnel section and significantly reduce the construction cost. However, the reduction of the encumbrance will reduce the length of the dropper and affect the current collection quality of the pantograph. The deterioration of the current collection quality will also aggravate the catenary's vibration and affect the service life. Simultaneously, to improve the transportation capacity of high-speed rail, rail operators often use double pantographs to collect the current. The interaction of the leading and trailing pantographs will also affect the pantograph's current collection quality and service life. Therefore, it has essential theoretical research significance and practical engineering value to study the current collection quality and service life of the high-speed rail pantographs-catenary system with a small encumbrance. This paper studies the current collection quality and service life of the pantograph-catenary system with a small encumbrance and double-pantographs operation. The main contents include: Carry out bench tests to obtain the catenary constitutive relationship that describes the dropper compression characteristics and the catenary SN curve. A finite element model of pantograph-catenary is established based on the test results to study the current collection quality with a small structure height and double-pantographs operation. A solid finite element model of the contact wire section is established to study the stress distribution of the area near the steady arm. And the fatigue analysis is conducted to analyse the contact wire fatigue life. The main works of the paper are summarised as follows: Firstly, aiming at the defect that the existing dropper model is only under tension but not under compression, a set of dropper compression test devices is designed. The dropper has compression stiffness in the initial stage of compression, and the compressive force is linearly related to the amount of compression. When the compression force of the dropper reaches the threshold, it continues to compress, and the compression force remains unchanged. The compression force threshold is the maximum compression force of the dropper. By fitting the test results, the value of the compressive stiffness of the dropper and the relationship between the maximum compressive force and the length of the dropper is determined. Secondly, consider the geometric nonlinearity of the contact wire, the messenger wire, and the dropper's tension-compression nonlinearity. A catenary model with small encumbrance is established based on the nonlinear finite element theory and the elastic modulus of the contact line material measured by the uniaxial tensile test. A double pantographs-catenary coupling model with a small encumbrance is established by coupling the finite element model of the catenary and the lumped model of the pantograph through the penalty function method. The new version of the European standard EN 50318 and the field test data were used to verify the model's accuracy. This proves that the model can be used to simulate dynamic behaviours with a common encumbrance. Then, the double pantographs-catenary dynamic simulation is carried out with different encumbrance, respectively. The results show that the current collection quality based on the traditional model does not change with the decrease of encumbrance. However, the m
Response 42 Country	India
Response 43 Country	Portugal
Response 43 Priority Topics	Predictive Maintenance and Prescriptive Maintenance of Railway Systems and Components, using a human-centric perspective and sustainability and circularity principles. Integration of predictive and prescriptive maintenance in railway operations, designing robust schedules to delays in operation and maintenance. Integration of railway network design and schedules in the transportation systems from a multimodal perspective, including detailed modelling (through Digital Twins) of main stations to estimate connection times in different platforms and other services in multimodal hubs.
Response 43 PhD 1 Title	RAMS in Transportation Systems: a Human-centric perspective
Response 44 Country	Switzerland

Response 44 Priority Topics	Robustness/ stability of operations monitoring and maintenance optimization integration of infrastructure maintenance and infrastructure development traffic control signalling upgrade, certification , automated design of systems prioritization of relevant projects versus less relevant; understanding cost benefit analysis in a time of uncertainties
Response 44 PhD 1 Title	Learning techniques for railway scheduling and timetabling
Response 44 PhD 1 Keywords	machine learning, precomputation, decomposition, algorithmics
Response 44 PhD 1 Description	The problem of organising high-performant railway services is essentially a scheduling problem, assigning scarce infrastructure resources to a series of trains so that both the number of trains (capacity) and performance are maximized. Performance KPIs are considered for both passengers and operators in terms of speed or travel time. Automated scheduling approaches exist in academia and practice. Though, they face a hard trade-off between the speed of computation (the faster, the better); the detail of the mathematical model considered (considering signals); and the scale of the instance solved (one station or one corridor; multiple stations; wide regions or an entire country). To move forward in this dilemma, we propose to use learning techniques at multiple stages: We want to learn the actual KPIs of the traffic controller/planner better. This insight allows us to focus on the actual problems based on the explicit feedback of users. We want to use machine learning to provide faster solution approaches. We aim for computational approaches by identifying the most promising research direction while exploring the solutions. We want to learn how practitioners accept or modify the solutions computed before implementing them in practice so that we are able to identify and anticipate their implicit preferences. We plan to integrate this approach in the working environment of both SBB and Siemens to allow direct usability of the resulting algorithms and the applicability of the insights in the current timetabling and scheduling processes.
Response 44 PhD 2 Title	Understanding choice process in railway traffic control
Response 44 PhD 2 Keywords	Human machine interaction, ergonomics, objective functions, surveys, choice modelling
Response 44 PhD 2 Description	The problem of organising high-performant railway services is essentially a scheduling problem, assigning scarce infrastructure resources to a series of trains so that both the number of trains (capacity) and performance are maximized. Performance KPIs are considered for both passengers and operators in terms of speed or travel time. Automated scheduling approaches exist in academia and practice. Though, they face a hard trade-off between the speed of computation (the faster, the better); the detail of the mathematical model considered (considering signals); and the scale of the instance solved (one station or one corridor; multiple stations; wide regions or an entire country). To move forward in this dilemma, we propose to use learning techniques at multiple stages: We want to learn the actual KPIs of the traffic controller/planner better. This insight allows us to focus on the actual problems based on the explicit feedback of users. We want to use machine learning to provide faster solution approaches. We aim for computational approaches by identifying the most promising research direction while exploring the solutions. We want to learn how practitioners accept or modify the solutions computed before implementing them in practice so that we are able to identify and anticipate their implicit preferences. We plan to integrate this approach in the working environment of both SBB and Siemens to allow direct usability of the resulting algorithms and the applicability of the insights in the current timetabling and scheduling processes.
Response 44 PhD 3 Title	Learning real-life constraints and objectives to determine timetables optimised for robustness interactively
Response 44 PhD 3 Keywords	robustness, simulation, optimization, feedback loop optimization-reality, stability

Response 44 PhD 4 Title	Dynamic stochastic learning of train dynamics as enabler to highly automated train operation
Response 44 PhD 4 Keywords	calibration, stochastic modelling, data driven model, train model
Response 44 PhD 4 Description	Currently, the most advanced motion models are based on concepts dating more than a hundred of years ago, with strong assumption on speed profile (a point-mass moving at a maximum possible acceleration and speed, neglecting all power losses), and little requirements on data collection and precision (Cunillera et al 2023). It is expected that a full exploitation of the current available data, and a better representation of the variability and real life dynamics requires a much higher precision of the motion models behind. While standard units like passenger trains are easy to model by few parameters, freight trains are much more diverse, and their current modelling is more often wrong than good. Freight trains have variable composition (length, weight), variable mass distributions, a variety of locomotives available, and may have large forces exchanged through couplers. This means that currently the driver has to probe (by marginally varying speed or tractive power) the real life characteristics of a vehicle. The uncertainty and limitations of such an approach require extremely conservative estimates (max vehicle speed, min vehicle separation) which limit system performance. The problem is how to describe a parsimonious and accurate dynamic model of train motion, with values calibrated from real life measurement of different sensor types; explicitly considering uncertainty and probability distributions of parameters; and embedding expert knowledge at multiple levels, both as input of the model specification, and as output of the model estimation. The process, data and output should determine standards and specification for both human driver and automated train operations, and trajectory planning for any downstream optimization of the schedule.
Response 44 PhD 5 Title	Efficient Safe Train Dynamics
Response 44 PhD 5 Keywords	Safety proof, rigid body simulation, safety assessment, traffic flow
Response 44 PhD 5 Description	This project studies the mathematical, physical, technical, and organisational conditions allowing and enabling higher degree of automation in railway traffic. The largest issue at hand is the variability and ignorance of precise values in train dynamics, especially for freight trains which feature various length, weight and wagon conditions, and are often carrying partially unknown goods (of partially unknown weight). For such vehicles the maximum acceleration that can be achieved for a specific traction force (i.e., a driving command), for both acceleration, cruising and especially for safe braking is currently unknown. This results in a conservative estimation of braking rate and dynamic performance, which decreases performance at the individual train level (going slower) as well as at the network level (running fewer trains). As a consequence, evaluation of increasing automation results in little added value. This project leverages data and mathematical modelling for tackling this challenge in three main steps.
Response 45 Country	Poland
Response 45 Priority Topics	1. Modification of the chemical composition and technology of manufacturing electric traction cables. 2. Replacing steel with light alloys based on Al and Mg and composites in the construction of railway rolling stock. 3. Replacing human personnel with drones when verifying the condition of railway infrastructure. 4. Simulation of a train ride with optimal control.
Response 45 PhD 2 Title	Study and implementation of a map of railway occurrences and its prediction model as tool used in the safety management system of railway undertakings
Response 45 PhD 2 Keywords	Railway incidents, collisions with animals, safety management system, animal collision prediction model
Response 46 Country	Netherlands
Response 46 Priority Topics	rail defects, contact mechanics, preventive maintenance, robotics, noise and vibrations
Response 47 Country	United Kingdom

Response 47 Priority Topics	Switches and Crossing (S&Cs) Condition Monitoring
Response 47 PhD 1 Title	Development of Predictive Models for S&C Monitoring and Predictive Maintenance
Response 47 PhD 1 Keywords	Condition Monitoring, Swithches and Crossings, Machine Learning model
Response 47 PhD 1 Description	This research aims to develop predictive models for Switches and Crossing (S&Cs) condition monitoring and predictive maintenance. Data analysis techniques is the main component of the project aiming to build a correlation between different source of data making up the predictive model such as vehicle-based, field measurement, lab test, and numerical models' data generation.
Response 48 Country	England
Response 48 PhD 1 Title	An AI based real-time adaptive railway traction system controller for improved low adhesion performance and reduced wheel-rail damage
Response 48 PhD 1 Keywords	real-time, adaptive, traction controller, low-adhesion, wheel-rail damage
Response 48 PhD 1 Description	This project aims to design and demonstrate, using the HAROLD 2.0 full-scale roller rig, a real-time traction control system for metro vehicles that adapts to changing adhesion conditions. The control system will manage traction under both low and high adhesion scenarios. In low-adhesion conditions, the control strategy will aim to minimise gross slip by maintaining slip within optimal limits, while in high adhesion scenarios, it will optimise wheel-rail forces to reduce damage caused by excessive or rapidly time-varying tractive forces. By incorporating AI techniques, the control system will deliver a more precise, adaptive, and real-time response, effectively managing the controller's behaviour to eliminate traction spikes during operation.
Response 49 Country	Turkiye

Response 49 Priority Topics	In Türkiye, railway priority themes are determined within the framework of the Ministry of Transport and Infrastructure, TCDD (Turkish State Railways), and sectoral strategy documents. Türkiye's railway policies and investments align with national development goals and integration processes with the European Union. Below are the key railway priority themes identified for Türkiye: 1. Expansion and Modernization of the Railway Network Expansion of high-speed and rapid train lines (e.g., Ankara-Istanbul, Ankara-Sivas, Konya-Karaman projects) Improvement and electrification of conventional railway lines Development of logistics centers and freight corridors 2. Increasing the Share of Railway Transportation Enhancing fast and comfortable passenger transportation Increasing the share of railway freight transport (e.g., Middle Corridor, Baku-Tbilisi-Kars Railway) Promoting combined transportation (rail + maritime + road) 3. Development of the National and Domestic Railway Industry National train, national high-speed train, and national electric locomotive projects (e.g., domestically produced electric train sets by TÜRASAŞ) Development of local railway signaling and infrastructure systems Research and development (R&D) and innovation in railway technologies 4. Smart and Sustainable Railway Systems Integration of digitalization and intelligent transportation systems into railways Development of signaling, telecommunications, and autonomous train systems Increasing the use of green energy and reducing carbon footprint (e.g., electrification projects, hydrogen-powered trains, solar and wind-powered stations) 5. Integration into International Railway Corridors Strengthening Türkiye's position as a logistics hub within the Middle Corridor (China-Central Asia-Türkiye-Europe) Investments in railway transport to enhance connections between Europe and Asia International railway projects such as the Baku-Tbilisi-Kars (BTK) line and the Halkalı-Kapıkule high-speed train project 6. Development of Urban Rail Systems Expansion of metro, tram, and suburban railway networks in major cities Implementation of light rail systems and electric public transportation solutions Widespread adoption of projects such as Marmaray, Başkentray, and Gaziray 7. Enhancement of Railway Safety and Standards Modernization of railway signaling systems Advanced automation and safety measures to prevent railway accidents Alignment of railway regulations with international standards These priorities are outlined in Türkiye's 2053 Transport and Logistics Master Plan and TCDD's strategic plans, reflecting both national development objectives and global railway trends.
Response 49 PhD 1 Title	Investigation of Fiber and Nano Particle Reinforced Polymer Matrix Hybrid Composite Development for Lightweight Body Production of Rail System Vehicles
Response 49 PhD 1 Keywords	Rail System Vehicles, Vehicle Body Structures, Composite Materials, Lightweight Design, Crash Resistance, Mass Saving

Response 49 PhD 1 Description	The application of carbon fiber reinforced polymer (CFRP) composite materials and structures in various industrial sectors is expanding significantly to meet the increasing demand for efficient, reliable and functional building materials. The use of CFRPs is a good alternative for improving railway structures and equipment due to their high strength-to-weight ratios, customizable mechanical properties and easy formability. However, it can be seen in the literature and the industrial industry that the railway industry has been slow to adopt composite materials compared to other transportation sectors such as aviation and aerospace. Therefore, studies to be carried out for CFRPs to reach their full potential in railway applications are important. "Lightweight and durable vehicle applications for the transportation sector in the field of advanced material technologies", which is also stated in the R&D and Innovation Topics of TÜBİTAK (The Scientific and Technological Research Council of Turkiye), is one of the scientific activity areas that have been given importance in our country recently. In this context, in addition to the lightening of railway vehicles, the main challenges encountered are to reduce energy consumption for transportation purposes and to reduce the emission of harmful gases by limiting the consumption of fuel resources. These disadvantages can be overcome with lightweight structures designed for vehicle bodies and frames. In addition, lightweight design is a very important issue for the high speed and performance expectations sought in high-speed trains (HST). Approximately 24% of the weight of a typical rail system passenger vehicle is the body structure. Carbon fiber reinforced composites are among the materials that can be preferred in the production of lightweight structures in order to reduce the total weight of the rail vehicle. In addition, the easy formability feature of the lightweight, high-strength, impact-absorbing composite material to be used in train cabins has the potential to make significant contributions to the development of the aerodynamic design structure in HSTs. The main goal in this study is to provide the production of polymer matrix hybrid composite materials by adding nano-sized reinforcements in addition to fiber reinforcement in order to provide the material with more superior properties as desired. In this context, it is aimed to produce a basic material that enables high strength and mechanically higher performance opportunities together with lighter body production, especially in the rail system sector. Within the scope of this project proposal, it is aimed to use two different nanoparticle additives that we have determined as a result of our research in a carbon fiber reinforced and polymer matrix composite and to create a hybrid material by vacuum bagging molding method in order to benefit from the superior properties of both nanoadditives. The developed materials will be characterized by UV-Vis spectroscopy, impedance spectroscopy, tensile, impact, hardness tests, FT-IR analysis and SEM analysis.
Response 50 Country	Thailand
Response 50 Priority Topics	- Railway Track Monitoring and Maintenance - Digital Twins in Rail - Rolling Stock Industrialization - AIOT in Rail Operation and Maintenance
Response 50 PhD 1 Title	Application of Digital Twins in real time investigation of Rolling Stock Envelopes
Response 50 PhD 1 Keywords	Rolling Stock Envelopes, Digital Twins, Multi Body Simulation, Artificial Intelligence
Response 50 PhD 1 Description	This study aims to develop a data-driven framework for real-time investigation of rolling stock envelopes using Digital Twin technology to enhance railway condition monitoring. By integrating simulation-based data with real-time sensor measurements to develop a Long Short-Term Memory (LSTM) network for predicting dynamic vehicle movement. A Multi-Body Model (MBM) simulation generates track irregularity and vehicle movement data, which, along with real-time accelerometer and tilt meter measurements, serve as inputs for training the LSTM-based prediction model. Model accuracy and loss function were then investigated to improve the accuracy of data prediction and reduce the risk of false prediction. The trained LSTM model enables dynamic gauge estimation, offering insights into track conditions and potential maintenance needs. By leveraging this data-driven framework, the proposed methodology provides information for optimizing track management and contributes to the safe and efficient operation of railway networks.
Response 50 PhD 2 Title	Development of Self Leveling Mortar for Enhancement of Stiffness and Stability of Ballasted Track
Response 50 PhD 2 Keywords	Self Leveling Mortar, Ballasted Track, Track Stiffness, Track Stability

Response 50 PhD 2 Description	The ballasted track system is extensively utilized in conventional railways because of its construction simplicity and cost-effectiveness; however, its primary disadvantage is the requirement for frequent maintenance. In recent years, the increasing need for railway cars with enhanced speeds and capacities has led to the rising popularity of concrete tracks, attributed to their superior rigidity and comparatively low maintenance requirements. This study devised a rapid conversion technology to replace existing ballasted tracks into concrete tracks with a self-leveling mortar characterized by high fluidity and early strength development, hence minimizing train operation disruptions. Twenty-five combinations were made, and the qualities of both fresh and hardened mortar were examined. The most appropriate qualities were selected for laboratory testing of track stiffness. Finite Element Method (FEM) was utilized for the design and analysis concerning track stability and fatigue through the application of the acquired parameters. Experimental results demonstrated that the track conversion was effective with the self-leveling mortar, and the concrete structures exhibited superior performance compared to the existing ballasted track.
Response 50 PhD 3 Title	High precision contact arcing and lateral wire contact detection of Overhead Catenary System using Modified Deep Learning Algorithms
Response 50 PhD 3 Keywords	Overhead Catenary System, Modified Deep Learning, High precision arcing, Lateral Wire Contact Detection, Contact Arcing
Response 50 PhD 3 Description	The overhead catenary system (OCS) plays a critical role in railway electrification, ensuring a stable power supply to trains. However, arcing and lateral wire displacement can lead to significant operational inefficiencies and infrastructure damage. This research proposes a high-precision detection for arcing and lateral wire displacement using modified deep learning algorithms. The proposed method enhances traditional deep learning architectures by integrating advanced feature extraction techniques and optimized model parameters, improving accuracy and computational efficiency. A comprehensive dataset of real OCS images and video sequences is used to train and validate the model. The findings of this study contribute to enhancing railway safety, reducing maintenance costs, and improving the overall reliability of electrified rail networks.
Response 51 Country	Italy
Response 51 Priority Topics	Safe maintenance, wireless interlocking, security assessment methodologies according to the new standards
Response 51 PhD 1 Title	Risk assessment and Threat Analysis methodologies complyant to the CLC/TS 50701
Response 51 PhD 1 Keywords	Threat Analysis, Standards, CLC/TS 50701
Response 52 Country	Spain
Response 52 Priority Topics	- Advanced modeling of pantograph-rigid catenary interaction. - Study and modeling of contact wire wear mechanisms in rigid catenary systems.
Response 52 PhD 1 Title	Advanced modeling of pantograph-rigid catenary interaction
Response 52 PhD 1 Keywords	Pantograph, Rigid catenary, Interaction, Finite element
Response 52 PhD 2 Title	Study and modeling of contact wire wear mechanisms in rigid catenary systems.
Response 52 PhD 2 Keywords	contact wire, wear, rigid catenary, finite elements.
Response 53 Country	Portugal

Response 53 Priority Topics	Predictive Maintenance Railway Safety Transports Mobility Sustainability
Response 53 PhD 1 Title	Computational Methods for Degradation Studies in Railway Vehicle Dynamics
Response 53 PhD 1 Keywords	railway dynamics, multibody dynamics, condition monitoring, degradation prediction, flexible multibody systems
Response 53 PhD 1 Description	The mobility of people and goods is essential for modern societies. The railway industry faces growing pressure to increase network capacity while ensuring safety, improving passenger comfort, and reducing maintenance costs. A key requirement is the thorough understanding of the degradation phenomena that affect the rolling stock and the track resulting from the operation. This knowledge supports the development of innovative designs and the implementation of predictive and condition-based maintenance strategies that minimise the life cycle costs of critical assets and maximise their availability. This work presents developments of computational methods to analyse the effects of degradation on the railway dynamics and support the design of railway components to minimise the degradation phenomena. First, a Design of Experiments approach is combined with a Response Surface Methodology to determine the most likely cause of a derailment scenario, which is a multivariate problem subject to uncertainty in the vehicle conditions. Next, a modelling approach for friction-damped vehicle suspensions is proposed, using imperfect kinematic joints to evaluate the effect of friction on the quantities used for vehicle homologation. Afterwards, a flexible multibody formulation is extended to simulate the structural deformations, with application to a bogie frame. Additionally, a pioneering development is proposed concerning the combination of multibody and peridynamics formulations to handle large structural deformations, including fracture. Next, transmissibility-based methods are developed to establish condition indicators, applied to the suspension elements and the bogie frame. Lastly, a methodology based on the Rolling Radius Difference function is proposed to optimise the geometry of a switch rail with the aim of minimising damage. The proposed methodologies form a comprehensive toolkit for the analysis of the interactions between component degradation and the railway dynamics in a computational environment. These achievements extend the potential to design and operate structures optimised to meet both present and future demands.
Response 53 PhD 2 Title	Methodological Framework for the Dynamic Analysis of Realistic Pantograph-Catenary Interaction
Response 53 PhD 2 Keywords	Multibody Dynamics, Pantograph-Catenary Interaction, Railway Dynamics, Co-simulation, Flexible Systems
Response 53 PhD 2 Description	The interaction of the train roof-mounted pantograph with the overhead contact line (catenary) is the main responsible for the transmission of electric energy from the grid to the locomotive engines. The quality of the contact in the interface between pantograph and catenary defines the ability of a train to operate at a chosen velocity in a particular railway network. The existing methods for the analysis of the dynamics of this interface require using the finite element method for catenary models, multibody dynamics for pantograph models, and a good understanding of the contact mechanics to handle their interface. In the process, computational efficiency can be achieved through co-simulation methods to handle the interface between models of different natures. The goal of this work is to improve the current state-of-art of the dynamics of the pantograph-catenary interaction, which can accomplished by: devising improved contact models that are sensitive to the sliding velocity, which ranges from 0 to 400 km/h; new modelling features that can handle specific mechanical components of the pantograph mechanisms; description of the dynamics of the pneumatic lifting devices, associated to the pressure bellows used to position the pantograph head in place, providing in the process a spring-damper type of behaviour to the overall pantograph; introduction of structural flexibility in the pantograph models in order to capture, realistically, the interaction dynamics for frequencies approaching, or passing, 100 Hz (current models are limited to 20 Hz); improvement of the methods to handle catenaries with general geometry, ie., catenaries with curves, gradients and multiple sections, to allow for realistic analysis scenarios; develop and apply structural reduction methods for the catenary models and nonlinear pantograph surrogate models to allow for the real-time simulation; and propose an extended procedure for the homologation of catenaries, to be considered for complementing the European Norm EN50318.
Response 54 Country	Malaysia
Response 54 Priority Topics	1. Defect detection using drone image processing and machine learning 2. 5G wifi connection for railway signaling and communication 3. Sharing Economy Model for Railway Transport 4. Carbon Credit and energy consumption for railway

Response 55 Country	Frane
Response 55 Priority Topics	Traffic management onboard riving assistance
Response 55 PhD 1 Title	Driving assitance based on AI
Response 56 Country	Sweden
Response 56 Priority Topics	- Derailment risk in case of longitudinal in-train forces - dynamic whee-rail forces and differentiated track access charges to incentivise track-friendly running gear - pressure pulses in tunnels, cross wind stability - lighter rail vehicles - optimisation of the wheel-rail interface - friction management
Response 56 PhD 1 Title	Active suspension for a new regional train concept
Response 56 PhD 1 Keywords	active radial steering, ride comfort
Response 56 PhD 2 Title	Using state estimation for active suspension control
Response 56 PhD 2 Keywords	state estimators, preview, Kalman filter
Response 56 PhD 3 Title	Multiphysics model of railway disc brake
Response 56 PhD 3 Keywords	FE model, temperature development, wear
Response 56 PhD 4 Title	New materials for vehicle components
Response 56 PhD 4 Keywords	sandwich material, carbon fibre material, LCC
Response 56 PhD 5 Title	Dynamic pantograph-catenary interaction
Response 56 PhD 5 Keywords	FE model, lumped mass models, dynamic interaction pantograph-catenary
Response 57 Country	Spain
Response 57 Priority Topics	Cloud interlocking Digital twins Virtual coupling Groundings
Response 57 PhD 1 Title	Model for EMC effects calculation on different alternating current electrification system
Response 57 PhD 1 Keywords	Electromagnetic compatibility;Energy;Affection;Induced voltage
Response 57 PhD 1 Description	The idea is to develop a model which can give an aproximation on affections derived from an altern current feed from a railway line into services, people and its interactions with the enviroment.

Response 58 Country	Belgium
Response 58 Priority Topics	- Punctuality of railway traffic - Optimal planning and routing on railway infrastructure - Impact of incidents on delay patterns & resilience
Response 58 PhD 1 Title	Predictive Process Mining Techniques to Improve Punctuality of Railway Traffic
Response 58 PhD 1 Keywords	Train punctuality, Delay incidents, Recovery, Process
Response 58 PhD 1 Description	Predictive process monitoring methods provide businesses with valuable information to identify deviances within a process execution, enabling them to carry out measures. In this research Infrabel's railway traffic data will be analyzed by representing train routes as a process and adding onto this the delay incidents and human actions to regulate the traffic.
Response 59 Country	Slovakia
Response 59 PhD 1 Title	Design of structural modifications of the railway superstructure in the transition zones
Response 59 PhD 1 Keywords	railway track, railway superstructure, transition area, computational models, finite elements method.
Response 59 PhD 1 Description	The thesis project in the introductory part presents the components of the classic construction of the railway superstructure (with track ballast). Furthermore, the thesis project deals with transition areas and the load on the railway line. The next part analyzes the methods of railway line calculations and describes the models used. In the end, the thesis project deals with the possibilities of creating computational models for the construction of the railway line and the creation of a test section.
Response 60 Country	Belgium
Response 60 Priority Topics	Railway-induced noise and vibration
Response 61 Country	Portugal
Response 61 Priority Topics	Predictive maintenance Novel solutions for transition regions Digital twins supported by real time numerical simulations
Response 62 Country	Ukraine
Response 62 Priority Topics	Train Safety and Risk Management, Digitalization and Information Management Systems, Innovation and Environmental Sustainability of Railway Transport, Integration with European Transport Systems
Response 62 PhD 1 Title	Development of predictive risk-based safety management of transport technologies using the example of railway transportation
Response 62 PhD 1 Keywords	Train Safety Management, Quasi-Predictive Approach, Risk Management, Hidden Statistical Patterns
Response 62 PhD 1 Description	A quasi-predictive approach to train safety management is developed based on the method of detecting hidden statistical patterns and risk management. A unified theory of self-organizing systems is used. Bottlenecks in rail transportation processes are prerequisites for the causes of transport incidents

Response 62 PhD 2 Title	Development of an information training and certification network system for traffic safety management to improve the level of safety in the field of railway transport
Response 62 PhD 2 Description	The dissertation is devoted to the implementation of the Regulations on the Train Safety Management System for an enterprise that uses railway infrastructure or rolling stock. The information system consists of sections devoted to: a) the study of traffic safety documents in Ukraine; b) testing and certification of knowledge; c) development and maintenance of a traffic safety management system at the enterprise
Response 62 PhD 3 Title	Measures and mechanisms to support implementation of rail technical innovations supporting the decarbonization of transport
Response 62 PhD 3 Description	An approach and program for implementing technical innovations in the EU railway sector are being developed. The dissertation is being carried out within the framework of the "PhDs EU-Rail" project of the Horizon Europe program. The work is intended for use in Europe's Rail Joint Undertaking and Ukraine
Response 63 Country	France
Response 63 Priority Topics	Energy Consumption Autonomous driving Data Exchange Vocabulary specification
Response 63 PhD 1 Title	Semantic interoperability for railway system modelling process
Response 63 PhD 1 Keywords	Semantic web, Knowledge engineering, Model based system engineering, Ontologies
Response 63 PhD 1 Description	The scientific issue we wish to address in this thesis concerns the verification of the railway modeling process (error checking, identification of dysfunctional properties, etc.) using semantic approaches. This problem is divided into 3 parts. The design and alignment of semantic (meta-)models, the adaptation in the form of semantic constraints (rules) of business, technological and operational constraints linked to the railway system environment, the design of optimized query mechanisms that can be applied to the ontology(s) constructed and aligned. The research project aims to automate verification procedures for railway system modeling, according to the needs expressed, particularly in terms of operating safety.
Response 64 Country	France
Response 64 Priority Topics	In collaboration with the Belgian railway infrastructure company Infrabel, the IESEG-UGhent-Infrabel On Track Lab studies train delay propagation, human-machine interaction, and employee workload balancing in digital railway control rooms.
Response 64 PhD 1 Title	Balancing workload to improve employee well-being in digital operations
Response 64 PhD 1 Keywords	Employee workload; behavioral operations; traffic controllers
Response 64 PhD 1 Description	Using event-level data on the tasks of the controllers in digital railway control rooms, we study how team characteristics and operations management relate to the balance of employee workload.
Response 64 PhD 2 Title	Employee-centric operations in a digital environment
Response 64 PhD 2 Keywords	Behavioral operations; digital control rooms; traffic controllers; human-machine interaction
Response 64 PhD 2 Description	The research focuses on human-machine interaction and individual learning from a behavioral operations management perspective, using event-level digital railway control room data.
Response 65 Country	India

Response 65 Priority Topics	Our research priorities list is 1 Integration of pantograph vehicle and track model in a single system 2 Pantograph centenary integration using Multibody and Finite element method 3 Development of Bridge transition for RDSO at their maximum axle load and speed 4 Effect of unsupported sleepers on the track Various projects are in progress and can be rolled out in India 1 High-speed rail development 2 Electrification of the entire network 3 Development for freight corridors 4 Safety and Infrastructure Modernization Development of Automatic Train Protection System 5 Urban Transit System Development of regional rapid transit systems (RRTS) like the Delhi-Meerut corridor. In semi-high-speed railway 7 Sustainability and Green Initiatives Development of Hydrogen operated train 8 Digitalization and Smart Railway 9 Track and wheel maintenance by incorporation of AI and Machine Learning
Response 65 PhD 1 Title	Coupled Dynamics of the Interaction between Track, Vehicle, Pantograph, and Catenary
Response 65 PhD 1 Keywords	Multibody Dynamics, Unsupported Sleeper, Pantograph, ADAMS Vi-Rail, Wheel Rail Interaction
Response 65 PhD 1 Description	The dynamic interaction between rail wheel-track and pantograph-catenary is critical in ensuring rail transport's stability, safety, and efficiency. The current study investigates the coupled dynamics of these components using multibody dynamics (MBD) simulations, focusing on unsupported sleepers, wheel-rail contact, and pantograph-catenary interaction. A co-simulation approach integrating ADAMS Vi-Rail is employed to analyze the influence of track irregularities, vehicle dynamics, and overhead line behaviour on system performance. The research evaluates the LHB Coach and Vande Bharat (Train 18) to compare their stability and ride quality under varying conditions. Special attention is given to the effect of mass, damping, and stiffness on critical speed and force transmission in the transition zone, particularly from embankment to bridge.
Response 65 PhD 2 Title	Static and Dynamic Study of Railway Catenary System Using Absolute Nodal Coordinate Formulation (ANCF)
Response 65 PhD 2 Keywords	Railway Catenary System, Finite Element Method, ANCF, Vibration Analysis, Design Optimization.
Response 65 PhD 2 Description	The catenary system ensures efficient power transmission for railway vehicles. The research focuses on evaluating the structural response of the catenary system under various loading conditions, capturing both the large deformations in static scenarios and the complex dynamic behaviour due to moving loads and environmental influences. The static analysis investigates load distribution, tension variations, and stress concentrations, while the dynamic analysis explores vibration characteristics and response under transient conditions. The results provide critical insights into the performance and safety of railway catenary systems and highlight the effectiveness of the ANCF-based FEM approach for predicting their behaviour. These findings offer valuable guidance for design optimization and maintenance strategies to enhance the reliability and efficiency of railway operations.
Response 66 Country	Brasil
Response 66 Priority Topics	Wheel-rail interaction issue; Vehicle dynamics safety analysis;
Response 66 PhD 1 Title	Wheel-rail wear severity prediction using semi-analytical computational method and pin-disc experimental test.
Response 66 PhD 1 Keywords	wear, simulation, pin-disc, wheel, rail

Response 67 Country	Spain
Response 67 Priority Topics	Pantograph-catenary interaction (computational simulation and hardware in the loop) Wheel-track noise (straight tracks and curves) Active pantographs AI in monitoring and measurement
Response 67 PhD 1 Title	Developement of high-speed advanced catenary model with cantilievers for the pantograph-catenary dynamic simulation
Response 67 PhD 1 Keywords	Catenary, Simulation, Finite element, Dynamic interaction, Cantilevers
Response 67 PhD 1 Description	AbThis study presents a numerical approach to determine the initial equilibrium configuration of a railway catenary system using the finite element method. Unlike conventional models, this work incorporates cantilevers as independent structural components, modeled with Euler-Bernoulli beam elements, rather than discretizing them within the overhead contact system. To ensure accurate coupling, a new constraint condition is introduced, based on the unit vector tangential to the track plane, enabling precise integration of cantilevers in a perpendicularly oriented plane. This methodology significantly enhances the realism of railway catenary models, improving their applicability for dynamic simulations. The proposed approach has been validated through case studies on railway networks in Spain, demonstrating its ability to capture structural interactions with greater accuracy while reducing computational costs associated with contact line simulations. These advancements pave the way for more precise railway infrastructure assessments and optimizations.
Response 68 Country	Ukraine
Response 68 Priority Topics	Integration of Ukrainian Railways into the European Transport System (TEN-T). High-speed railways and multimodal passenger transportation. Traffic Safety and Risk Management.Prediction of railway transport risks based on the analysis of hidden statistical patterns. Development of information systems for training, certification, and traffic safety management. Implementation of a safety management system at railway transport enterprises.
Response 68 PhD 1 Title	Technological aspects of the integration of Ukrainian railways into the EU Trans-European Transport Network (TEN-T 1435 mm)
Response 68 PhD 1 Keywords	technological solutions, mathematical models, optimization, TEN-T, railway integration, railway network interaction
Response 68 PhD 1 Description	Possible strategies for the phased integration of Ukrainian railways into the TEN-T 1435 mm gauge and interaction with the existing 1520 mm gauge railway network are developed, with various technological solutions being selected, among which optimal solutions will be selected based on appropriate mathematical methods and models
Response 68 PhD 2 Title	Integration of high-speed railway infrastructure into the system of multimodal passenger service
Response 68 PhD 2 Keywords	high-speed railways, multimodal transportation, transport system interaction, passenger demand, transport services, infrastructure management, economic aspects, phased implementation
Response 68 PhD 2 Description	The technological, organizational and other aspects of the phased creation of a high-speed railways network of 1435 mm gauge, their interaction with railways of 1520 mm gauge and other modes of transport based on multimodality of passenger service, satisfaction of passenger demand for transport and related services and economic interests of high-speed railway infrastructure manager companies are considered
Response 69 Country	Brazil
Response 69 Priority Topics	Railway track: materials and components, structural behavior, experimental studies, inspection and maintenance strategies
Response 69 PhD 1 Title	Thermo-hydro-mechanical behavior of the railway track subballast: an experimental and numerical study

Response 69 PhD 2 Title	Contribution to the design of ballasted tracks using elastic pads under concrete sleepers
Response 70 Country	Poland
Response 70 Priority Topics	new sustainable light vehicles, sustainable fuels, data lake solutions, green railway stations, digital twin solutions, energy hub, cargo management, intermodality, rail relation to SDGs
Response 71 Country	Czechia
Response 71 Priority Topics	power electronics, electric drives, electric machines, induction machines, synchronous machines, control of power converters and electric drives, power converters, traction converters, propulsion systems for transportation, control algorithms, real-time control
Response 71 PhD 1 Title	Optimal control methods for permanent magnet synchronous machines
Response 71 PhD 1 Keywords	electric drives, control methods, permanent synchronous machines, optimal control
Response 71 PhD 1 Description	The thesis deals with advanced control algorithms for electric drives with permanent magnet synchronous motors, specifically focusing on refinement of the traditional mathematical model by identifying magnetic flux maps, inductance maps, torque ripple compensation, and implementation of the refined model by means of finite control set model predictive control (FCS-MPC).
Response 71 PhD 2 Title	New powertrain concepts for electric vehicles
Response 71 PhD 2 Keywords	electric vehicles, electric drives, control algorithms, multiphase drives
Response 71 PhD 2 Description	The thesis deals with the analysis of current electric power units for road vehicles in order to identify the weak points of the propulsion system and to propose possible improvements of the system power concepts. As a possible solution, the use of multiphase machines as a replacement for as a replacement for the three-phase machines in use. A true analysis and testing of a multiphase system (mostly machine) is the focus of this paper. Multiphase machines, due to their stator winding design (larger number of phases), offer an additional degree of freedom that gives these machines several advantages: fault tolerance, use in multi-motor applications, low torque ripple to minimize noise, and the increase in torque injection. Higher harmonic currents, which also results in higher power density. One of the main parts of the thesis is dedicated to the possibility of injecting higher harmonic currents to increase the machine torque.
Response 71 PhD 3 Title	Control of new topologies of high voltage power converters
Response 71 PhD 3 Keywords	power converters, multilevel converters, traction supply systems, power quality, power balance
Response 71 PhD 3 Description	The thesis focuses on power semiconductor converters for traction power supply and their potential to improve power quality, power factor and power balance to minimize unwanted effects on power distribution and transmission systems. The main attention is paid to high-quality voltage systems, namely multilevel power converters, which are mainly applied in this field and, at the same time, represent one of the main research directions.
Response 71 PhD 4 Title	Control algorithms for new generation AC traction drives
Response 71 PhD 4 Keywords	ac traction drives, electric drives, control algorithms, optimal control
Response 71 PhD 4 Description	The thesis deals with regulated AC permanent magnet electric drives and their operation at the optimum point with respect to the maximum torque per ampere (MTPA) curve, which minimizes the Joule's losses at the required torque. This task of finding the MTPA online is directly related to the estimation of the actual electric motor parameters and the validation of the mathematical model.

Response 72 Country	Sweden
Response 72 Priority Topics	My colleagues at KTH and other Swedish universities have probably already provided a long list. Here's some additions(?) to those: - Cost-efficient solutions to maintain and upgrade low-traffic regional lines to reasonable standards. - How to include AI-based solutions into safety critical systems, maintaining Cenelec compliance.
Response 72 PhD 1 Title	Fail-safe train positioning
Response 72 PhD 1 Keywords	GNSS, IMU, Digital maps, Sensor fusion
Response 72 PhD 1 Description	Sensor fusion solutions for train positioning, exploiting a combination of GNSS (when available), inertial measurement units (IMUs) and map information, taking into account that map data may be approximate and uncertain.
Response 72 PhD 2 Title	Sensor analysis for safety critical applications
Response 72 PhD 2 Keywords	Level crossings, obstacle detection, Radar, Lidar, Cameras,
Response 72 PhD 2 Description	Specifically, studying different sensor technologies and sensor data processing techniques for obstacle detection in railway level crossings. More generally, studying sensor data processing techniques for safety critical applications.
Response 73 Country	Lithuania
Response 73 Priority Topics	Implementation efficiency of railway innovations; Monitoring of the railway track technical condition; Diagnostics of catenary and pantograph technical condition; Methods of utilizing the energy of regenerative braking; Utilization of hydrogen in rail vehicle powertrains; Detection of rail wheel rolling surface damages; Arrangement of railway engineer competences.
Response 73 PhD 1 Title	Study on the effectiveness of high-speed rail transport development projects
Response 73 PhD 1 Keywords	High speed railways; Rail Baltica; macro-environmental factors; interrelationship, Granger causality method.
Response 73 PhD 1 Description	The aim of this research work is a developing a methodology for assessing the link between high-speed rail development and passenger flows, taking into account the macro-environment of the railway undertaking. Study tasks are an identify and systemizing the most important macroenvironmental indicators for the Lithuanian rail passenger transport business; an analyzing the interrelationships between macro-environmental factors using expert judgement and Granger causality method; a carrying out passenger flow forecasting by means of univariate and multivariate models and evaluating the robustness of the models developed; a developing scenarios for the macro-environment based on forecasts and expert judgement; and a formulating conclusions and recommendations for the development of high-speed railways and for increasing passenger flows in Baltic States.
Response 73 PhD 2 Title	Multiple criteria analysis of rail traction rolling stock alternatives to improve passenger transportation quality and environmental protection
Response 73 PhD 2 Keywords	Railway passenger transportation; traction rail vehicles; multiple criteria analysis; mathematical modelling; fleet optimizing.

Response 73 PhD 2 Description	The aim of this study is a developing a mathematical model, based on experimental data and experimental research methods, that allows to determine the structure of the passenger rolling stock fleet with the highest socio-economic efficiency. Research tasks are: a conducting the research on passenger rolling stock types, energy consumption, rolling stock maintenance, and interaction with infrastructure, including the environmental impact of rolling stock dynamics; a develop and systematizing criteria for assessing the suitability of different types and qualities of rolling stock for passenger transportation and to determining their relative weights (importance); a creating out an original mathematical model to assess and compare the socio-economic efficiency of different types of traction passenger rolling stock on a selected railway section; and providing research-based conclusions and recommendations to enable companies, national institutions and other bodies to plan strategies for the development of passenger rolling stock, considering social needs, pollution reduction, efficient long-term investment, economic growth, and the implementation of new technologies.
Response 74 Country	Serbia
Response 74 Priority Topics	Technological improvement of railway operations.
Response 74 PhD 1 Title	Resilience of metro network of future metro in Belgrade (work title)
Response 74 PhD 1 Keywords	metro, resilience, network theory
Response 74 PhD 1 Description	The simulation of metro network resilience in the case of Belgrade would be conducted based on the principles of network theory. Complex network modeling has found widespread application in assessing the resilience of transportation systems. Resilience assessment generally follows five steps: 1. Constructing the network model, where nodes represent stations and edges represent railway tracks; 2. Defining resilience indicators; 3. Generating disruption scenarios; 4. Defining recovery sequences; and 5. Measuring resilience by analyzing changes in indicator values before and after disruptions.
Response 75 Country	Portugal
Response 75 Priority Topics	- Bridge asset management; - Normative aspects related with bridge dynamics; - Condition monitoring of bridges; - Condition monitoring of railway vehicles; - Renovation of existing structures;
Response 75 PhD 1 Title	Dynamic stability of trains over bridges: a normative research approach
Response 75 PhD 1 Keywords	Bridge dynamics; train running; riding comfort; bridge standards

Response 75 PhD 1 Description	The normative aspects related with the train stability on bridges date back to the 90s, especially from the studies carried out by the ERRI/D214 special committee [3] responsible for harmonizing the European standards related with the bridge dynamics. These studies culminated in most of the criteria stipulated in the current European norms, namely the namely the EN 1991-2 [1] and EN 1990-Annex A2 [2], whose main criteria discussed here are summarized in Montenegro et al. [4]. However, with the development of the computational capabilities, researchers from the field have been developing advanced numerical models of the train-bridge interaction (TBI) system, whose results are putting some of the criteria into question given its apparent degree of conservativeness. Among these criteria, the deck vertical and lateral deformation, vibration limits and the passenger comfort on bridges stipulated in EN 1990-Annex A2 [2] and EN 1991-2 [1] stand as some of the most outdated criteria, but that have a strong impact in the bridge design and cost. The EN 1990-Annex A2 [2] sets deck vibration limits for ballasted and ballastless track bridges. Based on Zacher and Baeßler's tests [5], the former indicates instability at 0.7 g accelerations, while the latter assumes derailment risk at 1 g, applying a safety factor of 2 [2]. Despite lacking scientific backing, this factor is chosen based on engineering judgment [6]. Recent Shift2Rail projects, particularly In2Track3, reveal a lack of correlation between deck acceleration and train derailment in ballastless tracks [7]. The need to revise these criteria for high-speed railway bridges is emphasized by European regulatory bodies,including the European Union Agency for Railways (ERA) [8]. Though not part of current EU-Rail call objectives, analyzing the deck vertical deflection limit (L/600 in [2]) is crucial, given its independence from structure type, traffic speed, or train type. Similar limitations exist in relative vertical deformations between the deck and adjacent constructions defined in [1]. International standards, like the Japanese [9], offer deck deflection limits for different scenarios, providing valuable insights for European codes. The lateral vibration criterion, defined by the ERRI/D181 committee [10], sets the bridge's lateral natural frequency for each span to be higher than 1.2 Hz, as adopted by EN 1990-Annex A2 [2]. This criterion originated from a study on six bridges with simply supported spans between 30 m and 120 m, where lateral resonant effects were observed. However, researchers [11,12] have highlighted limitations, especially for high-pier viaducts with continuous spans, where long-wavelength lateral modes with low frequencies (sometimes below 0.3 Hz) deviate from the original case studies. Several examples of such bridges are in service in Spain without reported issues [12,13]. The passenger comfort criterion in EN 1990-Annex A2 [2] relies on an outdated procedure based on an indirect measure of deck deflection. It was developed for bridges with simply supported spans but applies multiplication factors to other configurations. Although the European norm EN 12299 [14] provides more advanced comfort analysis, recent research [13,15] indicates the need for improvement, as it was initially designed for analyzing comfort during journeys and not specifically on bridges. Given the significant impact of the mentioned criteria on railway bridge design and costs, it is crucial to revisit them, leveraging today's higher computational power. Advanced numerical models of the train-bridge system can provide more detailed insights into train instability phenomena. Although the end-users towards which this PhD program is intended, namely the regulatory bodies ERA and CEN responsible for evaluating if the proposed normative recommendations can be adopted by the standards, it is expected that the recommendations for improving normative related with bridge dynamics that will arise from
Response 75 PhD 2 Title	Advancing the Eurocode normative criteria for high-speed railway bridges
Response 75 PhD 2 Keywords	High-speed; Railway bridges; Eurocode; Running safety; Probabilistic analysis.

Response 75 PhD 2 Description	Railways are essential to build a more sustainable future. In a time of rising concerns regarding climate, rail transport is highlighted as the greener alternative. The European Union is focused on developing high-capacity and environmentally-friendly rail networks, as demonstrated by the efforts in establishing Europe's Rail Joint Undertaking, through which research projects have worked towards improving the life cycle of infrastructures. High-speed railway bridges are vital parts of rail networks whose design is conditioned by norms such as the Eurocodes. This thesis builds upon concerns expressed not only by the scientific community but also by regulatory bodies regarding gaps identified in the Eurocodes. A three-part literature review is presented as a basis for research. The first includes the design dispositions in European, Chinese, and Japanese norms; the second focuses on methodologies to assess the dynamic behaviour of the trainbridge system; the third goes over probabilistic methods to evaluate structural safety. The gaps identified in this review motivate the three main objectives of the thesis. The first is to evaluate the limitations of the EN 1991-2 High-Speed Load Model (HSLM), considering that it may not cover new trains and that its limits of validity may be inconsistent. Randomly generated articulated, conventional, and regular train load models are generated and compared with the HSLM's envelope on a case study bridge. In addition to train signatures, dynamic analyses are presented, for which a novel tool to decrease computational cost in moving loads analysis is introduced. It is found that a load model can abide by the norm's limits but still not be covered by the HSLM. At the same time, the current HSLM envelope is partially suited to cover new trains. The second objective addresses deck acceleration in ballasted bridges, limited to 3.5 m/s2 by the EN 1990. This value is based on the application of a seemingly arbitrary safety factor of 2.0. To test its suitability, the physical limit for ballast stability of 7.0 m/s2 is compared with design accelerations calculated at critical speeds corresponding to probabilities of failure of 10−4. This target pertains to the fact that, while deck acceleration does not compromise structural safety, ballast instability may lead to derailment, and therefore, it is considered an Ultimate Limit State. To determine design accelerations, new definitions are put forward, clarifying the EN 1991-2's dispositions. The assessment of critical speeds conditioned by low probabilities of failure is done with a newly proposed algorithm based on subset simulation. Results from four case study bridges show that a bridge can be designed with a deck acceleration greater than the norm's current limit while staying within the target probability of failure, thereby without jeopardizing the traffic safety. The third goal is to understand the existence of a limit for deck acceleration in ballastless bridges. In these structures, the EN 1990's limit of 5 m/s2, in addition to being based on the same safety factor, likely reflects an assumption that a deck acceleration of 10 m/s2 (i.e. circa 1 g) is indicative wheel-rail detachment. Using both lateral and vertical dynamics, derailment criteria are calculated on five case study bridges containing different rail irregularities. A new three-dimensional model based on the HSLM is developed for this parametric study. The simulations' results do not suggest that there is a strong correlation between deck acceleration and derailment criteria. The normative recommendations from this work constitute suggestions towards advancing the Eurocodes in further revisions. By allowing new, faster trains to operate on existing lines, the lifecycle of high-speed railway bridges can be extended.
Response 75 PhD 3 Title	On-board track condition monitoring system based on inverse dynamic models
Response 75 PhD 3 Keywords	On-board condition monitoring; railway vehicles; railway track condition; runnign safety; derailment criteria

Response 75 PhD 3 Description	The goal of the proposed research is to develop a monitoring system capable of assessing the track condition through the vehicle's responses. It follows the standards and objectives stipulated by the Shift2Rail joint undertaking, more specifically, with the Innovation Programme 3 (IP3 - Cost-efficient and reliable high-capacity infrastructure) under the technical demonstrators 3.6-3.8 (TD 3.6/3.7/3.8 - Intelligent asset management strategies) (Shift2rail, 2014). In other words, the main objective is to use in-service vehicles to monitor the condition of the railway network, in particular the railway track, to evolve from the current reactive methods to modern predictive ones. Moreover, the need to recognise unsafe track sections goes beyond the issue of real-time monitoring and starts questioning the applicability of today's standard (EN13848-5, 2008). Hence, the track condition assessment must not only rely on the measurement of the track irregularities, but also on how the vehicle behaves when moving over them. In the proposed approach, the indicators related to the vehicle's response that will be used to assess the track condition will be based mainly on derailment factors, which depend on the lateral and vertical contact forces that arise in the wheel-rail contact interface. However, since it is impracticable to capture the contact forces directly, the development of an indirect approach is of the utmost concern. The work that will be carried out in the PhD thesis aims to overcome this drawback with the development of methodologies to indirectly assess the contact forces through inertial readings obtained in the moving vehicle. According to the above, this work attempts to fulfil the following objectives: 1. Perform a thorough review of existing on-board track condition monitoring systems and identify their potentialities and their limitations. 2. Develop numerical models of the train-track systems and calibrate/validate the dynamic models of the vehicles based on experimental campaigns. 3. Develop and implement the Inverse Dynamic Model (IDM) that can indirectly obtain the wheel-rail contact forces through the vehicle dynamic responses. 4. Validate the IDM using the results from the numerical simulations of the train-track systems. 5. Identify key performance indicators (KPIs) of the track condition based on the IDM. 6. Develop and implement tools to compute the KPIs based on the experimental vehicle dynamic responses. 7. Implement and demonstrate the on-board track condition monitoring systems for two real case scenarios (freight and passenger vehicles).
Response 75 PhD 4 Title	Damage Identification in Railway Bridges using Bridge-Track Monitoring Systems and Machine Learning Strategies
Response 75 PhD 4 Keywords	Structural health monitoring; filler-beam railway bridges; damping; damage detection; machine learning.
Response 75 PhD 4 Description	Structural Health Monitoring (SHM) plays a critical role in ensuring the safety and functionality of railway bridges. By continuously assessing the structural integrity and detecting potential damage early, SHM systems help prevent catastrophic failures and extend the service life of these vital infrastructures. In the context of railway bridges, SHM involves using sensors and techniques to monitor dynamic responses and identify anomalies that may indicate damage. Effective SHM systems are essential for maintaining the reliability of railway networks, as they enable timely maintenance and repairs, thereby minimizing disruptions and enhancing overall safety. The proposed work presents a comprehensive study on damage detection in filler-beam railway bridges, focusing on calibrating and validating these structures to determine damping coefficients and detect damage effectively. An innovative approach for assessing damping in filler-beam railway bridges will be introduced. The research includes developing and validating a machine learning-based damage detection methodology supported by robust numerical modelling. In parallel, an experimental monitoring system will be developed to enable early damage detection. An online strategy for identifying damage using dynamic responses from trains, integrating both experimental and numerical data, will be proposed. The outcomes of this study aim to enhance the reliability and efficiency of damage detection in railway infrastructure, thereby contributing to the safety and longevity of railway bridges.
Response 75 PhD 5 Title	Smart Wayside Monitoring for Early Detection, Diagnosis and Classification of Railway Wheel Damage by Artificial Intelligence Techniques
Response 75 PhD 5 Keywords	Wheel flat detection; wayside condition monitoring; train-track interaction; unsupervised learning

Response 75 PhD 5 Description	Wheel defects are pervasive and deleterious issues that significantly impair the performance and safety of railway vehicles. These defects not only lead to higher operational costs due to increased maintenance and replacement requirements but also pose severe safety risks, often resulting in catastrophic failures and accidents. Condition monitoring systems allow for real-time assessment and evaluation of wheel and track conditions. These advanced systems are indispensable for identifying defects, preventing potential failures and enhancing the safety and reliability of railway operations. Moreover, Artificial Intelligence (AI) based methods can revolutionize damage detection and its identification processes. In this context, the proposed study is motivated by the urgent need for a systematic and practical approach to vehicle damage identification, namely geometrical wheel defects with a focus on measurements from wayside monitoring systems. The research has two main objectives: i) to develop an unsupervised data-driven (machine learning) ML- methodology to detect, diagnose, and classify wheel defects at an early stage in operation; ii) to propose a methodology for predictive maintenance of common wheel defects (corrugation, polygonization, and flats).
Response 76 Country	Sweden
Response 76 Priority Topics	Trustworthy machine learning for railways Edge computing for railway applications
Response 76 PhD 1 Title	Detection and mitigation of adversarial attacks on situational awareness
Response 76 PhD 1 Keywords	physically realizable attacks, object detection, object tracking, collision avoidance
Response 76 PhD 1 Description	The project develops methodologies for the detection and mitigation of physically realizable attacks on machine learning based computer vision applications, such as object detection, object classification and object tracking. The main application areas are the mitigation of safety critical incidents through real-time situational awareness obtained using video surveillance, such as in level crossings and at railway stations.
Response 77 Country	Sweden
Response 77 Priority Topics	At a very high level, (railway) system-level optimisation. Then this is applied in different areas like energy consumption, maintenance cost allocation, LCC, LCA, robustness, capacity... all of these including multi-stakeholder and multi-disciplinary analyses. Further, transport system level sustainability-focused optimisation is a priority, while being difficult to address due to lobbying from the different transport sectors. Impact of global warming in the different subsystems is a priority too (robustness / resilience). This priorities are enabled by disciplinary research that has a clear systems perspective, such as estimation of track degradation based on rail vehicle dynamics, but including maintenance operations and railway undertakings logistics; another example is Digital Automatic Couplers for freight and all the surrounding research related to logistics, vehicle dynamics, braking dynamics, LTD...
Response 77 PhD 1 Title	Contact mechanics modeling for wheel and rail profile optimization applications
Response 77 PhD 1 Keywords	wheel profile, rail profile, wheel-rail contact, optimization, optimisation, contact mechanics
Response 77 PhD 1 Description	In wheel and rail profile optimization processes there are many variables that influence the outcome, with those related to contact modelling being an important component of the analysis. This project studies the characteristics of wheel and rail profile representation, contact mechanics, and overall vehicle dynamic effects in optimization processes, with special emphasis on the understanding of objective functions and constraints.
Response 77 PhD 2 Title	Vehicle Conceptualization, Compactness, and Subsystem Interaction
Response 77 PhD 2 Keywords	Early-stage design, Network Theory, Sensitivity Analysis, Subsystem Interaction

Response 77 PhD 2 Description	In early-stage design, there is little knowledge on the consequences of design choices but high freedom to modify design at a low cost. Therefore, it is important to bridge this knowledge gap. To achieve this, this work focuses on two aspects: (1) developing alternative forms of representing vehicle models and (2) developing methods to capture the intricate interactions at component, subsystem, and system level. These alternative forms and methods help us identify the most influential inputs for a specific output and identify the various interactions and knock-on effects caused by the input at different levels. The methods are applied to a case study involving electric traction chain components of a rail vehicle and their influence and interdependencies with other subsystems and in the wider railway system.
Response 78 Country	France
Response 78 Priority Topics	Railway Automation for maintenance Railway accessibilité to remote ares through light rail systems Automatic Train operations
Response 79 Country	France
Response 79 PhD 1 Title	Global issues and local strategies around new rail services: rethinking the relationship with the territory
Response 79 PhD 1 Keywords	Transport, urban planning, axis contracts, governance
Response 79 PhD 1 Description	This thesis examines different territoires ; to investigate how urban planning and rail transportation are coordinated in sparsely populated areas. The goal is to comprehend how this coordination is carried out, what steps local actors take, and how they implement this strategy. To achieve this, we use bibliographical analyses, urban planning papers, and information gathered from semi-directive interviews with elected officials, local government personnel, associations, and specialists in the two study areas that were chosen.
Response 80 Country	Czech Republic
Response 80 Priority Topics	From my expertise, wheel-rail tribology-related issues are identified: - Wheel and rail wear reduction - Squealing noise prediction and mitigation - Implementation of the wheel-rail friction management techniques - Development of a digital twin of the wheel-rail interface - Railway vehicle vibration diagnostics and the application of AI-assisted data processing - Particle emissions from the wheel-rail interface
Response 80 PhD 1 Title	The effect of contamination on friction modification in the wheel-rail contact
Response 80 PhD 1 Keywords	wheel-rail interface, friction management, contamination, water
Response 80 PhD 1 Description	The aim is to clarify the behaviour of substances affecting the friction in the wheel-rail contact, depending on the composition of the friction layer, which is formed naturally on the surface of the contact bodies. It is an experimental work exploring the interaction of natural contaminants and other substances deliberately applied to the contact.
Response 80 PhD 2 Title	Solid Stick Friction Management
Response 80 PhD 2 Keywords	Wheel-rail interface, friction management, solid stick
Response 80 PhD 2 Description	The aim is to research and develop an advanced system for the application of solid friction modifiers in the form of sticks on the wheels of rolling stock. The work includes experimental research on the effect of solid-stick composition and application parameters on wheel-rail friction, wear and other parameters. The development results in a consumable in the form of a stick of environmentally acceptable solid lubricant with the required properties.

Response 81 Country	Sweden
Response 81 Priority Topics	Maintenance for 32,5 tonnes Interface rolling stock - track in a cold climate and heavy haul context Climate adaptation of railway infrastructure Life cycle management of railways Engineering asset management for railway Flow optimisation of railway maintenance Rolling stock in a cold climate and heavy haul context System innovation perspectives for railways Maintenance logistics AI for maintenance decision support Automation of railway maintenance
Response 81 PhD 1 Title	Railway squealing noise
Response 81 PhD 1 Keywords	railway squealing noise generation root cause
Response 81 PhD 1 Description	Railway curve squeal is a strong tonal sound caused by instabilities in the wheel-rail contact of railway vehicles negotiating curved track sections. Squealing sound generates high noise levels creating noise problems in locations where curved railway tracks run close to residential areas. Despite extensive research, the underlying causes and effective mitigation strategies for curve squeal remain complex, influenced by environmental, operational, vehicle specific and track specific factors. Currently the only efficient measure for curve squeal mitigation is the application of friction modifiers/lubrication on the rail surface to gain suitable friction conditions where instabilities in the wheel-rail contact do not arise. However, the systems for rail lubrication are prone to defects and require continuous maintenance with short time intervals. Also, lubricating the rails can cause undesirable loss of the braking and traction performance of trains. Thus, there is a need for finding new ways to mitigate curve squeal and to optimize the current solutions. Understanding the mechanism of curve squeal is essential for the development of mitigating solutions. This project aims to address these gaps through a comprehensive study involving long-term data collection, statistical correlation analysis, machine learning modeling and dynamical system modeling to predict squeal occurrences and identify root causes of curve squeal. Based on the insights from the studies, strategies for curve squeal mitigation will be evaluated and optimized, contributing to sustainable and practical solutions for noise reduction in rail systems.
Response 81 PhD 2 Title	Creative AI and LLM for facilitatation of the transition to Industry 5.0 in the railway sector
Response 81 PhD 2 Keywords	AI LLM enhancing decision-making processes railway
Response 81 PhD 2 Description	The main purpose of this work is to conduct research and design an AI system platform that builds 'Creative AI' and LLM (Large Language Models). This AI system enables innovations that contribute to improved efficiency and effectiveness in the life cycle phases of railway industry. The project has a particular focus on increased utilization of LLM for handling three (3) types of content, namely: law-related, environmental-related and security-related.
Response 81 PhD 3 Title	Multiphysics simulation of Eddy current sensor and Railway track interaction
Response 81 PhD 3 Keywords	Multiphysics simulations Electro-Magnetic sensor Railway track
Response 81 PhD 3 Description	The purpose of the project is to enhance railway infrastructure management by developing a novel approach for detecting critical track components through Multiphysics simulation and data-driven models. The goal is to develop an automated monitoring system using a train-based differential eddy current sensor to continuously monitor multiple track components, improving operational capacity, service quality, and safety while minimizing downtime and delays.
Response 81 PhD 4 Title	TBD
Response 81 PhD 4 Keywords	monitoring data wagon CBM

Response 81 PhD 4 Description	Data from Wayside detectors has been analyzed to identify information that can be used for condition-based maintenance of vehicles. This is to reduce the number of faulty wagons that get stuck in the detectors, resulting in traffic disruptions.
Response 82 Country	Czech republic
Response 82 Priority Topics	railway traffic control - ERTMS, ETCS, ATO, AI in railway capacity issues - railway line, stations HSR - impacts to transport system in Czech republic (public transport)
Response 82 PhD 1 Title	Regional Rail Transport in the Context of the Planned High-Speed Transport in the Czech Republic
Response 82 PhD 1 Keywords	high-speed rail, regional rail transportation, transport concept, competition, methodology
Response 82 PhD 1 Description	The dissertation focuses on the possibilities of connecting high-speed rail transportation with regional rail transportation in the Czech Republic, with the aim of improving transportation accessibility and connectivity, which represents one approach to enhancing the quality of public transportation. The work explores these possibilities and develops a methodology, which includes an algorithm for identifying transportation synergies between these two distinct transport segments. The connection models created using this algorithm are subsequently tested through case studies in specific regions of the Czech Republic and results are compared with selected regions of European countries that have high-speed rail transportation.
Response 82 PhD 2 Title	Investigation of the impact of the frequency and regularity of public passenger transport services on passenger demand for transport
Response 82 PhD 2 Keywords	Public passenger transport, railway, bus, demand,
Response 82 PhD 2 Description	The thesis analyzes the impact of the frequency and regularity of public passenger transport services (especially railway and bus) on passenger demand for transport, with a focus on the conditions of rail passenger transport. The aim of the dissertation is to determine the extent of the impact of the frequency and regularity of public passenger transport services on passenger demand for transport, through process modelling, which will form the basis of a methodology for forecasting passenger demand for transport. The methodology takes into account other specific characteristics of the transport system, such as the inclusion of the studied session in the integrated transport system, tariff advantages in the use of public transport, the specifics of the existing transport infrastructure, the current number of connections on the selected session, to offer the compilation of several alternatives of frequency and regularity of services and the derivation of universal rules for the compilation of timetables of the said territory.
Response 82 PhD 3 Title	Methodology of yield management of a railway undertaking
Response 82 PhD 3 Keywords	Dynamic pricing, yield management, rail transport, multi-criteria analysis, tariff optimization, economic modelling, transport sustainability
Response 82 PhD 3 Description	The dissertation focuses on the development and application of dynamic pricing strategies in rail transport using the concept of yield management. The research focuses on economic modelling, tariff optimisation and evaluation of the impact on the transport market in the Czech Republic and abroad. The specific objective is to propose the implementation of dynamic pricing on routes with high competitive pressure (e.g. Prague-Ostrava, Prague-Brno) and to investigate the benefits for efficiency, occupancy and sustainability of rail transport.
Response 83 Country	Czech republic
Response 83 PhD 1 Title	Optimisation of the order in which trains pass through infrastructure elements
Response 83 PhD 1 Keywords	Railway traffic control, optimization, capacity utilization, simulation, station

Response 83 PhD 1 Description	Development of the model for short-time prediction of railway traffic as a support for traffic control. Model is of simulation character. Optimizing of traffic control at railway stations, including of optimization of station tracks utilization.
Response 84 Country	Czech Republic
Response 84 Priority Topics	
Response 84 PhD 1 Title	A mathematical model of a flexible transport system for areas with low population density
Response 84 PhD 1 Keywords	public transport, flexible transport systems, alternative transport systems, on-demand transport, transport services of the region, transport services of the municipality, population classification
Response 84 PhD 1 Description	The professional work focuses on obtaining data for designing a conceptual model of a flexible transport system for areas with low population density. In the thesis, an analysis of scientific knowledge in the Czech Republic and in the world is carried out, the goal of the future dissertation is determined, and suitable methods are selected for use in future work. The author focuses on the principles of operation of flexible transport systems.
Response 84 PhD 2 Title	Use of new command types in Automatic Route Setting
Response 84 PhD 2 Keywords	Automatic Route Setting, train route, Blocking time theory, traffic conflict, real-time railway traffic management, railway
Response 84 PhD 2 Description	The thesis deals with the development of new functional commands of the Automatic Route Setting. It first characterizes the current setup of the function and then analyzes the findings in the field of the real-time railway traffic management. Both provide the basis for the design of new commands to enhance the relevance of Automatic Route Setting at higher traffic volumes when traffic conflicts between two train routes need to be resolved.
Response 84 PhD 3 Title	Automation of railway traffic control in the ETCS environment
Response 84 PhD 3 Keywords	Traffic Management System , Automatic Route Settings system, automatic train operation, ETCS, ERTMS, GSMR
Response 84 PhD 3 Description	The dissertation thesis is focused to the topic of the application of railway traffic control automation in the conditions of the European Rail Traffic Management System (ERTMS) and the influence of the unified European train control system (ETCS) on the decision-making of control personnel and the Automatic Route Settings system (ARS). It also focused the individual effects of ETCS on the railway traffic control, in particular the differences to the character of the current operation without ETCS. The doctoral student will follow up on research work focusing on the area of automatic train control (ATO), and ETCS. From the recommendations identified, new functional requirements for the ARS/ASVC system will be defined, which will be included in a functional mathematical model.
Response 85 Country	Czech Republic
Response 85 PhD 1 Title	Mobile applications for operational management of railway transport
Response 85 PhD 1 Keywords	mobile application development, transport mobile applications, railway carriers, mobile application design methodology

Response 85 PhD 1 Description	This dissertation focuses on the design of a methodology for the development of mobile applications intended for operational control of railway transport. Using a systematic literature review, empirical and logical methods, the current state of mobile application development and available technologies in this area is analysed. On the basis of the obtained knowledge, the optimization of the mobile application development process is proposed using the method of system analysis and multi-criteria decision making, which takes into account the current priorities of the project. The paper presents five variants of project priorities and their possible combinations, and the impact of the proposed optimization measures for each variant is analyzed. To validate the proposed methodology, a mobile application design is developed in accordance with its principles and procedures, and the success and effectiveness of the design is analyzed and discussed.
Response 86 Country	Czech Republic
Response 86 PhD 1 Title	System approach to coordination of lockout activities on railway
Response 86 PhD 1 Keywords	railway, lockout, restrictions, coordination, temporary capacity restriction (TCR)
Response 86 PhD 1 Description	Closures or lockouts on the railway infrastructure caused by planned reconstruction, modernisation or maintenance, are featuring significant challenges for the effectiveness and reliability of the whole railway network. Closures can lead to delays, increased costs for the railway undertakings and also to decrease the quality of the whole transport service, which has negative effect on freight and passenger transport. This dissertation will propose system approach in coordination of planned closures with a target of developing a complex methodology, that is universally usable to decrease the negative impacts across the different parts of the railway network. Research will include a thorough analysis of current strategies of managing the closures and identifying weakspots.
Response 87 Country	Czech Republic
Response 87 PhD 1 Title	Rail-enabled urban logistics
Response 87 PhD 1 Keywords	Smart City, Urban Logistics, Rail, e-commerce, last-mile delivery
Response 87 PhD 1 Description	Rail offers advantages for freight movement including economies of scale, lower externalities per ton-km and avoidance of road congestion. Due to these facts, this PhD thesis will analyse the current and potential of rail in urban logistics through an extensive literature review, evaluation of global best practices, collaborative design process, simulation modelling and real-world piloting. It will provide data, models, and guidelines to support adoption of sustainable urban rail logistics in cities.
Response 88 Country	Czech Republic
Response 88 PhD 1 Title	Influence of loading character on crack propagation speed
Response 88 PhD 1 Keywords	fatigue, crack speed, crack propagation, Beach marks
Response 88 PhD 1 Description	Research into the influence of loading characteristics, such as shape and frequency, on crack propagation. Use of fracture surface mapping to identify crack propagation speed.
Response 89 Country	Czech Republic
Response 89 PhD 1 Title	The role of spin in wheel–rail interaction
Response 89 PhD 1 Keywords	wheel–rail interaction, spin, creepage, creep forces, roller rig

Response 89 PhD 1 Description	The thesis is focused on the influence of spin on forces transmitted in the wheel–rail contact. The main goal is to precisely measure the spin effect in full scale roller rig tests with real wheel geometry, and make comparisons with models used for calculations of wheel–rail interaction.
Response 89 PhD 2 Title	Methodology for evaluation of dynamic effects of rail vehicle on track
Response 89 PhD 2 Keywords	wheel–rail interaction, multi-body simulations, curving, curve resistance, damaging effects, wear number, track access charges
Response 89 PhD 2 Description	The thesis deals with quasi-static damaging effects at the wheel–rail interface during curving, from physical principles to software settings. Numerical simulations are employed to find the influence of multiple parameters on curving behaviour. Based on this analysis, a model for calculation of the Equivalent Wear Number is developed, to be used in computational analyses or variable track access charge models.
Response 90 Country	Czech Republic
Response 90 PhD 1 Title	Integration of renewable sources into transport with a focus on aviation and railway technology
Response 90 PhD 1 Keywords	renewable energy, integration in railway transport.
Response 90 PhD 1 Description	The aim is to analyze the technical principles of connectivity of renewable energy sources in transport.
Response 91 Country	Czech Republic
Response 91 PhD 1 Title	Analysis of a 25 kV 50 Hz traction network in power supply conditions with converter power stations.
Response 91 PhD 1 Keywords	Traction power supply 25 kV 50 Hz, traction circuit parameterization, short-circuit protection in continuous traction networks
Response 91 PhD 1 Description	The work is oriented to the methodology of circuit analysis, parameterization and tuning of short-circuit protection in new technologies of continuous traction power supply 25 kV 50 Hz with converter power stations.
Response 91 PhD 2 Title	Optimization of operating situations of 25 kV 50 Hz converter power stations
Response 91 PhD 2 Keywords	Traction power supply 25 kV 50 Hz, SFC (static frequency converter), output characteristics of the traction converter
Response 91 PhD 2 Description	The work is focused on the research and development of procedures for tuning the output power characteristics of high-voltage electronic converters for traction power supply 25 kV 50 Hz with respect to selected criteria, mainly oriented to energy efficiency and power supply reliability
Response 92 Country	Czech Republic
Response 92 PhD 1 Title	Experimantal and numerical analyses of concrete structures
Response 92 PhD 1 Keywords	Concrete structures, numerical model, bond-slip effect, stochastic model, earthquake
Response 92 PhD 1 Description	Advanced numerical (incl. stochastic analyses) and experimental modelling of concrete structures incl. research of bond-slip effect due to limited interaction between the plain reinforcement bar and surrounding concrete in structures designed and constructed using pre-70s construction practices (i.e., non-conforming details, plain reinforcement bars) in the existing building inventory of developing countries – study of the mechanical response of such a structure during earthquakes.

Response 92 PhD 2 Title	Effect of extraordinary climate load on fragility of (infra)structures
Response 92 PhD 2 Keywords	Bridge, Risk assessment, Natural Hazards, Flood
Response 92 PhD 2 Description	Research and methodology for assessing the risk of existing bridges under flood hazard, combining factors such as flood hazard, bridge vulnerability, and potential consequences.
Response 93 Country	Czech Republic
Response 93 Priority Topics	- The use of new technologies for the accumulation and control of electric energy flows for power supply of railway operations - Control of energy flows during the operation of rail vehicles with accumulators - vehicle and power infrastructure level - Evaluation of products used in wheel–rail friction management There has been a significant progress in testing of lubricants and friction modifiers in controlled, downscaled laboratory conditions, as well as modelling of the relevant physical phenomena. However, more attention should be paid to relevance for real wheel–rail contact, to facilitate development and introduction of efficient solutions in rail operation. Also, improvements to standardized testing methods should be sought to increase repeatability and comparability. - Non-destructive assessment of the stress-strain state in welded structural joints, with predictive analysis of critical stages under specific operational conditions as a key safety parameter.
Response 93 PhD 1 Title	Multiphase Steels for Transport Means Safety Parts for rails
Response 93 PhD 1 Keywords	plasma welding technology, contact-fatigue resistance, rails, contact wear
Response 93 PhD 1 Description	Research of advanced welding technology adaptation to create a heterogeneous rail contact layer. The aim is to increase the safety and contact fatigue resistance of rails.
Response 94 Country	Czech Republic
Response 94 PhD 1 Title	Loss of stability of thin-walled safety elements of transport means under dynamic loading
Response 94 PhD 1 Keywords	Loss of stability, FEM, thin-walled construction, dynamic loading
Response 94 PhD 1 Description	Road vehicle bodies are usually made of thin-walled profiles. Loss of stability usually occurs during their deformation. The main objective of the dissertation is to investigate the influence of time-varying loading (harmonic with different excitation frequency, impulse, etc.) on the loss of stability of a selected thin-walled element. The influence of dynamic loading on the loss of stability will be described by changing the limit load, the equilibrium curve, the shape of the loss of stability and the influence of imperfections.
Response 95 Country	Czech Republic
Response 95 Priority Topics	Sustainable, economical and safe transit. Automatization and application of intelligent technologies in railway transit. Low emission and ecological transit.
Response 95 PhD 1 Title	Squeal noise generation in the wheel-rail contact with modified friction
Response 95 PhD 1 Keywords	Wheel squeal noise, Noise mitigation, Friction management, Water lubrication, Wheel-rail contact tribology

Response 95 PhD 1 Description	This thesis investigates the potential of water as an innovative and environmentally friendly solution to reduce wheel-rail contact squeal noise without compromising safety or performance. The research is driven by the need for sustainable alternatives to traditional chemical-based friction modifiers. Through a series of experimental studies and simulation models, the work aims to establish water as an effective method of noise control in rail systems, particularly in urban environments where squealing noise has a significant impact on quality of life and system maintenance. The research consists of three key studies. The first study investigates the effect of the composition of water-based top-of-rail (TOR) products on noise and develops a measurement methodology that will later be applied to a twin-disc setup simulating real contact conditions. The second study focuses on the noise-reducing capability of clean water, verifying its effectiveness in reducing squeal noise by reducing the excitation of wheel frequency modes without causing low adhesion problems. It was also found that the amount of water applied did not significantly affect noise reduction or increase the risk of adhesion. The third study investigates the use of water lubrication as a strategy to reduce wheel squeal noise in tram systems and shows that water lubrication can effectively reduce noise levels, by 10-20 dB, especially at speeds of 3-4 m/s, which are achieved on tram track loops. However, the research shows that while water reduces the excitation of squeal noise, it does not eliminate it. The study also supports the idea of quasi-static and instantaneous creep curves as a mechanism of noise generation in modified contact due to the agreement between the experimental data and the results of the theoretical model. Overall, the thesis presents water lubrication as a promising and sustainable alternative for reducing squealing noise in railway systems, with the potential for further refinement and application in real-world scenarios.
Response 96 Country	Italy
Response 96 Priority Topics	Wheel-Rail contact;Adhesion;Multibody Simulation;Braking;Machine Learning
Response 96 PhD 1 Title	Study of the thermal behaviour of tread braked wheels
Response 96 PhD 1 Keywords	Tread Braking; Tribology; Wear; Rail Chill
Response 97 Country	Poland
Response 97 Priority Topics	- resilience from the railway traffic and railway infrastructure points of view, - risk in railway transport, - security and cybersecurity in railway transport, - operation and maintenance of rolling stock (also from the organisational point of view), - organisation of railway traffic, - organisation of railway transport, - optimisation,
Response 98 Country	Czech Republic
Response 98 Priority Topics	High-speed railway track structure and durability Study of railway track materials in dynamic triaxial device
Response 99 Country	NL
Response 99 Priority Topics	Condition monitoring, residual life prediction
Response 99 PhD 1 Title	MONITORING DYNAMIC PROPERTIES OF RAILWAY TRACKS USING TRAIN-BORNE VIBROMETER MEASUREMENT
Response 99 PhD 1 Keywords	LDV, monitoring

Response 99 PhD 1 Description	Please search on internet for the title of the thesis, you will find.
Response 99 PhD 2 Title	An investigation into the formation of squats in rails: modelling, characterization and testing
Response 99 PhD 2 Keywords	RCF, lab test, modelling
Response 99 PhD 2 Description	Please search on internet
Response 99 PhD 3 Title	Dynamic Wheel/Rail Rolling Contact at Singular Defects with Application to Squats
Response 99 PhD 3 Keywords	RCF, contact mechanics, squats
Response 99 PhD 3 Description	Please search on internet
Response 99 PhD 4 Title	Detection of early squats by axle box acceleration
Response 99 PhD 4 Keywords	Squat, axle box acceleration
Response 99 PhD 4 Description	Please search on internet
Response 99 PhD 5 Title	Mechanisms and mitigation of short pitch rail corrugation
Response 99 PhD 5 Keywords	Corrugation, contact mechanics
Response 99 PhD 5 Description	Please search on internet
Response 100 Country	Croatia
Response 100 Priority Topics	railway safety, timetable reliability, infrastructure maintenance, service quality
Response 101 Country	Italy
Response 101 Priority Topics	- Interoperable and reliable ERTMS systems - Future railways communications - Common and standardized railways data models - Stardardized data structures and interfaces for new generation ERTMS systems
Response 101 PhD 1 Title	ICT platforms for reliable and interoperable ERTMS systems
Response 101 PhD 1 Keywords	ERTMS, digitalization, ICT, interoperability
Response 101 PhD 1 Description	Objectives: Support and advance the research activities about the new generation TMS. This will be performed through the analysis of the current state-of-the-art of the ERTMS systems, deepening their lacks and drawing directions for future developments and improvements in terms of interoperability and reliability, focusing on the progressive digitalization of the systems and the introduction of standardized interfaces and common data models.

Response 102 Country	Serbia
Response 102 Priority Topics	1. Railway infrastructure improvement; 2. Increasing efficiency of railway companies; 3. Improving the reliability and safety of railway services through the use of modern technology, modern safety systems, energy efficiency measures and consideration of resilience; 4. Increasing rail modal participation by working on last-kilometer connectivity, urban integration, multimodal logistics centers and the concept of integrated territorial development.
Response 102 PhD 1 Title	Simulation of resilience of future metro network in Belgrade
Response 102 PhD 1 Keywords	metro, resilience, simulation, network modeling
Response 102 PhD 1 Description	The simulation of the resilience of the Belgrade metro network would be conducted using network theory principles. Complex network modeling has been widely applied in assessing the resilience of transportation systems. The general approach to resilience assessment follows five steps: Constructing a network model, where nodes represent stations and edges represent metro lines. Defining resilience indicators to measure network robustness. Generating disruption scenarios to simulate various failures. Defining recovery sequences to restore network functionality. Measuring resilience by analyzing changes in indicator values before and after disruptions. For this study, the first step involves constructing the transport network, where metro stations are modeled as nodes and metro lines as edges. The network structure would be based on the official metro plan available at www.bgmetro.rs. In the second step, disruption scenarios are identified, including three main types: Natural disasters (e.g., floods, earthquakes). The simulation of these disruptions would be based on historical data regarding locations and intensities of past events, aiming to evaluate the metro network's resilience to extreme weather conditions. Random failures (e.g., infrastructure or rolling stock malfunctions). The purpose of simulating random failures is to assess the metro network's ability to withstand unexpected disruptions occurring anywhere in the system. Targeted attacks (e.g., terrorist attacks, sabotage). This scenario aims to evaluate the resilience of the metro network when critical parts are deliberately disrupted. The simulation process would help assess the robustness of the planned metro network and its ability to recover from various disruptions.
Response 103 Country	Croatia
Response 103 Priority Topics	preventive railway maintenance digitalization of railways FRMCS implementation decision support system for real-time railway rescheduling
Response 103 PhD 1 Title	MULTI-OBJECTIVE RESCHEDULING OF MIXED RAILWAY TRAFFIC
Response 103 PhD 1 Keywords	railway traffic disturbances; railway timetable optimization; multi-objective techniques; train rescheduling; traffic heterogeneity
Response 103 PhD 1 Description	Various disturbances and disruptions reduce the stability and reliability of the timetable daily, the utilization of available infrastructure capacities, and also the quality of the railway transport service. As responsible dispatchers in practice mostly choose suitable recovery measures experientially, those can be unfavourable for certain stakeholders of the railway system or suboptimal, contributing to the propagation of delays and reduction of capacity. For this purpose, it is necessary to develop an approach to facilitate decision-making on train rescheduling that will credibly reflect the realistic operational situation on conventional lines with mixed traffic, and at the same time consider the viewpoints of several involved stakeholders. Due to the complex nature of the problem and the often conflicting interests of the participants in the transport process, the proposed approach will be based on multi-criteria decision-making techniques. The proposed train rescheduling solutions will enhance the effectiveness of the measures taken for typical sources of delay and ensure optimal capacity utilization.

Response 104 Country	Italy
Response 104 Priority Topics	Monitoring of overhead contact line; Crosswind on freight wagons (combined transport); Monitoring of track geometry; Monitoring of running gear condition.
Response 104 PhD 1 Title	SMART train: A bimodal locomotive with Systems for Monitoring and Assessment of Rolling-stock and Track
Response 104 PhD 1 Keywords	Bimodal train; battery-powered train; condition-based maintenance; wireless sensors.
Response 104 PhD 1 Description	This study presents the development of a bimodal locomotive powered by batteries to enhance autonomy while maintaining compatibility with conventional overhead contact lines. The increased mass from the new powertrain highlighted the need for advanced monitoring systems to ensure optimal performance and safety. To address this, a novel monitoring system was designed for retrofitting in-service trains, enabling comprehensive condition monitoring. As a case study, an early instability detector was implemented to assess vehicle conditions by identifying lateral instability. Recognising that sustainability must be approached holistically-from rolling stock to infrastructure, including maintenance operations-the scope was expanded to monitor railway infrastructure, focusing particularly on track geometry. This integrated approach underscores significant advancements in vehicle and infrastructure diagnostics, contributing to more sustainable, safer, and efficient railway operations.
Response 105 Country	Italia
Response 105 Priority Topics	predictive maintenance, energy consumption, traffic regualtion and response to disruption
Response 105 PhD 1 Title	Modelling of train dynamcis and signalling system (provisional)
Response 105 PhD 1 Keywords	railway signalling, longitudinal dynamics
Response 106 Country	Italy
Response 106 Priority Topics	- Expansion and optimization of high-speed rail networks - Sustainability: reducing emissions, increasing electrification, and promoting modal shift from road to rail. - Railway Safety & Security (e.g. derailment, aerodynamics-related safety issues, ...) – Infrastructure resilience and accident prevention. - Digitalization and automation, predictive maintenance, and AI-driven traffic management. - Cross-border connectivity: improving interoperability across EU member states. - Freight and logistics efficiency
Response 106 PhD 1 Title	Slipstream phenomenon due to the passage of trains on the platforms of a stop / station in the open field and in the tunnel
Response 106 PhD 1 Keywords	Train aerodynamics, Slipstream, Full-scale measurements, CFD, Railway tunnel
Response 106 PhD 1 Description	The project involves evaluating the slipstream phenomenon, considering the effects of confined spaces, various train types, and the corresponding impacts on passengers on platforms and workers trackside. Current approaches for vehicle aerodynamics testing and simulation are applied and extended. The evaluation will use CFD numerical models and experimental techniques, including full-scale tests, to understand the slipstream physical phenomenon and perform a probabilistic assessment of its effects on passengers and workers, specifically for tunnel environments. The research will identify the main parameters influencing the phenomenon and develop a numerical and experimental methodology to evaluate the slipstream in different locations and with various trains. This approach aims to enhance our understanding of slipstream effects and improve safety and efficiency in railway environments.

Response 107 Country	Poland
Response 107 Priority Topics	1. High speed lines 2. Line capacity improvement 3. Energy consumption 4. Alternative energy sources 5. Automatic wheel gauge change system at the 1435/1520 track 6. Wheel-rail interaction 7. Condition monitoring systems 8. Noise polution 9. DAC implementation strategy 10. Social and economical inclusivness
Response 107 PhD 1 Title	Evaluation of wheel-rail interaction using thermal imaging measurements and convolutional neural networks
Response 107 PhD 1 Keywords	thermal imaging, wheel rail interaction
Response 107 PhD 1 Description	The aim of this doctoral thesis is to use thermal imaging measurements and CNN networks to assess wheel and rail interaction on two levels – identification of the contact situation and estimation of the friction work in the contact. Information about the contact situation is an indicator of the quality of wheel and rail cooperation, while the estimation of the friction work allows for the assessment of the friction activity of the wheel/rail pair and the momentary intensity of wear of these elements.
Response 107 PhD 2 Title	Analysis and assessment of the influence of selected wheel-rail contact parameters on the stability of a rail vehicle
Response 107 PhD 2 Keywords	wheel/rail contact, stability, simulation
Response 107 PhD 2 Description	The main scientific objective is to analyze the influence of selected parameters of wheel-rail contact on the stability of rail vehicle , with particular emphasis on vehicles with an unconventional running gear structure. Thanks to this, the existing state of knowledge will be enriched with information on the influence of wheel-rail interaction on ride stability for rarely cited examples of unconventional rail vehicles, whose traffic conditions significantly differ from traditional bogie vehicles equipped with two wheelsets. The research gap is particularly visible on the basis of significant differences between the results of simulation calculations of critical speed and the values recorded during experimental analyses.
Response 107 PhD 3 Title	Decision model for the implementation of a railway automatic wheel gauge change system at the 1435/1520 track
Response 107 PhD 3 Keywords	automatic wheel gauge change system, track gauge, decision making
Response 107 PhD 3 Description	The aim of this thesis is to create a decision model for the implementation of a railway automatic wheel gauge change system at the 1435/1520 track. The topic is very important forthe political situation between Poland and Ukraine, as well as other eastern Europe countries.
Response 108 Country	Italy
Response 108 Priority Topics	DAC, infrastructure, operations management, maintenance and health monitoring
Response 108 PhD 1 Title	Development of a test bench for rail vehicles draft gear analysis
Response 108 PhD 1 Keywords	Longitudinal train dynamics, hardware-in-the-loop, DAC,

Response 108 PhD 1 Description	The objective of this doctoral project is to develop and validate an experimental test bench for analysing the coupling interface of two railway vehicles, including different draft gears system (Digital Auto Coupler and traditional buffer and chain system). This bench will be able to simulate the main manoeuvres which a freight train might endure (hard braking manoeuvres, tight curves and switches run at high speed, …). The bench will allow the installation and the testing of several types of coupling elements, such as normal buffers, central couplers, and the new Digital Automated Coupler . Moreover, the test bench will be able to be integrated into numerical simulations of a freight trainset to account for non-linearities in vehicle coupling as Hardware in the Loop, using MATLAB and Simulink as a working environment . This will allow the simulation to use the feedback coming from real components, thus increasing their accuracy. For this integration to be possible, a complete model of a freight trainset will be realized on Simulink. This model will comprise all the main subsystem of a trainset (couplers, traction and braking, longitudinal dynamics, control of the locomotives, …). This environment will act as a testing environment where the interaction between various components (both developed in-house or provided by partners and companies) can be tested.
Response 109 Country	Spain
Response 109 Priority Topics	Wheel-Rail contact; Rail Corrugation; Laser cladding for the railway industry; RCF; Safety against derailments; Ballastless tracks; Railway noise; hydrogen powered locomotives; Lightweight carbodies; New brakes for high speed trains; Light weight vehicles; Tribology; Communications; Signalling
Response 109 PhD 1 Title	Additive Manufacturing to reprofiling railway wheels worn by use
Response 109 PhD 1 Keywords	Additive Manufacturing, railway wheels, Wear
Response 109 PhD 1 Description	Study of the feasibility of an alternative approach to the current wheel reprofiling procedures based on the use of underfloor wheel lathes, by incorporating Additive Manufacturing
Response 109 PhD 2 Title	Topology Optimization for general type of structures and mechanical systems
Response 109 PhD 2 Keywords	Structural optimization
Response 109 PhD 2 Description	Topology optimization is a valuable tool in additive manufacturing, but its application requires careful consideration of various constraints to refine the optimization outcome. The extensive use of metal additive manufacturing makes specially useful the development of new structural optimzation algorithms
Response 110 Country	Croatia
Response 110 Priority Topics	1. PSO 2. Organization of long-distance trains 3. Organization of low density areas (rural) 4. Optimization of timetable 5. Railway freight transport and logistics
Response 110 PhD 1 Title	Fast Night Trains Operation
Response 110 PhD 1 Keywords	passanger, train, fast, night train, organization, operation
Response 110 PhD 1 Description	All about fast night trains operation.
Response 110 PhD 2 Title	Quality of Service Criteria in Integrated Passenger Transport Systems: An Overview
Response 110 PhD 2 Keywords	passenger, quality, QoS, integrated transport

Response 110 PhD 2 Description	All about QoS in IPTS.
Response 111 Country	Italy
Response 111 Priority Topics	- Railway noise and ground borne vibration - Railway comfort - Railway monitoring and diagnostics - Railway safety and derailment risk prevention
Response 111 PhD 1 Title	Modelling of railway curve squeal
Response 111 PhD 1 Keywords	railway noise, curve squeal, wheel-rail interaction, rail vehicle dynamics, vehicle architecture
Response 111 PhD 1 Description	This thesis investigates the phenomenon of railway curve squeal, focusing on its underlying causes, mechanisms, and potential solutions. Using advanced modeling techniques, the study examines the high-frequency interactions between the wheel and rail. Both frequency- and time-domain models are employed to assess the impact of wheel/rail contact conditions and vehicle architecture on curve squeal. The results of numerical simulations are compared with experimental data. Additionally, the thesis evaluates the effectiveness of various mitigation solutions.
Response 112 Country	Austria
Response 112 Priority Topics	Digital operations Sustainability and extension of infrastructure lifetime Noise barriers
Response 112 PhD 1 Title	Analytical, Numerical and Experimental Analysis of the Aerodynamic Load and Response of Noise Barriers Induced by Train Passages
Response 112 PhD 1 Keywords	Noise barrier, fatigue, aerodynamic load, load history, air pressure measurement
Response 112 PhD 1 Description	A new model for estimation of fatigue of noise barriers is being developed. Measurements of air pressure as well as noise barrier response are used to recalibrate existing models. The new method will additionally consider traffic management data including histories of rail traffic development to achieve more accurate prognosis of the remaining lifetime of noise barriers.
Response 113 Country	United Kingdom
Response 113 Priority Topics	Sustainability, Infrastructure, Steel
Response 113 PhD 1 Title	Engineering performance, sustainability metrics, and business models to drive the optimisation of steel in low carbon transport networks.
Response 113 PhD 1 Keywords	sustainability, rail, decarbonisation, sleepers, steel, infrastructure
Response 114 Country	Italy
Response 114 Priority Topics	1-high speed railway 2-infrastructure development 3-automation
Response 114 PhD 1 Title	Innovative operation of rail freight terminals

Response 114 PhD 1 Keywords	Innovation and automation
Response 114 PhD 1 Description	Regarding high-level specifications for a concept of a GoA4 automation system, detailed the nature of the innovations addressed, laying the basis for detailed specifications of the concept and a physical demonstrator of a part of it.
Response 114 PhD 2 Title	Innovative operation of rail freight terminals
Response 114 PhD 2 Keywords	Innovation and Automation
Response 114 PhD 2 Description	Regarding high-level specifications for a concept of a GoA4 automation system, detailed the nature of the innovations addressed, laying the basis for detailed specifications of the concept and a physical demonstrator of a part of it.
Response 115 Country	Poland
Response 115 Priority Topics	- AC power supply of DC and AC traction substations- power supply capacity, disturbances, harmonics, asymmetry , EMC in electric traction systems, energy storage devices, energy saving in transport, application of renewable energy in transport,
Response 115 PhD 1 Title	Regenerative Braking Effectiveness Improvement of DC Supplied Electric Rolling Stock with DC Motors
Response 115 PhD 1 Keywords	regenerative braking, DC motors, rolling stock
Response 115 PhD 1 Description	In recent years there has been considerable interest in switching to pure electric or hybrid types of transport, which must reduce the pollution injected into the atmosphere. Electric railway transport is undoubtedly the most promising and ecological type of transport. Electric traction has significant advantages compared with other types of transportation. However, due to the focus on reducing energy consumption, important issues are the efficiency and quality of energy processes that require in-depth analysis. The next problem is that a huge amount of currently used electric rolling stock is still equipped with DC traction motors, specifically in East Europe – even if new railway vehicles are equipped with AC traction motors. So this PhD thesis is devoted to problems of the effectiveness of regenerative braking of various types of DC electric rolling stock equipped with DC traction motors. It discovers the main problems connected with the phenomenon of energy recovery in the processes of braking. Also, existing methods and solutions for improving their effectiveness are studied and discussed at the beginning of the thesis based on existing researches and publications. The author established that energy recuperation is a very complex process depending on various stochastic variables, which are voltages, currents, powers, moments of time etc., so for analysis of such processes, there is a need for the application of the methods based on probabilistic and statistical theories. To perform a qualitative analysis of energy processes in existing railway transportation systems, the author made numerous experimental journeys on different types of electric rolling stock, such as a few types of freight locomotives, multiple-unit train and tram, which are described in the next chapters on the thesis. In addition, experimental research was performed using a DC/AC inverter, enabling the return of excess recovered energy to the AC grid. The results of experimental investigations and collected data allowed the author to perform an in-depth analysis of the quality of regenerative braking as a mode that is frequently used in the process of railway vehicle motion. Furthermore, the quality analysis of energy recovered in this mode and its parameters are shown together with probabilistic and statistical analyses. All of these allowed the author to propose an application of an energy storage device on board of a railway vehicle and perform autonomous (i.e. independent from traction network) regenerative braking. The supercapacitor cells were taken to analyse the operation of assumed schematic solutions in autonomous regenerative braking. The methods used in the research, as well as the range and results of the thesis, allowed making detailed descriptions of energy recovery as a complex stochastic process in a regenerative braking mode operation of a rolling stock and application of energy storage in electric transport means with DC traction motors supplied by DC network. The presented results of the research will also be useful for performing of re-engineering or modernisation of railway vehicles with DC motors.
Response 116 Country	Poland
Response 116 Priority Topics	- cybersecurity of the railway OT systems - hydrogen propulsion - innovative materials

Response 116 PhD 1 Title	safety challenges regarding hydrogen refueling in railway transport
Response 116 PhD 1 Keywords	railway / safety / hydrogen / refueling / RAMS / CSM RA
Response 116 PhD 1 Description	Thesis in elaboration. Preparation of detailed rules dedicated for safe hydrogen refueling on the basis of railway regulations and standards including CSM RA and RAMS taking into account high risks associated with hydrogen
Response 116 PhD 2 Title	Railway Mobile Radio cybersecurity analyses
Response 116 PhD 2 Keywords	railway / cybersecurity / RMR / FRMCS / safe data transmission
Response 116 PhD 2 Description	Thesis in progress. New 5G mobile communication standard is being tailored for railway purpose at the moment. The on-going works focus on functionalities and overall safety. As multiple 5G soultions are based on applications it is key to define technicals regarding protection against DDoS, malware, ransomware, etc. as well as software manipulations and APTs.
Response 117 Country	GERMANY
Response 117 Priority Topics	- staff shortages - infrastructural bottlenecks and backlog - changings job profiles - digitisation - network access
Response 117 PhD 1 Title	Language Barriers in (freight) rail
Response 117 PhD 1 Keywords	Communication, Language, Safety, organisational and technical approaches
Response 117 PhD 1 Description	Holistic concept of (human) communication in Railways. Define "Barriers". Derive and evaluate mitigation approaches on technical and personal level.
Response 117 PhD 2 Title	CO2 Footprint methodology of railway construction projects
Response 117 PhD 2 Keywords	railway constructions, emissions, database, methodology
Response 117 PhD 2 Description	Analyse construction phase including material transports Holistic concept Differentiation of work actictivities Determine emission related assessment tool
Response 118 Country	Czech Republic
Response 118 Priority Topics	1) Funding and financing of railways, particularly in the context of the forthcoming Multiannual Financial Framework. 2) Digitising rail services and ensuring the deployment of key tools for rail such as the European Rail Traffic Management System (ERTMS) (and FRMCS), Digital Automatic Coupling (DAC), Digital Capacity Management (DCM). 3) Military mobility given the high priority of defence and security in the agenda of the new European Commission. 4) Connecting all EU capitals by high-speed rail to increase the market share of long-distance transport and achieve a permanent modal shift.

Response 118 PhD 2 Title	Methodology of Designing the Optimization of the Network of Logistics Centers in the Czech Republic
Response 118 PhD 2 Keywords	Logistics Optimization, Network Design, Location Allocation, GIS in Logistics, Supply Chain Management, Transportation Networks, Operational Efficiency, Logistics Centers, Spatial Data Analysis, Cost Minimization, Scenario Analysis, Czech Republic, Quantitative Modeling, Simulation
Response 118 PhD 2 Description	The objective of this thesis is to analyze and optimize the network of logistics centers in the Czech Republic. It will evaluate various location-allocation and network flow models to assess their effectiveness in improving logistics efficiency and reducing operational costs. The goal is to identify the most suitable logistics center locations and configuration strategies to enhance delivery times, resource allocation, and supply chain resilience within the region. Additionally, the thesis aims to provide recommendations for integrating optimized logistics center networks into the Czech Republic's logistics infrastructure. The research for this thesis will be conducted using descriptive, quantitative, and computational modeling methods. A detailed literature review will establish a foundation for understanding current practices in logistics network optimization, especially within the Central European context. Comparative analysis will assess different logistics optimization models, while spatial data analysis will guide site selection for new centers. Data will be collected from government reports, logistics companies, and geographic information sources. The practical component of the thesis will involve developing a prototype optimization model to demonstrate the application in a specific logistics scenario, such as regional warehousing or transportation network enhancement.
Response 119 Country	CZ
Response 119 Priority Topics	Vehicle dynamics, transport system safety, and reliability.
Response 119 PhD 1 Title	Passive safety of rail vehicles
Response 119 PhD 1 Keywords	crash safety, crash dynamics, coupling elements, deformation elements
Response 119 PhD 1 Description	Thesis deal with design of deformation elements of rail vehicles.
Response 120 Country	Italy
Response 120 Priority Topics	Reducing carbon emissions by promoting rail as a sustainable transport option. Promoting intermodal transport solutions. Developing and modernising freight infrastructure and operations. Digitalisation railway network services.
Response 121 Country	Austria
Response 121 Priority Topics	Track availability Track Train interaction lighweight construction
Response 121 PhD 1 Title	Development of new isolated joint systems
Response 121 PhD 2 Title	Ballast Condition Analysis and Behaviour
Response 121 PhD 3 Title	Prudhomme´s Criterion - an update
Response 121 PhD 4 Title	Behaviour of turnout sleepers and their interaction with ballast

Response 122 Country	The Netherlands
Response 122 Priority Topics	Railway maintenance: - inspection of wear and RCF, repair, replacement of rails, catenary systems and other rail structure elements - Rail substructure, stability Train - Maintenance on wheels - diagnostics of train systems (such as HVAC) to avoid unexpected failures Operation - optimisation of operation (track occupancy) - Logistics & planning - Automate train systems - ERTMS
Response 123 Country	The Netherlands
Response 123 Priority Topics	Asset Management Sustainability Resilience
Response 123 PhD 1 Title	Real-Time COF Estimation Using Direct Measurements From Electric Locomotives
Response 124 Country	Brazil
Response 124 Priority Topics	Track maintenance, Recycling materials for application in the track substructure, geometric monitoring
Response 124 PhD 1 Title	Study of the dynamic stabilization of railway ballast to improve the operational conditions of the permanent way
Response 124 PhD 1 Keywords	Railways, Monitoring, Maintenance, Tamping operation, Dynamic ballast stabilization
Response 124 PhD 1 Description	For many years, Brazil prioritized investments in road freight transport, leading to an imbalance in its national transportation matrix, which increased logistics costs and negatively impacted the economy and exports. Recently, however, investments in railway renewal and new rail lines have grown, aiming to restore balance. To ensure effective use of these investments, improving railway construction and maintenance techniques is crucial for enhancing durability and efficiency. Currently, track alignment, leveling, and tamping are common maintenance practices, but they can accelerate track degradation. To mitigate this, the dynamic stabilization method was developed, complementing tamping by applying lateral vibrations and vertical loads to consolidate the ballast and improve track stability. However, recommended stabilization parameters, often based on international studies, may not be ideal for Brazilian railways. This research aimed to identify the best parameter combinations for dynamic stabilization in heavy-haul railways, such as the Carajás Railway (EFC). Two tamping techniques (single and multiple insertions) and four stabilization configurations (vertical loads of 170–230 kN and vibration frequencies of 28–35 Hz) were tested. The study was conducted in two phases: controlled environment experiments to determine optimal parameters, followed by field tests on an EFC section to assess long-term performance. Specific measurement methods were developed, including an innovative track geometry assessment technique, which led to a patent application. Results showed that multiple-insertion tamping combined with dynamic stabilization at 230 kN and 35 Hz provided the best track stability and vertical stiffness maintenance. This approach could reduce maintenance frequency and operational costs, contributing to a more efficient and sustainable railway system. The study advanced knowledge of dynamic stabilization in Brazilian railways, offering a cost-effective and productivity-enhancing maintenance technique for heavy-haul freight transport.

Response 125 Country	Germany
Response 125 Priority Topics	automated train operation remote train operation operation rules rail human factors hybrid technology alternative materials for sleeper
Response 125 PhD 1 Title	Umsetzungsempfehlung für die Rückfallebene fahrerlosen Fahrens im Schienenpersonenverkehr mit Zugbegleiter und Teleoperierendem unter besonderer Berücksichtigung von Sicherheitsaspekten
Response 125 PhD 1 Keywords	Remote Operation, Safety
Response 125 PhD 1 Description	Fahrerloses Fahren im Schienenpersonenverkehr auf Haupt- und Nebenbahnen wird in naher Zukunft als Teil der Digitalisierung des Bahnbetriebes eine bedeutende Rolle einnehmen. Ähnliche Entwicklungen sind bei U-Bahnen bereits vollzogen. Während die Entwicklung von ATO-Systemen, Hinderniserkennung und Schnittstellen zu ETCS bereits in Wissenschaft und Industrie voranschreitet, gibt es zu dem Themengebiet der Rückfallebene fahrerlosen Fahrens aktuell nur einen begrenzten wissenschaftlichen Kenntnisstand. Dieser ist jedoch wichtig, da bei Ausfall des ATO-Systems oder einer anderen für fahrerloses Fahren relevanten Komponente das technische System den Betrieb (teilweise) einstellt und die Betriebsverantwortung an den Menschen übergibt. Ausgehend von der Notwendigkeit einer Transition vom Regelbetrieb zur Rückfallebene, untersucht diese Arbeit verschiedene betriebliche Aspekte potenzieller Rückfallebenen in Bezug auf Kommunikation, Ausbildung, Arbeitsort und Ausstattung der beteiligten Rollen. Aus jedem dieser Aspekte wird eine zielführende Umsetzung gewählt, um die Systemdefinition zur Untersuchung von Sicherheitsaspekten zu erstellen. Im Hauptteil dieser Dissertation wird auf Basis der erarbeiteten Systemdefinition eine Untersuchung von Sicherheitsaspekten für drei Betriebsszenarien der ATO-Rückfallebene durchgeführt: • Fahrt mit Zugbegleiter, • Fahrt mit Teleoperierendem und • Fahrt mit Teleoperierendem und unterstützendem Zugbegleiter. Nach Durchführung einer Differenzanalyse werden die ermittelten betrieblichen Änderungen bewertet. Hierfür wird jeweils ein Tripel aus Schnittstellen, geänderten Umgebungsbedingungen und zu bewertenden Funktionen verwendet, um Gefährdungen zu bestimmen. Die relevanten Schnittstellen sowie die geänderten Umgebungsbedingungen werden mittels einer detaillierten Auswertung der Systemdefinition in Kapitel 4 erarbeitet. Die für die Gefährdungsermittlung verwendeten Funktionen werden der Funktionsliste TeSiP der SIRF und der ATO-Funktionsliste aus dem geförderten Projekt X2Rail-4 [CORDIS] entnommen. Weiterhin wird als Kreativmethode ein HAZOP-Workshop durchgeführt, um weitere Gefährdungen zu identifizieren. Es werden für jede Gefährdung Mitigationen ermittelt, wobei Gefährdungen mit hohem Risiko oder geringer Möglichkeit der Mitigation separat betrachtet werden. Die ermittelten Gefährdungen und Mitigationen werden entsprechend der expliziten Risikoanalyse mit einer eigenen Methode bewertet. Diese Methode umfasst Anteile der semi-quantitativen Bewertung nach DIN VDE V 0831-103 und der zur Ableitung der menschlichen Zuverlässigkeit bei Handlungen im Eisenbahnwesen kalibrierten Methode RARA. Als Ergebnis können einem Eisenbahnverkehrsunternehmen (EVU), das einen fahrerlosen Betrieb auf Haupt- und Nebenbahnen plant, relevante Aspekte des Betriebes in der ATO-Rückfallebene und eine fundierte Umsetzungsempfehlung zur Verfügung gestellt werden. Geht man davon aus, dass das EVU bereits über Erfahrungen mit der Rückfallebene für den GoA 2-Betrieb verfügt, so stellt diese Arbeit eine sinnvolle Erweiterung des Wissensstandes des EVU für die Rückfallebene für den GoA 3- und GoA 4-Betrieb dar.
Response 126 Country	UK
Response 126 Priority Topics	Rail vehicle lightweighting
Response 127 Country	Croatia

Response 127 Priority Topics	Multi-objective methods for rail timetable optimization Optimization models for a timetable in a multimodal environment Smart railway stations for seamless passenger experience Smart railway stations/terminals for freight movement AI and data-driven railway operations Reducing environmental impact from freight railway operations Reducing environmental impact from passenger railway operations Challenges in railway digitalization
Response 127 PhD 1 Title	Multi-Objective Rescheduling of Mixed Railway Traffic
Response 127 PhD 1 Keywords	multi-objective methods, rescheduling, disturbances, railway operations
Response 127 PhD 1 Description	Various disturbances and disruptions daily reduce the stability and reliability of the timetable, the utilization of available infrastructure capacities, but also the quality of the railway transport service. As competent dispatchers in practice mostly choose suitable recovery measures experientially, those can be unfavourable for certain stakeholders of the railway system or suboptimal, contributing to the propagation of delays and reduction of capacity. For this purpose, it is necessary to develop an approach to facilitate decision-making on train rescheduling that will credibly reflect the real operational situation on conventional lines with mixed traffic, and at the same time consider the viewpoints of several involved stakeholders. Due to the complex nature of the problem and the often conflicting interests of the participants in the transport process, the proposed approach will be based on multi-criteria decision-making techniques. The proposed traffic rescheduling solutions will increase the effectiveness of the actions taken for the most common sources of disruption and ensure optimal capacity utilization.
Response 128 Country	Austria
Response 128 Priority Topics	Predictive maintenance; lightweight design; wear (rail vehicle/infrastructure), wear-free braking
Response 128 PhD 1 Title	Wheel polygonization in trams: mechanisms and mitigation strategies
Response 128 PhD 1 Keywords	out of round wheels
Response 128 PhD 2 Title	Dynamics of magnetic track brakes
Response 128 PhD 3 Title	Electromagnetics in magnetic track brake
Response 129 Country	Denmark
Response 129 Priority Topics	Punctuality, capacity
Response 129 PhD 1 Title	Data-driven predictive maintenance of rails
Response 129 PhD 1 Keywords	Rail wear, track maintenance, forecasting
Response 129 PhD 1 Description	We expect to develop a stochastic forecast model allowing a modular architecture for easy model adaption to other rail networks. The probabilistic forecast setting allows a description of defect formation and remaining in-service life in terms of distributions rather than only points, thereby providing a flexible modeling framework that more closely resembles the stochastic properties of metallurgical defect growth. This is expected to improve rail defect predictions, hence enhancing the knowledge basis to plan maintenance activities

Response 129 PhD 2 Title	CAMP: Control and accountability in mega projects
Response 129 PhD 2 Keywords	megaproject, project management, high speed rail
Response 129 PhD 2 Description	The study performs an in-depth analysis of the project management and progress of three mega-projects: The California High Speed Railroad, Femern Bælt Forbindelse, and the Tanzania Standard Gauge Railway.
Response 130 Country	FRANCE
Response 130 Priority Topics	Human-centered design Resilience Human-AI coevolution Energy Pollution reduction Sustainability Inclusive mobility
Response 130 PhD 1 Title	Train driving assistance based on Artificial Intelligence supports
Response 130 PhD 1 Keywords	Grade of Automation, human factors, AI, digital assistant
Response 130 PhD 1 Description	The PhD thesis aims to define a new way to design and validate AI-based driving assistance by respecting constraints like energy consumption, fatigue or driver attention. It will study three scientific topics: Grade of Automation (GoA1 to GoA3), Information and Communication Technology and Human-In-The-Loop (HITL) concept. HITL includes the monitoring of human factors whatever the Grade of Automation (GoA1 to GoA3) and the monitoring of the train by drivers. Driving assistance and disruptive Information and Communication Technology (ICT) will be selected and implemented for GoA in case of normal and abnormal control situation. New concepts for designing future train cabin will be then defined and validated.
Response 131 Country	Italy
Response 131 Priority Topics	Wheel damage Braking issues - investigation for new materials used in brake blocks. Condition Monitoring Light Rail - Subway structural damage problems Developement of new lightweight coach structures and related connection tecnologies. Early warning devices for derailments
Response 131 PhD 1 Title	Developement of scaled test rigs for railway brake blocks
Response 131 PhD 1 Keywords	Railway Braking - Wheel damage - block braking stress simulation
Response 131 PhD 1 Description	The work consists in the modeling and experimental verification of the damage of railway wheels under braking conditions.
Response 132 Country	Slovakia

Response 132 Priority Topics	• Modernisation of railway infrastructure (modernisation of railway lines and nodes, increase of line speed and capacity, electrification of lines, introduction of ERTMS/ETCS, interoperability) • Increasing the competitiveness of rail freight transport (creation of logistics centres, digitalisation of processes, support of combined transport) • Optimisation of rail transport in regions (integrated transport systems, punctual transport) • Increasing the accuracy and reliability of transport (monitoring and analysis of delays, impact of infrastructure on the performance of carriers) • Reducing the carbon footprint of rail transport (support of vehicles with alternative propulsion). • Expansion of intermodal and combined transport • Implementation of smart technologies and big data in rail transport (intelligent planning, predictive maintenance, operation monitoring) • Automation and unmanned train control (testing autonomous technologies in closed systems or sidings) • Analysis of financing of railway infrastructure and transport services (efficiency of public investments, PPP projects) • Liberalisation of the railway passenger transport market (advantages and risks of entry of new carriers, competition for transport service performance) • Risk management and crisis scenarios in rail transport (pandemics, extreme weather, infrastructure failures)
Response 132 PhD 1 Title	Alternative drives vs. electrification of railway lines – economic and non-economic aspects
Response 132 PhD 1 Keywords	alternative drives, railways, economic aspects
Response 132 PhD 1 Description	The basic goal of the European Green Deal is to become climate neutral by 2050. This main goal is diversified into goals in individual areas, one of which is the need to transition to sustainable mobility. In the field of railway transport, two fundamentally different approaches can contribute to achieving this goal – electrification of railway lines or the use of alternative drives. The aim of the dissertation is to propose a methodology for evaluating these approaches, which will take into account both economic and non-economic aspects, as well as to point out the need for new investments in the entire process of transition to sustainable mobility.
Response 132 PhD 2 Title	Modeling of transport processes
Response 132 PhD 2 Keywords	process modeling, railway transport, strategy
Response 132 PhD 2 Description	The aim is to create a model that defines modern forms of transport processes, used to understand the relationships and predict the impacts of changes in the decision-making optimisation problem of transport allocation on the network. The architecture of the model will be focused on defining the optimal structure using multi-criteria parameters. The aim of the presented work is in accordance with the formulated vision of an effectively planned sustainable integrated multimodal transport system in the "Strategic Plan for the Development of Transport of the Slovak Republic until 2030" and is based on the assumptions of the "Methodological Guide to the Compilation of Transport Models and Transport Forecasts, Ministry of Transport and Construction of the Slovak Republic".
Response 132 PhD 3 Title	The impact of increasing electromobility on the transport operation of railway passenger transport
Response 132 PhD 3 Keywords	electromobility, railway, passenger transport, tractive vehicles, scheduling
Response 132 PhD 3 Description	The Recovery Plan for the Slovak Republic includes significant support for ecological "green" technologies. Within the framework of transport, it also concerns the development of railway passenger transport, mainly through the support of the development of electromobility. This is feasible in rail transport either through further electrification of lines or by purchasing hybrid traction rolling stock, which can use electric energy directly from the overhead line on electrified lines and on lines without overhead lines use electric energy from accumulator batteries, which the rolling stock charges while staying in stations or while driving on electrified lines. However, this residence time necessary to recharge the accumulator batteries significantly interferes with the technological processes of rail transport operations. The aim of the work is to analyze the current technical possibilities of developing electromobility in rail passenger transport and to evaluate its impact on the technological processes and characteristics of rail transport operations (line capacity, station capacity, vehicle turnover time, vehicle demand, etc.).
Response 132 PhD 4 Title	Methodology for improving transport service using regional railway lines

Response 132 PhD 4 Keywords	freight transport, regional services,
Response 132 PhD 4 Description	The aim of the work is to analyse the state of rail freight transport and propose a methodology for systematically improving transport services in freight transport using the potential of regional railway lines. The work will deal with the role of regional lines in rail freight transport, proposals for improving their condition and use from the perspective of transition to an ecological way of servicing the territory according to EU plans. The work will be part of the solution of the submitted international research project within the framework of the Interreg Central Europe programme.
Response 133 Country	China
Response 133 Priority Topics	continuous welded rail track; environmental vibration and noise; track damage; track quality evaluation; track service status inspection; track service monitoring
Response 134 Country	Indonesia
Response 134 Priority Topics	Track and Vehicle Health Monitoring System. Wheel - Rail Wear and Rolling Contact Fatigue. Rolling Stock Manufacturing System (Intelligent System in Design and Manufacture). Rail vehicle maintenance. Hybrid technology for rail vehicle traction.
Response 134 PhD 1 Title	Track defect identification based on regular vehicle responses.
Response 134 PhD 1 Keywords	Track defect, vehicle responses, machine learning
Response 134 PhD 2 Title	Wheel - Rail Wear and Rolling Contact Fatigue
Response 135 Country	UK
Response 135 Priority Topics	Condition monitoring, navigation and map matching, predictive maintenance, big data and sensor fusions.
Response 135 PhD 1 Title	TBC - Predictive Maintenance in Railway Track Geometry
Response 135 PhD 1 Keywords	In-service monitoring, map matching, big data
Response 136 Country	china
Response 136 Priority Topics	High speed railway AI data wheather resilience recycled materials in railway engineering Green
Response 136 PhD 1 Title	GPR in railway ballasted track
Response 136 PhD 1 Keywords	GPR ballasted track
Response 136 PhD 1 Description	data anaalysis GPR

Response 136 PhD 2 Title	Rail ultrasonic detection by AI classfication
Response 136 PhD 2 Keywords	Rail ultrasonic detection AI classfication data
Response 136 PhD 2 Description	Rail ultrasonic detection AI classfication data
Response 136 PhD 3 Title	composite sleeper optimization and innovation
Response 136 PhD 3 Keywords	recylced plastic composite sleeper FEM and lateral resistance
Response 136 PhD 3 Description	composite sleeper optimization and innovation recylced plastic composite sleeper FEM and lateral resistance
Response 136 PhD 4 Title	bamboo sleeper mechanics and performance FEM and long term effects
Response 136 PhD 4 Keywords	bamboo sleeper mechanics and performance FEM and long term effects
Response 136 PhD 4 Description	bamboo sleeper mechanics and performance FEM and long term effects Green sleeper
Response 136 PhD 5 Title	non-steel bars reinforced concrete sleeper optmization and evaluations
Response 136 PhD 5 Keywords	non-steel bars reinforced concrete sleeper optmization and evaluations
Response 136 PhD 5 Description	FRP, CFRP,BFRP
Response 137 Country	Germany
Response 137 Priority Topics	Capacity, construction works in the railway network
Response 137 PhD 1 Title	Approach for determining operationally optimized track possession for ETCS installation
Response 137 PhD 1 Description	As part of the mobility transition, more traffic is to be shifted to railway and cross-border traffic in Europe is to be simplified. This will be made possible by a nationwide rollout of the uniform European Train Control System (ETCS). For this rollout, ETCS infrastructural components have to be installed along the track, which necessitates track possessions. The track possessions are accompanied by a severe impairment of railway operations, with far-reaching consequences, especially in urban transport hubs. To minimize disruptions, all track possessions in the railway network must be coordinated and bundled in advance. It is therefore necessary to register the track possession up to ten years in advance of the actual possession. At this early stage, detailed planning is non-existing and cannot be used to determine the track possession. Furthermore, there are currently no empirical values to determine the track possession for ETCS installation. Hence, an approach for determining the operationally optimized track possession for ETCS installation will be developed in this research work. By doing so, more capacity in the railway network can be gained, the roll out of ETCS is accelerated and duplication of work in planning is reduced.
Response 138 Country	Italy
Response 138 Priority Topics	aerodynamics, maintenance, performance

Response 138 PhD 1 Title	Aerodynamics of high-speed freight trains
Response 138 PhD 1 Keywords	train aerodynamics, freight train, aerodynamic drag, slipstream
Response 138 PhD 1 Description	This PhD position aims at achieving an improved understanding of the aerodynamic effects, considering the specificities of freight trains, and to synthesize the knowledge gained in this research into recommendations for extending and improving existing standards for train aerodynamics, proposing freight train-specific criteria.
Response 139 Country	Poland
Response 139 Priority Topics	Solutions for fatigue problems of the catenary - train - track railway system, in particular by using theoretical approach, including stochastic one (this is just my area of interest)
Response 139 PhD 1 Title	2024 (completed): DYNAMICS OF COUPLED CATENARY – TRAIN – TRACK SYSTEM ON HIGH SPEED RAILWAY LINES
Response 139 PhD 1 Keywords	high-speed railways, catenary, pantographs, moving loads, dynamic interaction, train-track system, track stiffness discontinuity, numerical modeling, numerical analysis vibration simulations
Response 139 PhD 1 Description	The dissertation concerns dynamic phenomena of railway vehicles and infrastructure while running a train along the railway track. The subject of the work is the development of vibration simulation method of the coupled dynamic system catenary – train – track, and numerical analysis leading finally to the assessment of the impact of vibrations of railway vehicle body, caused by high speed passing through the track discontinuity having form of a sudden change in stiffness of the track substrate, on the vibrations of catenary.
Response 140 Country	Spain
Response 140 Priority Topics	Safety, traffic management system
Response 140 PhD 1 Title	HiL test of doucle contact wire catenary
Response 140 PhD 1 Keywords	Hardware-in-the-loop; simulation; catenary; pantograph
Response 140 PhD 2 Title	HiL test of pantpograph in rigid catenary
Response 140 PhD 2 Keywords	Hardware-in-the-loop; simulation; catenary; pantograph
Response 141 Country	Spain
Response 141 Priority Topics	Contact forces and wear on rigid catenary facilies Devices and tools for Maintenance activities
Response 141 PhD 1 Title	Prediction of wear on rigid catenary facilities
Response 141 PhD 2 Title	Wear tests on rigid catenary
Response 142 Country	UK

Response 142 Priority Topics	Aerodynamics, wind engineering, decarbonisation, climate change effects, efficiency, safe railways
Response 142 PhD 1 Title	GIS modelling of wind effects on railway infrastructure
Response 142 PhD 1 Keywords	crosswinds
Response 142 PhD 2 Title	The aerodynamics of a freight train through a tunnel
Response 142 PhD 2 Keywords	aerodynamics, tunnel
Response 143 Country	China
Response 143 Priority Topics	Health monitoring and data mining of railway track Intelligent operation and maintenance of railway track
Response 144 Country	China
Response 144 Priority Topics	Hidden disease identification of railway track Health monitoring and data mining of railway track Intelligent operation and maintenance of railway track
Response 144 PhD 1 Title	Research on Irregularity Characteristics of High-speed Turnout and Vehicle Dynamic Response in Operation Period
Response 144 PhD 1 Keywords	Turnout; Track irregularity; Vehicle dynamic response; Vehicle-Turn-out coupled model; Irregularity characteristics; Random parameter
Response 144 PhD 1 Description	In this paper, based on the dynamic inspection data from comprehensive inspection trains, the charac-teristics of track irregularity of high-speed turnouts are studied. Considering multi-struc-tural flexibility characteristics, a rigid-flexible coupled model of the vehicle-turnout-track foundation is established. The dynamic effect of track irregularities in the turnout area is further studied, as well as the matching optimization between the reduced values of the switch rails and rail wear profiles based on the dynamics model. Finally, the prediction of vehicle dynamic responses is realized based on a deep learning model.
Response 144 PhD 2 Title	Research on Vibration Propagation Mechanism and Long-Term Collaborative Control of Slab Track and Large Elevated Station in High-Speed Railway
Response 144 PhD 2 Keywords	High-speed railway; Large elevated station; CRTSIII slab track; Fine dynamic model; Waveguide mechanism; Long-term synergistic control
Response 144 PhD 2 Description	It conducts a random vibration analysis of large high-speed railway passenger stations under the complex operational conditions of multiple high-speed train lines passing through. The goal is to develop a set of vibration synergistic control methods applicable to the entire lifecycle of large high-speed railway passenger stations, ensuring efficient high-speed railway operations and promoting integrated station-city development.
Response 145 Country	France
Response 145 PhD 1 Title	Smart Management of 5G network slices in the railway system
Response 145 PhD 1 Keywords	5G, NFV, Slicing, Railway, AI
Response 145 PhD 1 Description	The PhD thesis aims at developping an AI based solution to exploit the network slicing concept for the development of a flexible, safe and secure wireless consist network

Response 146 Country	France
Response 146 PhD 1 Title	ML-based scheduling techniques in joint GSM-R and 5G Future Railway Mobile Communication Systems
Response 146 PhD 1 Keywords	FMRCS and GSM-R cohabitation, 5G, scheduling techniques, AI
Response 146 PhD 1 Description	The aim of this PhD is to develop an AI-based scheduling solution to permit GSM-R and FRMCS cohabitation in the same frequency band.
Response 147 Country	France
Response 147 PhD 1 Title	Energy transition of rail transport worldwide to 2035: Market assessment and technico-economic analysis of decarbonization solutions - The case of freight and regional trains
Response 147 PhD 1 Keywords	Energy transition, freight, regional, technico-economic
Response 148 Country	France
Response 148 PhD 1 Title	Station accessibility by mobility services
Response 148 PhD 1 Keywords	accessibility, station, mobility
Response 149 Country	France
Response 149 PhD 1 Title	Real-time optimization of train speed commands to limit energy consumption, taking into account information provided by on-board sensors
Response 149 PhD 1 Keywords	train-speed command, optimization, energy consumption, sensors
Response 150 Country	France
Response 150 PhD 1 Title	Contribution to train localization by visual odometry based on an AI algorithm robustified
Response 150 PhD 1 Keywords	localization, odometry, image processing, AI
Response 151 Country	France
Response 151 PhD 1 Title	Integrating AI and Operational Research for rail traffic management
Response 152 Country	France
Response 152 PhD 1 Title	Preventing and combating violence against women and gender minorities during travel. An experimental approach based on the situated experience of mobility

Response 152 PhD 1 Keywords	gender minorities, woman, public transport
Response 153 Country	France
Response 153 PhD 1 Title	Towards the dynamic optimization of maintenance planning for a fleet of railway rolling stock, taking into account logistical and operational constraints.
Response 153 PhD 1 Keywords	maintenance, dynamic optimization, rolling stock
Response 154 Country	France
Response 154 PhD 1 Title	Relative and cooperative satellite localization for rail systems based on remote position calculation.
Response 154 PhD 1 Keywords	positionning, GNSS
Response 155 Country	France
Response 155 PhD 1 Title	Level crossing, Railway safety, Requirements engineering, Model-based analysis, Traffic estimation/prediction, Intersection management
Response 155 PhD 1 Keywords	positionning, Level corssing, safety
Response 156 Country	France
Response 156 PhD 1 Title	Destabilizing and transforming intercity passenger mobility: examining socio-technical changes in long-distance rail and air transport in Europe (1950 - present)
Response 157 Country	France
Response 157 PhD 1 Title	Optimizing Railway infrastructure
Response 158 Country	France
Response 158 PhD 1 Title	Improving Quality of Service in heterogeneous rail mesh networks: towards SDN-based solutions - Application to mixed rail-road autonomous vehicle traffic
Response 158 PhD 1 Keywords	QoS, Mesh networks, 5G, SDN, road and rail
Response 159 Country	France
Response 159 PhD 1 Title	Tyre/Road-Rail adhesion study: Towards a safer “Ferromobile” transport solution

Response 159 PhD 1 Keywords	tyre road-rail, Railway
Response 160 Country	France
Response 160 PhD 1 Title	Millimeter antenna systems for railway applications
Response 160 PhD 1 Keywords	antennas, mmW, Railway
Response 161 Country	France
Response 161 PhD 1 Title	Use of RIS to improve wireless communications at mmW in railway tunnels for metro
Response 161 PhD 1 Keywords	RIS, mmW, propagation, Railway
Response 162 Country	France
Response 162 PhD 1 Title	Measurements based dynamic radio channel characterisation and modelling in the mmW band in railway environments
Response 162 PhD 1 Keywords	mmW, channel model, channel sounding, Railway
Response 163 Country	France
Response 163 PhD 1 Title	Dependability analysis of a wireless communication system for virtual coupling of autonomous trains - the case of platooning
Response 163 PhD 1 Keywords	dependability analysis, wireless system, Virtual coupling, Railway
Response 164 Country	France
Response 164 PhD 1 Title	Study and design of codebooks for medium- and high-mobility millimetric communications systems: applications to high-speed trains
Response 164 PhD 1 Keywords	code book, mmW, Railway
Response 165 Country	UK
Response 165 PhD 1 Title	Optimising carbon sequestration through vegetation management of the UK rail network

Response 165 PhD 1 Description	As one of the largest landowners in the country and publicly owned, Network Rail is expected to proactively manage the land to meet biodiversity targets and help achieve national goals of net zero greenhouse gas emissions. The aim of the PhD is to investigate and develop a methodology for optimising carbon sequestration through vegetation management within the constraints of running a safe, reliable and cost effective business. This will include establishing a baseline of current carbon stocks in the vegetation and soils, reviewing current vegetation management practices and those of other transport networks, modelling carbon sequestration under different scenarios and synthesising the results to produce a set of principles to assist Network Rail managers optimise carbon sequestration.
Response 166 Country	UK
Response 166 PhD 1 Title	Robotic and autonomous passenger train servicing
Response 166 PhD 1 Description	As part of the 'Robotics and Autonomous Systems for Rolling Stock Maintenance' research competition, RSSB funded project COF-RAS-01, Robust Automated Servicing of Passenger Train Fluids (RASPT-F). The study, carried out by Brunel University, found that RAS technology can be used to perform fluid servicing on electric and diesel passenger trains, removing most of the human errors associated with these tasks. Subsequently, the project team were awarded funding from Innovate UK, as part of a consortium led by TBG Solutions with support from Chiltern Railways, to develop prototype port interfaces and robot end-effectors plus a test rig. To support the industrial research, the studentship aims to identify tasks within rail servicing and prioritise these for robotic and autonomous servicing solutions. This will include: reviewing and critically evaluating state-of-the-art practice; targeting one or two applications for design solutions; building, testing and evaluation of one or two prototypes; investigation of economic and technical viability; investigation of human/RAS interactions; and, formulation of design guidelines and standards to inform designers of future trains.
Response 167 Country	UK
Response 167 PhD 1 Title	A novel railway maintenance robot for inspection and repair
Response 167 PhD 1 Description	Robot integration in railway maintenance steps a prominent pavement in high-efficient and low-cost job execution for the infrastructure management. To achieve practical and diverse inspection and repair railway job, a robot manipulator on a locomotive platform is one of the best options. A lot of research has been conducted to find the accuracy and precision of industrial robotic manipulator where the manipulator base is fixed. This research aims to develop a multipurpose Robotic Inspection and Repair System (RIRS) capable of performing improved railway track inspection by fusion of multiple sensors and demonstrating multiple simulated track repair tasks with and without human involvement.
Response 168 Country	UK
Response 168 PhD 1 Title	Autonomous localization and navigation for a railway inspection and repair system
Response 168 PhD 1 Description	Enhancing the vehicle's location, especially the location of the maintenance vehicle on the railway track, is critical. The autonomous maintenance vehicles on the railway tracks are designed to find the defect and stop by the defect location, to do some pre-determined repair tasks. In this regard, the main aim of this research is implementing autonomous localization and navigation of the RIRS on and around the railway track for the purpose of precisely enabling inspection and repair. For reaching this aim, there are a number of key challenges that need to be addressed. These challenges are including the unavailability of GPS in some parts of the railway environment, perception or understanding of the surrounding environment of the vehicle, simultaneous localization and mapping of the environment, autonomous navigation, path planning, etc.

Response 169 Country	UK
Response 169 PhD 1 Title	Real-Time fault detection and prognosis framework based on unsupervised data-driven approaches for prognostic and health management of railway door systems.
Response 169 PhD 1 Description	Despite much attention to data-driven approaches for fault detection, the major challenge is the lack of labelled datasets to build the models since maintenance is usually conducted regularly to avoid significant defects. In order to tackle the issue, we aim to develop a novel framework for fault detection and prognosis based on unsupervised data-driven approaches to railway door systems.
Response 170 Country	UK
Response 170 PhD 1 Title	Visual Analytics Applied to Rail Industry Asset Management
Response 170 PhD 1 Description	The aim of this research is to design, implement and validate a conceptual framework for visual analytics in rail infrastructure asset management in order to improve decision making. To maintain safe operations and cost-effective maintenance, British railway tracks must be monitored. Track recording assets which include trains and cars, regularly monitor key components of the track in order to detect and diagnose early incipient faults. The measurements accumulate over time, providing time series data that can be used to model track geometry deterioration process. However, the modelling results are often too sophisticated to be used to their full potential in track asset management. As a result, the goal of this research is to use visualisation approaches to display the results of track geometry deterioration, which would simplify and enhance track asset management. Two visual techniques have been used. The first visual includes two dimensional plots enabling visual fault detection and localisation and the second is a 3D plot which gives a better sight for the decision makers to act. These visual analytics allowed a better understanding of fault occurrence, enable a vast amount of data integration, flexible and simple for stakeholders to use. The limitations of such approaches include the inability to visualise more than 5 dimensions and human interpretation.
Response 171 Country	UK
Response 171 PhD 1 Title	Obstacle avoidance for railways autonomous vehicles
Response 171 PhD 1 Description	Aim “enabling trustworthy obstacle avoidance for autonomous navigation in railway environment.” Objectives: • Construct customized dataset for railway environment. • Investigate and develop transfer learning techniques to enhance detection of railway objects. • Investigate and develop multi-task learning for object detection and tracking in railway environment. • Evaluate and validate algorithm performance with robot in real-world railway environment.
Response 172 Country	UK
Response 172 PhD 1 Title	The Corporate Sustainability Strategy Decision-making of Network Rail
Response 172 PhD 1 Description	The project aims to develop a comprehensive framework for integrating sustainability into Network Rail's corporate strategy. To achieve this goal, the project will involve a thorough analysis of Network Rail's current sustainability practices and policies. Moreover, we will identify the drivers and inhibitors that may impact the formulation and implementation of corporate sustainability strategy. Furthermore, the project will assess the potential environmental and economic implications of various sustainability strategies.
Response 173 Country	UK
Response 173 PhD 1 Title	The Integration of Data and Knowledge for Remote Monitoring

Response 173 PhD 1 Description	Aim: Develop an improved control system for predictive maintenance. Research Objective 1: Develop a model for accommodating faults in closed loop control system. Research Objective 2: Online diagnosis of fault types. Research Objective 3: Online prediction of the future state and impact. Research Objective 4: Whole life cycle (WLC) management of Improved closed loop control system.
Response 174 Country	UK
Response 174 PhD 1 Title	Structural optimisation and fatigue life investigation of the IMAGE composite electrification mast
Response 174 PhD 1 Description	The aim of this PhD studentship is to optimise the structure of the OLE (mast and cantilever) to find a pultruded composites cross section that maximise stiffness to weight and strength to weight ratio also ensuring other crucial performance like electrical conductivity.
Response 175 Country	UK
Response 175 PhD 1 Title	An automated system for waste detection in train carriages
Response 175 PhD 1 Description	Carriage interior cleaning is currently performed by staff, usually at a train's final stop. This process presents challenges, due to both the uncomfortable ergonomics of the work and the potential for contact with biohazardous waste. The aim of this project is to develop an automated on-board cleaning system for railway carriage interiors, including an AI algorithm to classify waste items and a robot to collect and dispose of rubbish.
Response 176 Country	UK
Response 176 PhD 1 Title	Autonomous inspection of brickwork and masonry assets
Response 176 PhD 1 Description	This project aims to inspect the brickwork and masonry assets of railway bridges, particularly the intrados of arches where access is limited. Images could be collected autonomously by flying drones under the arches and then analysing the images to automatically detect the defects in the structure. Defects could include cracks, spalling, water seepage, insufficient mortar, misalignment, and crushing. The study could make use of a mock-up bridge to develop the control and navigation of the drone and any available images of defects to develop image processing.
Response 177 Country	UK
Response 177 PhD 1 Title	Low-carbon self-healing cementitious materials for rapid repair and maintenance of assets
Response 177 PhD 1 Description	This PhD project aims to develop low-carbon, fast-setting and self-healing cementitious materials sprayed with robotic arms for the rapid repair of the railway infrastructure, with a particular focus on Victorian masonry tunnels.
Response 178 Country	UK
Response 178 PhD 1 Title	AI Cultural Diagnostic and Prognosis Toolkit for Change

Response 178 PhD 1 Description	The goal of this research project is the design, development and evaluation of a standardised, scalable system of AI cultural diagnostic and prognosis and services for NR, tested within the NR environment. The next generation cultural assessment system be based upon evaluating the capabilities and limitations of, for example, existing techniques and tools like EMOTIVE.
Response 179 Country	UK
Response 179 PhD 1 Title	Decision Reliability using Incomplete or Inaccurate Asset Data
Response 179 PhD 1 Description	Loughborough University will interrogate and validate the seasonally agnostic railway model (SARM). The SARM has been developed in direct response to the Dame Julia Slingo report following the tragic accident at Stonehaven and is the key component of Recommendation 3 of the Weather Action Task Force report on the development of a digital platform. The platform will assimilate weather, asset and timetable data in the building of decision support tools for all ROCs.
Response 180 Country	UK
Response 180 PhD 1 Title	Machine Learning for Ladder Logic Verification
Response 180 PhD 1 Description	Ensuring that the full state space is covered when using Model Based formal methods is a computationally expensive undertaking when using existing traditional techniques. This project will investigate the possibility of using machine learning system to identify effective approaches for state space exploration.
Response 181 Country	UK
Response 181 PhD 1 Title	A Satisfiability-modulo-theory (SMT) proof checker compatible with an existing SMT solver
Response 181 PhD 1 Description	Satisfiability-modulo-theory (SMT) solvers are state-of-the-art tools for verifying computer programs. They do this using a set of theories and a search algorithm to prove the correctness of software. One deficiency of SMT-solving is that there is no standardised format for SMT-proofs and therefore no standard approach to checking their validity. The combination of SMT-solving and proof checking will lead to improvements of both, efficiency and robustness, and will produce a highly reliable verification solution that can replace and improve more traditional forms of verification and testing.
Response 182 Country	UK
Response 182 PhD 1 Title	Railway crew rescheduling for disruption management
Response 182 PhD 1 Description	This Research & Development project will implement and test a crew re-planning decision quality improvement module. Decision Support Module will provide a solution which leads to a step change improvement in decision quality assessment for control decisions that require real-time or short term crew re-planning. The project will have at its heart a new software module operating in a sandbox environment for validation and acceptance of its approach. This fully functioning software environment will run using real data from disruptions and be appraised and validated by control centre staff.
Response 183 Country	UK
Response 183 PhD 1 Title	Geospatial utility to assess the stability of rail vehicles under crosswinds
Response 183 PhD 1 Description	The aim of this project is to develop an integrated aerodynamics based geospatial framework to assess the risk of railway vehicles to highly localised winds

Response 184 Country	UK
Response 184 PhD 1 Title	Mapping the resilience of green transport corridors to strong winds effects
Response 184 PhD 1 Description	This PhD study will develop a digital tool to aid the identification of trees which pose a risk to the railway in strong wind storms and highlight estimated mechanisms of tree failure to supplement lineside vegetation management strategies
Response 185 Country	UK
Response 185 PhD 1 Title	Maximising ecosystem services from linear forests under a changing climate
Response 185 PhD 1 Description	This PhD will work with Network Rail to inform their 21st Century vegetation management plan, to ensure they maximise the ecosystem service provision from the linear forests, whilst ensuring a safe and resilient railway for the future. The project will explore, through the development and application of a suitable integrated modelling approach, how vegetation management will best be adapted to predicted climate change scenarios (UKCP18) in order to deliver improved ecosystem services, reduce adhesion risk and maintain railway safety.
Response 186 Country	UK
Response 186 PhD 1 Title	Digital twins of power converters connected to Network Rail's AC traction power supply
Response 186 PhD 1 Description	The number of power converters connected to the rail traction power network is expected to increase significantly over the next few years to integrated renewable power sources, storage devices, and electric vehicle charging stations. However, time-domain models developed by manufacturers use a number of parameters and data that are normally not publicly available but are essential to understand the response of the converter when included in the rail traction system. This PhD programme aims at developing generic simulation approaches and mathematical techniques for the incorporation of black-box power system converters in traction power systems. The research will look at the minimum data needed from manufacturers to enable a satisfactory representation of the power converter, and work towards standards of data transfer that have been developed theoretically and tested in practice. The work will generate generic methods which could be provided to any software developer, without the need of using proprietary code and single piece of software.
Response 187 Country	UK
Response 187 PhD 1 Title	Operational Network Responses to Weather Events to Improve Future Climate Resilience
Response 187 PhD 1 Description	Utilising sophisticated modelling techniques and systems of systems approaches the impact of different weather events on the network can be investigated and optimum
Response 188 Country	UK
Response 188 PhD 1 Title	Operational and VR modelling of new service running
Response 188 PhD 1 Description	This PhD project is mainly to study the approaches using advanced modelling and simulation technologies to enhance the operational stability of new train services into railway networks.

Response 189 Country	UK
Response 189 PhD 1 Title	Development predictive maintenance models for S&C monitoring and predictive maintenance
Response 189 PhD 1 Description	The project will focus on further developing the advanced modelling capabilities already available at the University of Huddersfield for predicting the full vehicle-turnout dynamic behaviour, by bringing together different field monitoring data (from NR data to specific spot measurement using accelerometers, hammer testing and other sensors on specific assets) and advanced FEM/MBS modelling techniques of vehicle-track interaction in S&C.
Response 190 Country	UK
Response 190 PhD 1 Title	Human Performance in Rail: determining the potential of physiological data from wearable technologies
Response 190 PhD 1 Description	The aim of the project is to improve understanding of how to practically measure human cognitive performance in rail. Initial interviews identified front-line rail staff workload as a concern. Periodic competency assessments are carried out to assess human performance but these do not account for second-by-second fluctuations in cognitive workload. Physiological measures were identified as a potential novel measure to assess workload more continuously and these are currently being researched and applied in sports, automotive and aviation industries. The focus of the PhD is the feasibility of assessing signaller workload using wearable physiological measures. However, an understanding of wearable physiological measures could be applied in the monitoring of cognitive workload associated with train driving tasks and other safety-critical rail tasks.
Response 191 Country	UK
Response 191 PhD 1 Title	Exploring stability and flexibility in railway operations
Response 191 PhD 1 Description	This PhD research project is designed to understand some of the mechanisms for stability and flexibility in the management and operation of the railway system, with an aim of improving the system's resilience by exploring ways to increase flexibility in work processes and behaviours without compromising the system's stability. This will involve examining concepts of stability and flexibility in safety management through the lens of the rail industry, identifying and describing manifestations of flexibility and stability within rail transport safety systems, investigating sources and factors influencing stability and flexibility in everyday operations, producing clear descriptions of how stability and flexibility do (or have the potential to) merge, and development of a framework to understand and classify safety-enhancing mechanisms and tools in relation to the operational needs for stability and flexibility.
Response 192 Country	UK
Response 192 PhD 1 Title	High Speed Railway - Renewal Scheduling
Response 192 PhD 1 Description	As new high speed railways are built, it is important that plans are in place to ensure that they are sustainable and affordable so that elements can be renewed as they wear out or become obsolete due to new technologies. The funding for renewals is generated through a usage charge levied by the infrastructure owners on the train operating companies. However, should this charge be too little then necessary replacements will not take place, or, in the event that it be too much, the consequence is higher than necessary fares for passengers. The aim of this PhD is to fix and justify the right charges, using advanced developments in degradation modelling, and through the definition of an optimisation problem which minimises the whole system costs and satisfies constraints which account for the practicalities of performing the renewals to have minimal impact on the service provision.
Response 193 Country	UK

Response 193 PhD 1 Title	Exploring late adopters' engagement with digital technology in the rail sector
Response 193 PhD 1 Description	To address knowledge gaps related to late adopter engagement, this PhD project will adopt ideas and concepts from the areas of tourism, disability studies, human factors, and transport studies to explore how digital systems used (or not used) by passengers can be improved or adapted to better suit the needs of users with later technology adopting tendencies. The overarching research question driving this project is: "What are the barriers to rail travel for late technology adopting passengers and to what extent is this explained by the social privilege dimension of constraints negotiation theory and the diffusion of technology theory?" The findings of this research will generate recommendations for the rail sector related to improving accessibility policies and industry standards to remove technological, psychological, or physical barriers in both the digital and built environment.
Response 194 Country	UK
Response 194 PhD 1 Title	Detecting and influencing behaviour at transport locations
Response 194 PhD 1 Description	This research aims to study how humans spot, interpret, and predict behaviours of others and will produce guidance and recommendations for the design of future decision aids and surveillance technologies. This research will include review of current security practices for the detection of human behaviour, collection of people's experiences of identifying unusual behaviour, description of observer's decision-making when detecting behaviour and identifying factors which influence these decision strategies, identifying aspects of visible behaviour, examining observer's ability to detect and interpret suspicious intentions correctly, modelling the observer's performance of the behaviour detection task, considering the design of security training processes and support tools, and identifying opportunities for automation of aspects of observers' performance in the context of suspicious behaviour detection.
Response 195 Country	UK
Response 195 PhD 1 Title	An optimisation approach for railway network recovery actions in response to disruptions
Response 195 PhD 1 Description	The project will focus on developing a methodology and research software to investigate the best recovery actions in response to a disruption. The methodology will explore a range of decision options based on the properties of the disruption and priority criteria of the controller. The ambition of the project is to replace some of the current decision-making processes by an automated advisory tool to offer a range of best strategies.
Response 196 Country	UK
Response 196 PhD 1 Title	System probabilistic modelling of bridge deterioration and maintenance
Response 196 PhD 1 Description	The main output of this work will be a model for the deterioration modelling of bridges as a system. The model will be implemented in a computational platform which, combined with a detailed manual, will be made available to NR.
Response 197 Country	UK
Response 197 PhD 1 Title	Capturing Richer Information to Better Understand Rail Passengers Uncertainty in the psychological factors and its impact on rail passengers' travel mode choice in Great Britain

Response 197 PhD 1 Description	Research shows that the public image of a transport system has an impact on service demand. This study is aiming to distinguish and understand the uncertainty in people's perceptions of rail transit experience (caused by lack of information, discord in different experiences, flexibility, and vagueness in language expression etc.) and investigate how these uncertainties affect the rail passenger decision-making process in Great Britain. The outcome of this research will assist the rail industry to better understand their customers and potential customers as well as to better target specific market segments.
Response 198 Country	UK
Response 198 PhD 1 Title	Improving Customer Feedback Mechanisms to Better Understand Customer Experience in the Rail Industry
Response 198 PhD 1 Description	This PhD aims to create a new framework/methodology or 'tool' for capturing and assessing customer feedback in the rail industry to help understand passenger experience in greater depth. The tool will include data collection via a questionnaire, data analysis via hybrid sentiment analysis, and a user interface to present the outcomes of the tool's analysis.
Response 199 Country	UK
Response 199 PhD 1 Title	Multi-active bridge isolated DC/DC converter for traction systems
Response 199 PhD 1 Description	The isolated Multi-active bridge (MAB) DC/DC converter is a promising solution for applications that require multiple DC connections. With its galvanic isolation, multi-way power flow capability, high power density and efficiency, and high voltage gain, the MAB converter can satisfy the needs of a variety of applications. Due to inherent cross-coupling behaviour, however, the MAB converter is difficult to control. In addition, reliability concerns, such as fault tolerance, become more important as the number of ports in the converter increases and each port's failure impacts the other ports' normal operation. This project proposes the MAB converter for train traction power systems, which is capable of integrating all forms of storage systems in a single stage. In addition to charging and discharging storage elements and controlling the motor, the proposed converter can provide state-of-charge balancing to extract the optimum amount of power and capacity. To achieve this, the steady-state and dynamic operation principles of the MAB converter must be investigated in depth. Then, a suitable control scheme, and power management strategy will be created to satisfy the requirements. Simulation and experimental tests will be developed and performed, to validate the effectiveness of the proposed control strategies.
Response 200 Country	UK
Response 200 PhD 1 Title	Time/ Frequency domain characterization of power converters in traction systems
Response 200 PhD 1 Description	To study output waveforms to develop methodologies for efficiently measuring and quantifying in a meaningful way the time dependent radiation and conducted emissions from power electronic converters. To develop techniques in complexity reduction and optimisation with the very large data sets.
Response 201 Country	UK
Response 201 PhD 1 Title	Line side converter to enable the railway to be a collaborative user of electrical energy

Response 201 PhD 1 Description	Exploring the applicability of Wireless Power Transfer (WPT) technology in the context of railways as an alternative for unelectrified routes in the UK. I have actively contributed to the design of power electronics converters, which play a crucial role in supplying energy to the power converters. Design process of coils for both the transmitter and receiver units in WPT systems. Notably, the design of the power converter places significant emphasis on establishing a robust and safe connection to the power grid while prioritizing efficiency and minimizing electromagnetic interference. Through careful consideration of these factors, the aim is to optimize the performance and reliability of the WPT system in railway applications.
Response 202 Country	UK
Response 202 PhD 1 Title	EMC of DC and AC traction supply railway systems with automatic devices
Response 202 PhD 1 Description	Based on the emission level of the traction supply system and the immunity level of the automatic devices, the Electromagnetic Compatibility (EMC) issue will be analysed using simulation tools and then it will be verified using experimental and field visit results. This project will help to develop new or ongoing standards, especially for low-frequency ranges which are not included in the current standards and to introduce new techniques to mitigate the electromagnetic interference from the traction supply system.
Response 203 Country	UK
Response 203 PhD 1 Title	Optimal Evaluation of converter emissions for the first-time right design
Response 203 PhD 1 Description	To develop a new measurement methodology for scanning electrical devices (power converters in particular). Since the structure and schematic of modern electronic devices is rather complicated to represent in simulation tools, these tools are used for validation and calibration purposes. For example for representing the electrical device in simulation software the schematic and manufacturing documentation is required as well as the datasheets for all components used in the design, including their nonlinear behaviour. As the result is quite tedious and time-consuming to reflect the device in simulation tools and computational-costly to simulate. Thus in the EMC domain, it's much more practical to evaluate the emissions by using the direct measurement of the device under test (DUT). The final goal of the research is to develop a new methodology for evaluating emissions levels for the DUT under development or right after the development stage. For validation of the effectiveness of this methodology both the measurement and simulation of the primitive electric circuit are performed. Due to the primitiveness of this circuit is much easier to change the input parameters and then compare the measured results with the simulation, hence, to calibrate and validate the meas. method.
Response 204 Country	UK
Response 204 PhD 1 Title	Bidirectional converter for DC traction Power Supply system
Response 204 PhD 1 Description	Develop a model for Bidirectional converter for utilizing regenerative energy completely to reduce the peak power demand by the utility grid using Regenerative energy and to perform case and field studies with low-power bi-directional converters for using the railway electrical system supporting the local electrical network.
Response 205 Country	UK
Response 205 PhD 1 Title	Whole life cost modelling for rail drainage

Response 205 PhD 1 Description	The UK railway drainage system is facing significant asset management challenges due to the presence of large numbers of assets with long asset life cycles. Maintaining the required asset performance economically and efficiently, while complying with the relevant legislation and regulations is a major concern for Network Rail's asset managers. The whole life cost (WLC) approach has been developed and implemented in many industries and has proven its usefulness in the management of assets, particularly for assets with long life spans and in situations of uncertain future expenditure. WLC involves estimating the present value of the total cost of ownership over any asset's likely operational life. It is often integrated with decision support tools to enable a more robust decision making process. This has significant benefits in regulated industries in which all expenditure requires clear justification. This project developed a whole life cost model suitable for railway drainage systems, considering the uniqueness and complexity of costs associated with railway business operations.
Response 206 Country	UK
Response 206 PhD 1 Title	Improving fundamental understanding of rough surface contacts with third-body layers present
Response 206 PhD 1 Description	The project will involve both experimental and modelling work to explore transient wheel/rail interface conditions, with a range of third-body layers including friction modifiers and leaves. A computational model will be developed to predict frictional conditions given initial and transient roughness conditions.
Response 207 Country	UK
Response 207 PhD 1 Title	Solid mechanics and AI hybrid approach to mitigation of climate change driven track buckling
Response 207 PhD 1 Description	This research will tackle a significant problem for rail networks - the prevention of track buckling in hot weather, particularly a climate change leads to extreme and variable conditions. Buckling risk means trains run at slow speeds, reducing network capacity and giving poor customer experience. Traversing buckled track can lead to derailment with severe safety consequences. Data shows buckles are more prevalent for specific track conditions. Individually insignificant factors occur in combination leading to a buckle without an obvious cause. Contributory factors may have stochastic nature through variability in components, installation, their age, loading history or other factors. Large-scale data collection on the railway network is opening the possibility of Artificial Intelligence (AI) approaches to accompany conventional mechanics in understanding rail infrastructure. An analytical mechanics model of rail buckling considering the track system as a restrained ladder structure is available in University of Sheffield. In this research it is anticipated this will be extended with a finite element model to more fully capture realistic (and stochastic) behaviour. Alongside this an AI model of buckling will be developed with rail network data. A particular fuzzy-set based methodology has proven to offer fast reliable predictions (in alternative cases 95-97% accuracy) estimating factors influencing results significantly. The joint support of the research by academic supervisors and industry will provide an exceptional opportunity to address the research problem using the latest ideas with potential to deliver real benefits of improved rail system performance.
Response 208 Country	UK
Response 208 PhD 1 Title	Improving prediction of low adhesion friction considering transience
Response 208 PhD 1 Description	This PhD studentship builds on the previous work to improve understanding of how friction varies with time and distance along the track (transience) and validate the forecasting approach. The project will collect lab and field data to build up the machine learning tool, develop and test a complementary sensor pack, and conduct validation of the overall system on a train.
Response 209 Country	UK

Response 209 PhD 1 Title	Improving Understanding of Low Adhesion Transience in the Rail-Wheel Contact through Experiment and Modelling
Response 209 PhD 1 Description	Understanding low adhesion at the rail-wheel interface is of vital importance to having safe and reliable trains. There is a growing body of research on the causes and remedies for the phenomenon, but there is extremely limited work on the transience of these effects. The ability to understand and predict the transience in low adhesion spatially and temporally is required to develop control strategies. This PhD research project has a focus on how contaminated rail conditions change with the weather, as well as how contamination develops and the linked changes to adhesion.
Response 210 Country	UK
Response 210 PhD 1 Title	Data driven hydrological modelling for railway water management
Response 210 PhD 1 Description	Recent collaboration between NR and The University of University of Sheffield (UoS) has begun to shed light on the performance and degradation of drainage assets, and the resulting impacts on parent assets. However, this understanding is contingent on accurate and reliable knowledge of the volume of water entering the railway system from the surrounding catchment. Current hydrological models operate at large scale to predict broad areas of flooding, and are not developed for accurate modelling of flow paths at scales relevant to individual railway assets. Digital terrain models are typically limited in resolution and can omit smaller scale drainage features such as roadside ditches that can substantially alter a small catchment. Models also suffer from deep uncertainty in factors such as infiltration rate, storage capacities and flow routing. This project will use a data-driven approach to address the uncertainty in water transport processes from rainfall to railway, enabling more accurate prediction of arrival flow volumes at the individual railway asset level.
Response 211 Country	UK
Response 211 PhD 1 Title	Developing Rail Head Cleaning Strategies through Characterising Growth and Depletion of Low Adhesion Layers
Response 211 PhD 1 Description	Low adhesion still remains a problem on the railway network. Contaminated railhead often caused by leaves or “wet-rail” (small amounts of water mixing with any metal oxide present – forming a slippery paste) causes safety concerns due to the impact it has on braking. Furthermore, this can lead to performance issues and delays and widespread passenger dissatisfaction. Great effort is put into managing the railhead during Autumn by all stakeholders, however a greater understanding is needed of how effective current mitigation techniques are and how best to deploy them. The aim of this work is to understand how leaf layers are seeded and grow and how they are removed by the passage of trains as well current water jetting techniques and the application of abrasive “traction gels”.
Response 212 Country	UK
Response 212 PhD 1 Title	Battery assisted discontinuous electrification

Response 212 PhD 1 Description	Rail is a crucial component of the UK's future low carbon sustainable transport system both for freight and passenger use. It is planned that diesel-only trains will be phased out by 2040, however, many sites scheduled for electrification to help meet this decarbonisation goal are challenging due to limited space around the line. For example, there are small bore tunnels through which energised wires cannot be accommodated. Moreover, many outlying parts of the network have no high capacity electricity grid connections making it challenging to electrify the railway without high grid connection costs. A novel solution to these issues is 'discontinuous electrification' making use of onboard batteries to supply power in otherwise difficult locations. Research challenges are in application of materials tolerant of making/breaking mechanical and electrical contact without loss of system resilience, and in developing battery management for the duty cycle to be performed. This research therefore bridges mechanical and electrical engineering, and follows the recently completed EPSRC TransEnergy project which linked the investigators in our Mechanical and Electrical departments. The research will aim to understand the difference in applications for battery trains and what each use case means for battery and current collection design. Successful implementation of discontinuous electrification will offer benefits by reducing the cost and complexity of electrification. Moreover, it can help de-carbonise rail transport more quickly.
Response 213 Country	UK
Response 213 PhD 1 Title	Optimising Railway Maintenance: Minimising Network Disruption
Response 213 PhD 1 Description	This project will measure benefits in moving from a static plan for scheduled maintenance to a dynamic risk-based plan that is continually refreshed base on measured and predicatively modelled changes in the track system
Response 214 Country	UK
Response 214 PhD 1 Title	Railway Digital Twin: Getting Best Value from Data
Response 214 PhD 1 Description	Develop a "Digital Twin" of the railway network that captures the key factors that cause network disruption. The Digital Twin can be used to explore scenarios that include changes in operations, vehicle and infrastructure reliability, crew availability, planned interventions (maintenance, refurbishment and renewal) and external factors - including weather and climate change.
Response 215 Country	UK
Response 215 PhD 1 Title	Carbon accounting in geotechnical solutions of capex funded strengthening across the UK mainline railway
Response 215 PhD 1 Description	Methods used to account for the sustainability of solutions are often qualitative rather than quantitative. This project will provide a methodology to quantify and monetise the contribution of embedded carbon by each standard detail.
Response 216 Country	UK
Response 216 PhD 1 Title	Carbon accounting for bridges
Response 216 PhD 1 Description	Construct validated probabilistic service life models of stainless steel reinforced with concrete bridges to form the basis for Live cycle cost analysis for quantifying the potential maintenance cost savings that are brought about by higher initial investment in the materials.
Response 217 Country	UK

Response 217 PhD 1 Title	Management of rail stress with climate change for modern and legacy track specifications
Response 217 PhD 1 Description	Investigate the relationship between rail stress temperature vs break and buckle risk in relation to a range of selected track variables, building on the work within In2Track2.Consideration will be given to current break/buckle risk management strategies and how these could evolve to meet the challenges of long term climate change in the UK.
Response 218 Country	UK
Response 218 PhD 1 Title	Capacity of pile foundations for railway over-line electrification equipment
Response 218 PhD 1 Description	Project will explore the factors influencing the capacity of pile foundations for railway OLE support masts, which may include the effects of an embankment or curring slope on the lateral resistance; soil stiffness and the assessment of serviceability; the impacts of load cycling and gust loading; interactions between lateral, vertical and twist loading and site characterisation issues.
Response 219 Country	UK
Response 219 PhD 1 Title	Threshold loading effects on railway ballast
Response 219 PhD 1 Description	The investigation of ballasted track settlement will be based on tests in the University of Southampton Rail Testing Facility, in which cumulative ballast settlements under millions of load cycles will be assessed as a function of varying axle load and loading pattern / frequency. Experimental data will be supported by various types of modelling, from empirical ballast settlement equations through rheological type models to a finite element / vehicle-track interaction analysis.
Response 220 Country	UK
Response 220 PhD 1 Title	Performance of fixed diamonds in complex railway S&C
Response 220 PhD 1 Description	Recent research has focused on understanding the real behaviour of switches and how it is influenced by their component parts. The project will extend that work to the fixed diamond element of crossings. It will involve field monitoring of fixed diamonds at 1-3 problematic or other locations on the UK network, to obtain baseline behaviour of actual performance. These data will be used to develop models of crossing behaviour for use in geotechnical and / or vehicle-track interaction (VTI) models, possibly in collaboration with the University of University of Huddersfield.
Response 221 Country	UK
Response 221 PhD 1 Title	Modelling strategies for network predictability, human performance and chaotic behaviour appraisal
Response 221 PhD 1 Description	During the first year this project will carry out preliminary background research to define the underpinning modelling approaches used to predict rail network performance, including identifying the parameters used, their relevance and the data sources that provide them. The second and third years will be dedicated to explore the application of machine learning and visualisation to validate a hypothesis on how these techniques could transform predictability accuracy, including gaps in the parameters used. assess the potential of considering rail network prediction as a chaotic problem.
Response 222 Country	China

Response 222 PhD 1 Title	Recycled plastic sleeper performance and optimizations
Response 223 Country	China
Response 223 PhD 1 Title	Bamboo sleeper performance and optimizations
Response 224 Country	China
Response 224 PhD 1 Title	GPR on ballast track analysis by AI
Response 225 Country	China
Response 225 PhD 1 Title	GPR and track geometry correlation analysis
Response 226 Country	China
Response 226 PhD 1 Title	Rail ultrasonic detection defaults classifications by AI
Response 227 Country	China
Response 227 PhD 1 Title	Turnout inspection by LiDAR
Response 228 Country	France
Response 228 PhD 1 Title	Technico-Economic Feasibility of On-Board Hydrogen Production for Train Operations
Response 228 PhD 1 Keywords	hydrogen trains, technico-economic feasibility, railway operations, electrolyser
Response 228 PhD 1 Description	This study assesses the feasibility of on-board hydrogen production for trains, focusing on technical and economic viability. It explores the concept of reversible hydrogen trains to eliminate the need for costly refueling infrastructure, aligning with SNCF's carbon neutrality goals.
Response 229 Country	Austria
Response 229 PhD 1 Title	Influence of Train and Traffic Control on Railway Station Capacity
Response 229 PhD 1 Keywords	ETCS Level 3 Hybrid, capacity, railway signalling, train protection system, virtual blocks
Response 229 PhD 1 Description	This research examines how train and traffic control adaptations can increase railway station capacity, focusing on ETCS Level 3 Hybrid to improve headway times and operational efficiency.

Response 230 Country	Italy
Response 230 PhD 1 Title	A Multibody Model to Study the Post-Derailment Dynamics of Railway Vehicles and Their Interaction with Containment Structures
Response 230 PhD 1 Keywords	multibody dynamics, finite element analysis, derailment, post-derailment dynamics, derailment containment structure
Response 230 PhD 1 Description	This work develops a multibody model to simulate post-derailment dynamics and interactions with containment structures, aiming to improve safety and design guidelines for derailment mitigation.
Response 231 Country	Netherlands
Response 231 PhD 1 Title	A Numerical and Experimental Study of Ratcheting for Head Check Initiation in Rails
Response 231 PhD 1 Keywords	rolling contact fatigue, FE cyclic contact simulation, V-Track tests, microscopic analysis, constitutive modelling
Response 231 PhD 1 Description	This research investigates head check crack initiation in rails through numerical and experimental methods, focusing on ratcheting effects to improve rail This research investigates head check crack initiation in rails through numerical and experimental methods, focusing on ratcheting effects to improve rail This research investigates head check crack initiation in rails through numerical and experimental methods, focusing on ratcheting effects to improve rail maintenance and longevity.
Response 232 Country	France
Response 232 PhD 1 Title	Enhancing Jamming Resilience in GNSS-based Localization for Safety-Critical Land Transportation
Response 232 PhD 1 Keywords	GNSS, jamming, safety-critical applications, KPIs
Response 232 PhD 1 Description	This study focuses on improving GNSS resilience against jamming for railway applications, proposing detection and mitigation techniques to ensure reliable positioning for safety-critical systems.
Response 233 Country	France
Response 233 PhD 1 Title	Design of a mmWave Channel Sounder and Channel Model Extraction in Railway Environment
Response 233 PhD 1 Keywords	measurement, channel sounder, mmWave, railway, model
Response 233 PhD 1 Description	This PhD develops a 60 GHz channel sounder for railway environments, enabling dynamic measurements and modeling to support future FRMCS communication systems.
Response 234 Country	Romania
Response 234 PhD 1 Title	Remote Monitoring and Diagnosis Solutions for Relay Interlockings
Response 234 PhD 1 Keywords	relay interlockings, wireless sensor networks, PLC, railway safety
Response 234 PhD 1 Description	This research proposes a hybrid monitoring system for aging relay interlockings, combining wireless sensors and PLC-based logic to improve fault detection and maintenance efficiency.

Response 235 Country	United Kingdom
Response 235 PhD 1 Title	Temperature Measurement in Rail Grinding
Response 235 PhD 1 Keywords	rail grinding, superabrasive grinding, high-speed grinding, tool design
Response 235 PhD 1 Description	This study explores superabrasive and high-speed grinding technologies to improve rail maintenance, focusing on temperature effects and surface quality.
Response 236 Country	Portugal
Response 236 PhD 1 Title	Innovative Acoustic Barrier Solutions for Railway Environments
Response 236 PhD 1 Keywords	acoustic barrier, railway noise mitigation, numerical modelling, experimental validation, urban impact
Response 236 PhD 1 Description	This PhD develops low-height acoustic barriers for railways, balancing noise mitigation with urban integration through numerical modeling and experimental validation.
Response 237 Country	Poland
Response 237 PhD 1 Title	Simulation Studies and Evaluation of the Running Gear of a Rail-Road Vehicle
Response 237 PhD 1 Keywords	road-rail vehicles, safety against derailment, running stability, multi-body simulation
Response 237 PhD 1 Description	This research analyzes running gear designs for rail-road vehicles, focusing on stability, safety, and wear reduction through simulation and optimization.
Response 238 Country	Sweden
Response 238 PhD 1 Title	Influence of Railway Wheel Tread Damage and Track Properties on Wheelset Durability
Response 238 PhD 1 Keywords	railway wheel tread damage, dynamic wheel-rail interaction, instrumented wheelset, maintenance
Response 238 PhD 1 Description	This study investigates the impact of wheel tread damage on wheelset durability, using field tests and simulations to optimize maintenance strategies.
Response 239 Country	Austria
Response 239 PhD 1 Title	Integration of Short-Wave Effects into Asset Management of Railway Infrastructure
Response 239 PhD 1 Keywords	railway infrastructure, asset management, system behaviour, maintenance optimization
Response 239 PhD 1 Description	This research examines short-wave effects (e.g., rail irregularities) on track performance, proposing methods for detection and integration into asset management.

Response 240 Country	Germany
Response 240 PhD 1 Title	Conceptual Design of a Universal Test Facility for Modern Train Control Systems
Response 240 PhD 1 Keywords	train control system, ETCS, EULYNX, railway signalling, laboratory equipment
Response 240 PhD 1 Description	This PhD develops a generic test system (GERDA) for modern train control technologies, enabling validation and training for ETCS and EULYNX systems.
Response 241 Country	United Kingdom
Response 241 PhD 1 Title	Scaling-Up the Tribological Assessment of Laser Clad Rail to Build the Case for Field Implementation
Response 241 PhD 1 Keywords	wear, laser cladding, premium rails, RCF, rail steel
Response 241 PhD 1 Description	This research evaluates laser cladding for rail repair and wear resistance, combining small-scale tests, full-scale trials, and field validation.
Response 242 Country	Netherlands
Response 242 PhD 1 Title	Improving Environmental Sustainability of Regional Railway Services
Response 242 PhD 1 Keywords	regional railways, advanced propulsion, renewable fuels, Well-to-Wheel, greenhouse gas emissions
Response 242 PhD 1 Description	This study assesses alternative propulsion systems (e.g., hydrogen, hybrid-electric) for regional railways, focusing on Well-to-Wheel energy use and GHG emissions.
Response 243 Country	Italy
Response 243 PhD 1 Title	Track Geometry Monitoring Using Measured Data from Commercial Trains Towards Predictive Maintenance
Response 243 PhD 1 Keywords	track geometry, predictive maintenance, lateral displacement, machine learning
Response 243 PhD 1 Description	This PhD develops an on-board monitoring system using lateral displacement measurements and machine learning to predict track geometry faults.
Response 244 Country	Netherlands
Response 244 PhD 1 Title	Vibration-Based Railway Track Condition Monitoring: A Physics-Based Digital Twin Approach
Response 244 PhD 1 Keywords	digital twin, AI, railway condition monitoring, axle box acceleration, track stiffness
Response 244 PhD 1 Description	This research combines physics-based models and AI to transform vibration data into actionable insights for track condition monitoring, validated through field tests.

Response 245 Country	Netherlands
Response 245 PhD 1 Title	Railway Track Support Condition Assessment: From Onboard Measurement to Maintenance Decision Support
Response 245 PhD 1 Keywords	railway monitoring, axle box acceleration, impact modal testing, track quality index
Response 245 PhD 1 Description	This study advances axle box acceleration (ABA) for track support monitoring, integrating it with TQI to enhance maintenance planning and standardization.
Response 246 Country	United Kingdom
Response 246 PhD 1 Title	Development of a Railroad Friction Estimation Tool Applying Field Measurements and Machine Learning
Response 246 PhD 1 Keywords	low adhesion, friction estimation, machine learning, railhead conditions
Response 246 PhD 1 Description	This research develops an AI-based tool for real-time railhead friction estimation, combining environmental data and railhead images to mitigate low-adhesion risks.
Response 247 Country	Denmark
Response 247 PhD 1 Title	Reliable and Secure Shared Telecommunication Infrastructure for Railways and Roads Co-existence Scenarios
Response 247 PhD 1 Keywords	SDN, slicing, edge computing, railway communication
Response 247 PhD 1 Description	This PhD explores SDN and edge computing for shared railway-road communication infrastructure, focusing on reliability, security, and service prioritization.
Response 248 Country	Spain
Response 248 PhD 1 Title	Trainsportation: methodology for the application of Artificial Intelligence to optimise existing rail mobility
Response 248 PhD 1 Keywords	Future mobility, smart transportation methodology, predictive maintenance, applied artificial intelligence.
Response 248 PhD 1 Description	This PhD proposes a methodology for applying AI to optimize rail mobility at regional and national levels. It addresses the lack of integration among stakeholders (infrastructure, operators, and manufacturers) and leverages data-driven AI techniques for predictive maintenance, demand forecasting, and multimodal optimization. Five case studies demonstrate AI's effectiveness in improving railway operations.
Response 249 Country	France
Response 249 PhD 1 Title	Obsolete and Dysfunctional? The Technical and Institutional Construction of the Underperformance of RER Line C
Response 249 PhD 1 Keywords	Dysfunction, obsolescence, RER, complexity, socio-technical system.

Response 249 PhD 1 Description	This research examines the socio-technical and institutional factors contributing to the dysfunction of Paris's RER Line C. It analyzes how stakeholders interpret and respond to operational failures, emphasizing the challenges of managing inherited rail systems in evolving urban and regulatory contexts. The study combines discourse analysis with mobility data to explore pathways for systemic adaptation.
Response 250 Country	Italy
Response 250 PhD 1 Title	Pantograph Testing Methodology Based on Hybrid System Response Convergence.
Response 250 PhD 1 Keywords	Hybrid testing, pantograph, catenary, dynamic interaction, OHL.
Response 250 PhD 1 Description	This thesis develops a hybrid testing method (HSRC) to simulate pantograph-catenary interaction, reducing reliance on costly full-scale tests. By iteratively correcting offline simulations with experimental data, the approach improves accuracy and flexibility in assessing dynamic performance. Validations show convergence with real-world measurements, supporting its use for design and maintenance optimization.
Response 251 Country	Spain
Response 251 PhD 1 Title	Encoded Surfaces That Are Read by Three-Dimensional Radar Imaging Systems
Response 251 PhD 1 Keywords	mm-Wave radar, vehicle positioning, adaptive braking, speedometer.
Response 251 PhD 1 Description	The PhD proposes using mm-wave radar to read encoded infrastructure (e.g., metal sheets or road markings) for precise vehicle positioning. Applications include train stopping systems (<2.5 cm accuracy) and road vehicle guidance. Prototypes demonstrate reliability under adverse conditions, offering a low-maintenance alternative to optical systems.
Response 252 Country	Germany
Response 252 PhD 1 Title	Integrated, Analytic and Utilization-based Models for Demand-centered Capacity Analysis in Complex Railway Networks.
Response 252 PhD 1 Keywords	Railway capacity, networks, Petri nets, MIP, MFD
Response 252 PhD 1 Description	This work introduces a Petri net-based model (RNUM) and mixed-integer programming (MIP-RNUM) to assess railway network capacity, integrating infrastructure, operations, and demand. The framework identifies critical bottlenecks and optimizes utilization, validated on real-world networks like the Dutch railway system.
Response 253 Country	Italy
Response 253 PhD 1 Title	Models and Algorithms for Improving Public Transport Services
Response 253 PhD 1 Keywords	Sustainable transportation, fleet management, public transport, operations research, metaheuristics.
Response 253 PhD 1 Description	The thesis develops optimization models for urban electric bus scheduling, freight shunting, and passenger train calendars. Contributions include metaheuristics for fleet management, MILP-based shunting policies, and rule-based timetable generation, validated via collaborations with Volvo, Trenitalia, and CFL Multimodal.

Response 254 Country	Spain
Response 254 PhD 1 Title	Change Making for Gender Equality in Rail
Response 254 PhD 1 Keywords	Gender Equality, Workforce Diversity, Passenger Experience, Inclusion
Response 254 PhD 1 Description	This study aims to explore strategies to promote gender equality within the rail industry, focusing on improving the experience of women both as users of rail services and as members of the workforce. It includes analyzing travel behaviors, identifying specific needs, and developing effective practices for attracting and retaining female workers.
Response 255 Country	Italy
Response 255 PhD 1 Title	Education and Training in Rail
Response 255 PhD 1 Keywords	Education, Training, Digitalization, Workforce Development
Response 255 PhD 1 Description	This research focuses on developing innovative educational and training methodologies to equip the rail workforce with necessary skills, particularly in the context of digitalization and automation. It addresses the challenges of recruiting suitably educated personnel and the need for standardized training across Europe.
Response 256 Country	Portugal
Response 256 PhD 1 Title	Rail-Enabled Urban Logistics
Response 256 PhD 1 Keywords	Urban Logistics, Rail Freight, Sustainability, City Hubs
Response 256 PhD 1 Description	This study investigates the integration of rail freight services into urban logistics to enhance efficiency and sustainability. It examines the development of Logistics City Hubs and the conditions necessary for rail services to fit into urban freight systems, including infrastructure needs and regulatory frameworks.
Response 257 Country	Italy
Response 257 PhD 1 Title	Fast Night Train Operations
Response 257 PhD 1 Keywords	Night Trains, High-Speed Rail, Sustainability, Passenger Experience
Response 257 PhD 1 Description	This research assesses the feasibility and potential of high-speed night trains as a sustainable alternative for long-distance travel. It includes market analysis, route identification, fleet assessment, and evaluation of technical and operational challenges to improve the overall passenger experience.
Response 258 Country	Portugal
Response 258 PhD 1 Title	Dynamic Stability of Trains Over Bridges
Response 258 PhD 1 Keywords	Structural Dynamics, Train-Bridge Interaction, Safety, Vibration Analysis

Response 258 PhD 1 Description	This study analyzes the dynamic interactions between trains and bridge structures to ensure safety and reliability. It focuses on the dynamic stability of trains crossing bridges, considering factors such as structural responses and train-induced vibrations.
Response 259 Country	France
Response 259 PhD 1 Title	Safety-Relevant Communication in Railway Systems
Response 259 PhD 1 Keywords	Safety Communication, Railway Systems, Interoperability, Reliability
Response 259 PhD 1 Description	This research aims to enhance communication systems critical to the safety and efficiency of railway operations. It involves studying safety-relevant communication protocols, technologies, and systems to improve reliability and interoperability within the rail network.
Response 260 Country	Czech Republic
Response 260 PhD 1 Title	Societal KPIs of Rail Research Programs
Response 260 PhD 1 Keywords	Societal Impact, KPIs, Rail Research, Evaluation Metrics
Response 260 PhD 1 Description	This study evaluates the societal impacts and key performance indicators (KPIs) associated with rail research initiatives. It focuses on developing metrics to assess the effectiveness of research programs in contributing to societal goals such as sustainability, accessibility, and economic development.
Response 261 Country	Croatia
Response 261 PhD 1 Title	Inclusion and Accessibility for Individuals with Intellectual Disabilities
Response 261 PhD 1 Keywords	Accessibility, Inclusion, Intellectual Disabilities, Rail Services
Response 261 PhD 1 Description	This research focuses on improving the accessibility of rail services for passengers with intellectual disabilities. It aims to identify barriers, develop inclusive design solutions, and propose strategies to enhance the travel experience for individuals with intellectual disabilities.