Shift2Rail

ANNUAL ACTIVITY
REPORT 2016

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FOREWORD

Henrik Hololei
Director-General for Mobility and Transport

For the Shift2Rail Joint Undertaking, 2016 was a year full of first time experiences. Of that, two particular dates stand out - 24 May and 24 June. On May 24, the Joint Undertaking became operationally autonomous and on June 24, the first S2R 27 grants were awarded. In addition to those two dates that stand out many other achievements ensured a successful technical and operational start of the Shift2Rail Research & Innovation Programme.

Rail has many advantages which sets it apart from its competitors, for instance its ability to provide mass transit, passenger comfort and safety together with low emissions and good energy efficiency. It is among the most sustainable modes of transport. However, as technology develops and society changes, rail faces further challenges. In order to successfully respond to these challenges, the Shift2Rail JU has been established.

The S2R's R&I Programme should deliver the necessary innovations for rail to reach its full potential and become the backbone of the future multimodal European Transport system.

The European Commission is committed to Shift2Rail. The work performed by the JU demonstrates the added-value of key actors working together towards a more competitive and stronger European Railway industry, fully equipped to support the future needs of EU transport.

S2R shall deliver, through railway research and innovation, the capabilities to bring about the most sustainable, cost-efficient, high performing, time driven, digital and competitive customer centered transport mode for Europe.

2016 RESULTS

Executive Director - Carlo M. Borghini

2016 has been a truly pivotal year for the Shift2Rail Joint Undertaking (S2R JU). Through the strong support and commitment of the Directorate General for Mobility and Transport of the European Commission, backed up by the Directorate General for Research and Innovation, on 24 May this year, the S2R JU became operationally autonomous and started the ramp up phase of its Innovation Programme through the launch of initial research & innovation activities. In parallel, the organization was set up to warrant sound financial management, legality and regularity of operations.

The S2R JU, set up as a public-private partnership within the meaning of Article 187 TFEU, provides a platform for the rail sector to address the challenges faced through a comprehensive and coordinated approach to Research & Innovation (R&I) in Europe. In addition, the S2R JU is tasked to manage all rail-focused R&I actions co-funded by the Union. The S2R Programme delivers strategically focused R&I and market driven solutions in order to create the railway of the future, with a particular focus on the needs of the rail system(s) and its users. Specifically, the S2R JU works towards doubling existing railway capacity; increasing reliability and punctuality by as much as 50%; and halving the life-cycle cost of railway. The S2R JU work contributes to the removal of technical obstacles holding back the rail sector in terms of interoperability and efficiency, and to the reduction of negative externalities, in particular noise, vibrations, emissions and other environmental impacts. The S2R JU facilitates the collaboration between stakeholders within the entire railway value chain as well as actors outside the traditional rail sector, giving particular attention to SMEs, research and technology centres, and universities: it is becoming a rail R&I hub.

The S2R JU was established in light of several global megatrends, such as climate change, digitalisation and urbanisation, which provide both opportunities and challenges for Europe. The S2R JU supports the paradigm shift necessary for the European railway sector to realise its full potential in order to meet the future needs of EU transport and evolving user requirements.

To this end, the S2R Programme is implemented through integrated Projects selected from yearly calls for proposals and/or for tenders. Building upon the ongoing S2R Initiative "Lighthouse Projects", the 2015/16 Call was launched in December 2015, and 27 grants were awarded in June 2016. The Projects under this Call, covering all the 5 S2R Innovation Programmes and Cross-Cutting Activities, contribute to developing innovative solutions that will increase the quality, reliability and punctuality of rail services while also reducing the life-cycle cost and delivering interoperability starting with cross-border travel and corridors; largely they target R&I at a low/mid TRL Level. The 2017 Call for proposals was launched in November 2016 and the innovative actions will continue to build on the successes of this year.

The year has also been marked by the participation of the S2R JU to key research and industrial events, in particular InnoTrans 2016 in Berlin where the S2R Programme was presented for the first time to the entire rail sector with the supporting presence of the European Commissioner for Transport, Ms Violeta Bulc.

2016 has seen the S2R JU become autonomous and move forward as an independent entity and with fully operational activities. S2R has now begun delivering the building blocks which enable innovative solutions needed to meet the needs of railway operators and network managers, for European citizens and freight business. Expressed in the form of Capabilities, the technological innovations will bring about the most sustainable, cost-efficient, high-performing, time driven, digital, and competitive customer-centred transport mode for Europe. I trust that, with the strong commitment and support of the Membership, 2017 will witness an even greater evolution in railway research and innovation to show the initial results at InnoTrans 2018, through ad hoc demonstrations. The S2R JU and its R&I Programme are at the forefront of these efforts and substantially contribute to the European Commission priorities for the Union citizens.

2016 In Milestones

16th MAY 2016

Executive Director took office

24th MAY 2016

Shift2Rail JU became autonomous

24th JUNE 2016

S2R JU awarded 27 grants (13 to proposals from its Members and 14 Open Calls)

SEPTEMBER 2016

Signature of the underpinning Grant Agreements and ramp up phase of the R&I activities

NOVEMBER 2016

Launch of the 2017 proposals

27 PROJECTS
FOR A TOTAL VALUE OF
€ 167 MILLION

454 PARTICIPANTS

CO-FUNDED
€ 79 MILLION

14 OPEN CALLS PROJECTS

18 EU MEMBER STATES

108 SMEs
53 RETAINED

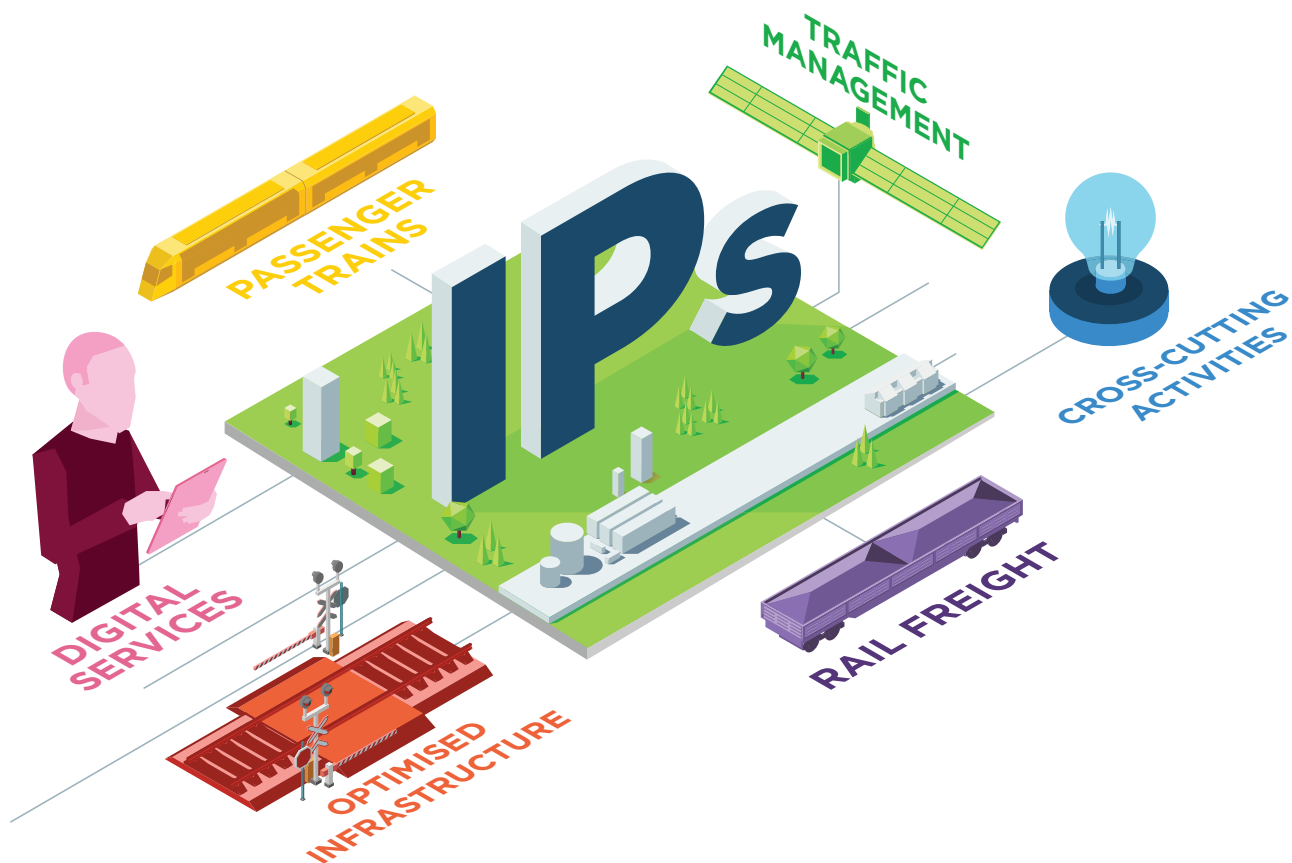**14.5%** PERCENTAGE OF WOMEN
PROJECT COORDINATORS IN H2020

THE S2R PROGRAMME
Innovation Programmes

TRAFFIC MANAGEMENT

PASSENGER TRAINS

IPs

CROSS-CUTTING ACTIVITIES

DIGITAL SERVICES

RAIL FREIGHT

OPTIMISED INFRASTRUCTURE

The S2R Programme is an integrated set of R&I activities structured around five asset-specific Innovation Programmes (IPs), covering key structural (technical) and functional (process) subsystems of the rail system, with a number of common cross-cutting activities (CCA). The Innovation Programmes aim to deliver the concrete solutions needed for the railway system to be the backbone of future mobility. They define the progress and innovations that need to happen to make railways among many things more sustainable, competitive and customer driven.

While the S2R JU was still in its setup phase , under the Horizon 2020 Transport Programme and the Call 2014, EUR 52 million were awarded by the European Commission in May 2015, as part of the S2R Initiative, to the so-called four "S2R Lighthouse Projects", precursor of the S2R research and innovation activities. Lead by the European Commission Directorate General for Mobility and Transport and Directorate General For
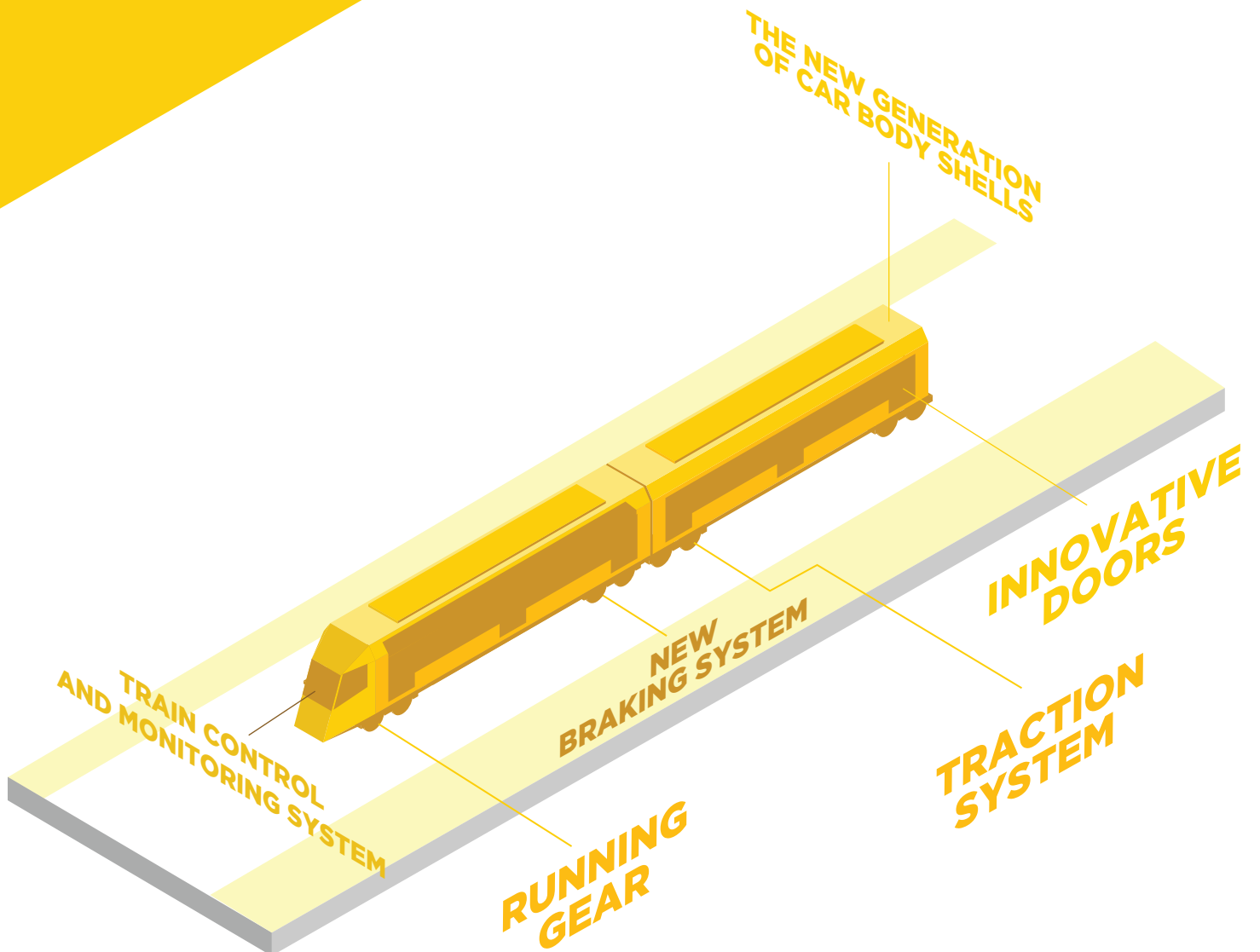
Research and Innovation, the Lighthouse projects have set the base for the S2R R&I Programme future development and successes.

The role of the S2R JU is to deliver the S2R Programme through the supervision of R&I, ensuring focused result-oriented activities, synchronized effective and efficient implementation, pooled together user require-ments for interoperability, and mobilising the necessary public and private sector funding/resources. The S2R JU ensures that interactions between the various IPs are adequately considered and managed through a whole mechanism of systems approach, given that technological developments in one part of the system could lead to changes in performance in other parts, with the aim to create advantageous synergies leading to delivering innovations. In addition, cross-cutting activities include research on long-term economic and societal trends such as customer needs and human capital and skills, which must be taken into account by the different IPs.

PASSENGER TRAINS

IP1

THE NEW GENERATION
OF CAR BODY SHELLS

INNOVATIVE
DOORS

NEW
BRAKING SYSTEM

TRACTION
SYSTEM

TRAIN CONTROL
AND MONITORING SYSTEM

RUNNING
GEAR

Cost-efficient and reliable trains, including high capacity and high-speed trains

Train control and monitoring system: The development of a new-generation TCMS allows current bottlenecks caused by physically coupled trains to be overcome. The new drive-by-data concept for train control, along with wireless information transmission, aims to make new control functions possible; it involves interaction between vehicles and consists, with high safety and reliability levels, through very simple physical architectures.

Running gear develops innovative combinations of new architectural concepts, new actuators in new lighter materials leading to new functionalities, and significantly improved performance levels with the possibility of vibration energy recovery. A mechatronic bogie able to steer through points and crossings is opening huge possibilities for a new design philosophy in collaboration with IP3.
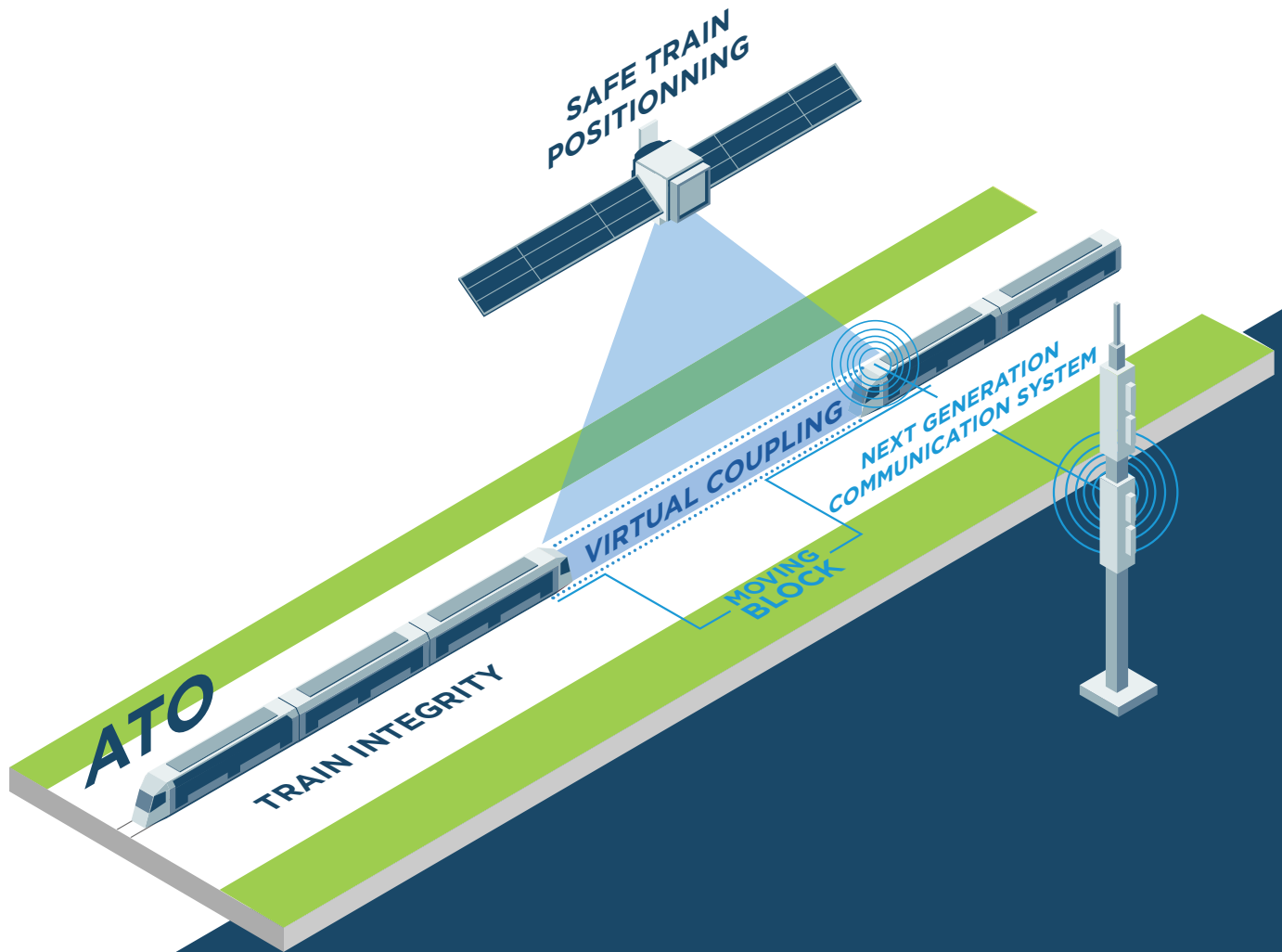
Traction system is developing new traction components and subsystems using mainly silicon carbide (SiC) technologies, which lead to new architectures. The work produces TDs (including a traction system based on independently rotating wheels) to implement into a Metro, a Regional train and a High-Speed Train.

The new generation of car body shells using composite or other lightweight materials will be a step change in the sector, leading to significantly lighter vehicles that carry more passengers within the same axle load constraints, use less energy and have a reduced impact on rail infrastructure.

New braking systems with higher brake rates and lower noise emissions provides major capacity gains in terms of mass and volume in bogies, paving the way for a fresh revisit of bogie design.

Innovative doors aim to move away from current access solutions based on honeycomb and aluminium or steel sheets; their drawbacks relate to energy consumption, and noise and thermal transmission. New lightweight composite structures could be made to react faster at existing safety and reliability levels, reducing platform dwell times and increasing overall line capacity.

Train modularity in use develops new modular concepts for train interiors that allow operators to adapt the vehicle layout to the actual usage conditions, and improves passenger flows, thus optimising both the capacity of the vehicle and dwell times.

TRAFFIC MANAGEMENT

IP2

SAFE TRAIN POSITIONNING

VIRTUAL COUPLING

NEXT GENERATION COMMUNICATION SYSTEM

MOVING BLOCK

ATO

TRAIN INTEGRITY

Advanced Traffic Management and Control System

The work of IP2 is organised around the following key areas

A new **Communication System** delivers an adaptable train-to-ground communications system usable for train control applications in all market segments, using packet switching/IP technologies (GPRS, EDGE, LTE, Satellite, Wi-Fi, etc.). **Automatic Train Operation** (ATO) (up to GoA3/4 - over ETCS) helps increasing the efficiency of railway lines on mainline/high speed, urban/suburban, regional and freight lines. The introduction of **Moving Block** also improves line capacity by decoupling the signalling from the physical infrastructure, and removing the constraints imposed by trackside train detection, thereby allowing more trains on a given main line. An innovative on-board train integrity solution allows for autonomous train-tail localisation. **Virtual Coupling** enables 'virtually coupled trains' to operate much closer to one another and dynamically modify their own composition on the move (virtual coupling/uncoupling of train convoys). **Safe Train Positioning** develops a fail-safe, multi-sensor train positioning system, applying Global Navigation Satellite Systems (GNSS) technology to the current ERTMS/ETCS core. It boosts the quality of train localisation and integrity information, while also reducing overall costs, in particular by enabling a significant reduction of trackside detection systems.
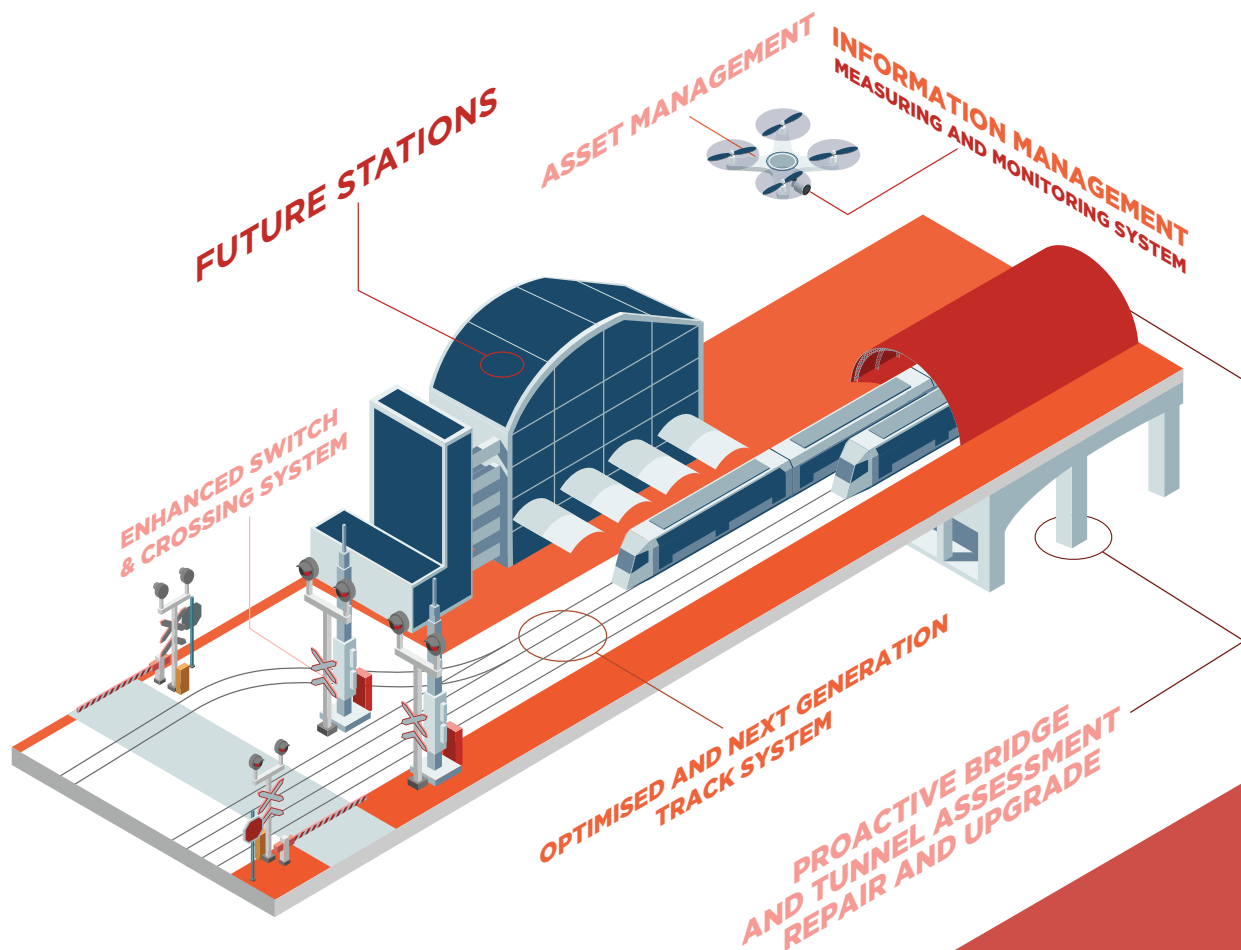
An optimised **Traffic Management** System improves operations with automated processes for data integration and exchange with other rail business services, in a scalable and interoperable way. These features are combined with new business service applications to allow for predictive and dynamic traffic management. Smart radio-connected all-in-all wayside objects are able to connect with control centres, other wayside objects and communicating devices in the area or with on-board units, providing opportunities for cost reduction and improving asset and network information management.

A **new laboratory test framework** comprises simulation tools and testing procedures to minimise on-site testing. The development of a set of **standardised engineering and operational rules** also facilitates the verification and authorisation processes. **Cyber Security** aims to achieve the optimal level of protection against any significant threat to the signalling and telecom systems in the most economical way (e.g. protection from cyber-attacks).

OPTIMISED INFRASTRUCTURE

IP3

FUTURE STATIONS

ASSET MANAGEMENT

INFORMATION MANAGEMENT
MEASURING AND MONITORING SYSTEM

ENHANCED SWITCH & CROSSING SYSTEM

OPTIMISED AND NEXT GENERATION TRACK SYSTEM

PROACTIVE BRIDGE AND TUNNEL ASSESSMENT REPAIR AND UPGRADE

Cost Efficient and Reliable Infrastructure

Work in IP3 is organised around 11 Technical Demonstrators (TDs) strongly interconnected focusing on improved management of infrastructure,

The main objective of the **'Enhanced Switch & Crossing System'** is to improve the operational performance of existing Switch & Crossing (S&C) designs

The **'Next Generation Switch & Crossing System'** aims to provide radical, novel system solutions that deliver new methods for directing trains to change tracks

The **'Optimised Track System'** challenges track construction assumptions currently implicit in track design andexplores how innovative solutions in the form of products, processes and procedures can provide higher levels of reliability, sustainability, capacity and LCC savings.

The **'Next-Generation Track System'** aims at drastically improving the track system performances, targeting a time range some 40 years beyond the present state of the art.

The main objective of the **'Proactive Bridge and Tunnel Assessment, Repair and Upgrade'** is to improve inspection methods and repair techniques to reduce costs, improve quality and extend their service life. Moreover, the reduction of noise and vibrations are prioritised objectives.

The **'Dynamic Railway Information Management System (DRIMS)'** aims at defining an innovative system for the management, processing and analysis of railway data.

The **'Railway Integrated Measuring and Monitoring System (RIMMS)'** is to provide innovative tools and techniques for capturing information on the current status of assets in a non-intrusive and fully integrated manner.

The vision of the **'Intelligent Asset Management Strategies (IAMS)'** is a holistic, whole-system approach of asset management employing collected and processed data. This includes putting long-term strategies in the context of day-to-day execution of the maintenance and other maintenance activities.

The wider objective of the **'Smart Power Supply'** is to develop a railway power grid in an overall interconnected and communicating system.

The objective of the '**Smart Metering for Railway Distributed Energy Resource Management System'** is to achieve a fine mapping of real time energy flows within the entire railway system, as the basis of any energy management strategy.

The primary objective of the **'Future Stations'** is the provision of improved customer experience at stations mainly through improved flows and train accessibility.

DIGITAL SERVICES

IP4

IT Solutions for Attractive Railway Services

The **'Trip-tracker'** gives travellers in-trip assistance when navigating transport nodes, while also providing personalised information (related to predefined preferences) and up-to-date status reports on subsequent legs of the journey; it supports them in case of disruption, by proposing updated booking possibilities together with updated rights to travel.

'Business Analytics' manages the data of services related to individual travels and to additional sensors, creating numerous possibilities to generate unprecedented insights for all the actors of the ecosystem, and new intelligence for the benefit of operators and travellers.

'Interoperability Framework' aims to facilitate multimodal travel in a highly diverse environment and with many transport modes.

Thanks to the **'Travel Companion'** which stores and shares personal preferences in a wallet, the traveller hasfull control of the journey.

'Travel Shopping' aims at providing a comprehensive shopping application enabler which combines all modes of transport, all operators and all geographies; it provides a list of customer-relevant trip offers which are guaranteed available for booking, purchase and ticketing.
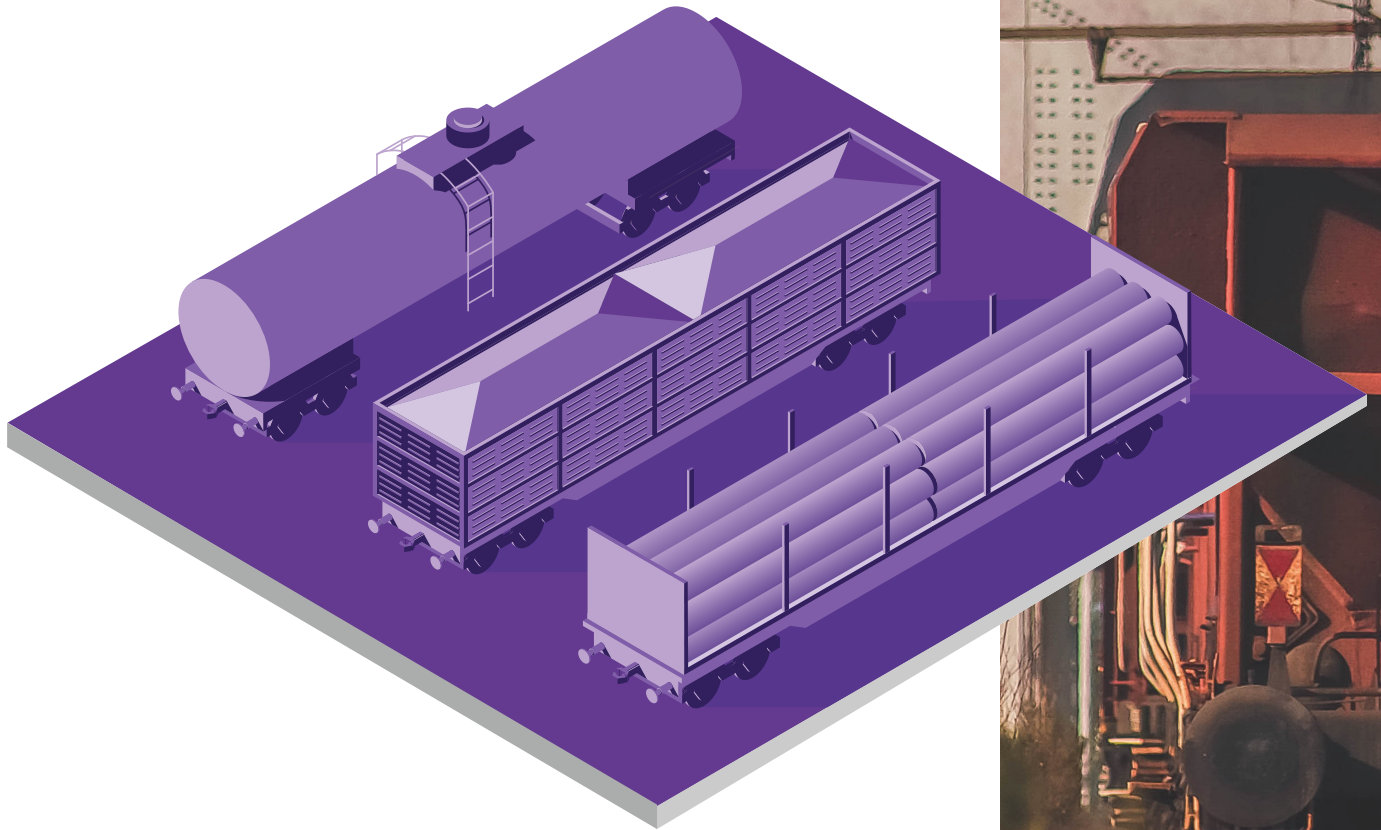
The **'Booking & Ticketing'** orchestrates multiple but parallel interactions with several booking, payment and ticketing engines, including the all-important roll-back activities, should any single transaction fail, in order to minimize risks.

RAIL FREIGHT

IP5

Technologies for Sustainable& Attractive European Rail Freight

'Implementation Strategies and Business Analytics' ensures that IP5 develops technologies in line with the market needs and with sound plans for introductions into the market. This is provided by migration plans for implementing new technology solutions on a large scale, identifying market segments, and developing specifications and Key Performance Indicators.

'Fleet Digitalisation and Automation' targets the adaption of those two global megatrends for rolling stock. The automatic coupling for freight trains is an important enabler for reliable data connections through the train. Digitisation of Rolling Stock leads to smart, connected assets that offer the necessary information for improved services like condition-based and predictive maintenance. Digitised assets are also a pre-condition for efficient Driver Advisory Systems and reliable automated freight trains for mainline operations.

'Digital Transport Management' is targeting the Digitisation of processes to optimise service planning and operation thanks to real-time data gathering, steering, operation and coordination of intermodal transport

through the asset control tower, thereby supporting better utilisation of available capacity, by optimising access and operation of local hubs which are essential but cost-intensive subsystems for rail freight business.

'Smart Freight Wagon Concepts' has the objective of delivering technical demonstrations of next generation running gear and freight wagons, including essential components such as telematics and electrification. The next generation freight wagons will improve the competitiveness of rail freight logistics by providing more flexible and reliable high-capacity assets at competitive costs.

'New freight propulsion concepts' aims at developing smart and eco-efficient propulsion technologies for last mile, longer coupled trains with distributed power and improving the overall performance of today's locomotives as well as hybridising the legacy shunting fleet. These technologies will equip rail freight operators with a higher degree of operational flexibility and stability as well as strengthen the environmental and sustainability advantage of rail freight over other modes of transport.
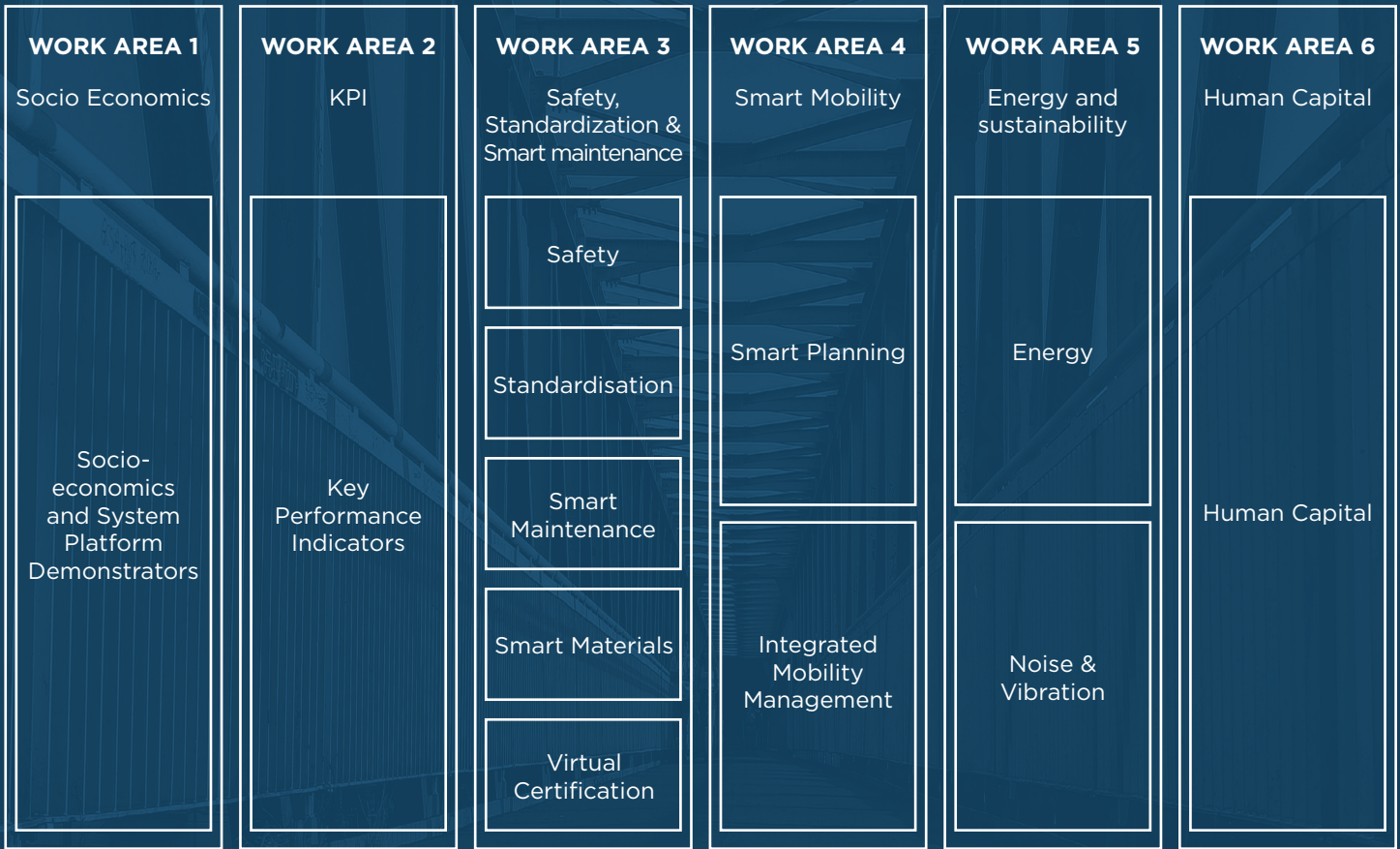
CROSS-CUTTING ACTIVITIES

WORK AREAS

CCA work is organised so as to achieve the objectives of the following areas indicated in the Shift2Rail Master Plan: Long-term needs and socio-economic research; Smart materials and processes; System integration, Safety and interoperability; Energy and sustainability and Human capital. In addition to these areas, CCAs also covers the development of a common methodology for assessing the achievement of the S2R objective.

WORK AREA 1

Socio Economics

Socio-economics and System Platform Demonstrators

WORK AREA 2

KPI

Key Performance Indicators

WORK AREA 3

Safety, Standardization & Smart maintenance

Safety

Standardisation

Smart Maintenance

Smart Materials

Virtual Certification

WORK AREA 4

Smart Mobility

Smart Planning

Integrated Mobility Management

WORK AREA 5

Energy and sustainability

Energy

Noise & Vibration

WORK AREA 6

Human Capital

Human Capital

PROJECTS 2015-2016

IP1: PASSENGER TRAINS

Project Title		Period	Project Value
CONNECTA	CONtributing to Shift2Rail's NExt generation of high Capable and safe TCMS and brAkes. Phase 1.	01/09/2016 31/08/2018	€13 291 983,55
PINTA	IP1 Traction TD1 and Brakes TD5 - Phase 1	01/09/2016 30/11/2018	€29 201 993,71
SAFE4RAIL	SAFE architecture for Robust distributed Application Integration in roLling stock	01/10/2016 30/09/2018	€6 681 211,25

IP2: TRAFFIC MANAGEMENT

Project Title		Period	Project Value
X2RAIL-1	Start-up activities for Advanced Signalling and Automation Systems	01/09/2016 31/08/2019	€45 003 870,33
CYRAIL	Cybersecurity in the RAILway sector	01/10/2016 30/09/2018	€1 498 150
MISTRAL	Communication Systems for Next-generation Railways	01/11/2016 31/10/2018	€499 282,50
VITE	Virtualisation of the testing environment	01/11/2016 31/10/2018	€1 008 826,25

IP3: OPTIMISED INFRASTRUCTURE

Project Title		Period	Project Value
IN2Smart	Intelligent Innovative Smart Maintenance of Assets by inte-gRated Technologies	01/09/2016 31/08/2019	€16 405 562,56
IN2TRACK	Research into enhanced tracks, switces and structures	01/10/2016 30/09/2018	€6 366 942
S-CODE	Switch and Crossing Optional Design and Evaluation	01/11/2016 31/10/2018	€4 999 771,25

IP4: DIGITAL SERVICES

Project Title		Period	Project Value
ATTRACkTive	Advanced Travel Companion and Tracking Services	01/09/2016 31/12/2018	€5 059 579
CO-ACTICE	CO-modal journey re-ACcommodation on associated Travel serVices	01/10/2016 30/09/2018	€7 818365,21
GoF4R	Governance of the Interoperability Framework for Rail and Intermodal Mobility	01/11/2016 31/10/2018	€2 000 000
ST4RT	Semantic Transformations for Rail Transportation	01/11/2016 31/10/2018	€1 000 000

IP5: RAIL FREIGHT

Project Title		Period	Project Value
ARCC	Automated Rail Cargo Consortium: Rail freight automation research activities to boost levels of quality, efficiency and cost effectiveness in all areas of rail freight operations	01/09/2016 31/08/2019	€3 600 360
FFL4E	Future Freight Loco for Europe	01/09/2016 31/08/2019	€3 375 017
FR8RAIL	Development of Functional Requirements for Sustainable and Attractive European Rail Freight	01/11/2016 31/10/2018	€7 826 783
DYNAFREIGHT	Innovative technical solution for improved train DYNAmics and operation of longer FREIGHT Trains	01/11/2016 30/06/2016	€999 822,50
INNOWAG	INNOvative monitoring and predicitive maintenance solutions lightweight WAGon	01/11/2016 30/04/2019	€1 500 562,50
SMART	Smart Automation of Rail Transport	01/10/2016 30/09/2019	€999 598,75

CCA

Project Title		Period	Project Value
FINE1	Future Improvement for Energy and Noise	01/09/2016 31/08/2019	€3 017 281 68
IMPACT 1	Indicator Monitoring for a new Paradigm in seamlessly integrated Cross modal Transport chains - Phase 1	01/09/2016 28/02/2018	€886 819
PLASA	Smart Planning and Safety for a safer and more robus European railway sector	01/11/2016 31/10/2018	€786 349
DESTINATE	Decision supporting tools for implementation of cost-efficient railway noise abatement measures	01/11/2016 30/06/2016	€1 271 812,50
GoSAFE RAIL	Global Safety Management Framework for RAIL Operations	01/11/2016 30/04/2019	€1 298 750
NEAR2050	Future challenges for the rail sector	01/10/2016 30/09/2019	€399 891,25
OPEUS	Modelling and strategies for the assessment and OPtimisation of Energy USage aspects of rail innovation	01/11/2016 30/04/2019	€797 130

2016 ANNUAL ACCOUNTS
BALANCE SHEET

	Note	EUR'000 31.12.20
NON-CURRENT ASSETS		
Property, plant and equipment	2.1	284
Pre-financing	2.2	34026
		34310
CURRENT ASSETS		
Pre-financing	2.2	6 773
Exchange receivables and non-exchange recoverables	2.3	9 795
		16 567
TOTAL ASSETS		**50 877**
CURRENT LIABILITIES		
Payables and other liabilities	2.4	(4 737)
Accrued charges and deferred income	2.5	(6 310)
		(11 047)
TOTAL LIABILITIES		**(11 047)**
NET ASSETS		**39831**
NET ASSETS		
Contribution from Members	2.6	51 755
Economic result of the year		(11 925)
NET ASSETS		**39 831**

STATEMENT OF FINANCIAL PERFORMANCE

	Note	EUR'000 2016
REVENUE		
Revenue from non-exchange transactions		284
Other	3.2	370
Total revenue		**370**
EXPENSES		
Operationg costs	3.2	(10 564)
Staff costs	3.3	(651)
Other expenses	3.4	(1079)
Total expenses		**(12 295)**
ECONOMIC RESULT OF THE YEAR		(11 925)

28 MEMBERS

GOVERNING BOARD

European Union represented by the European Commission: HOLOLEI Henrik (MOVE), BALDWIN Matthew (MOVE.DDG2), METTHEY Jack (RTD.I), DE LA TORRE Clara (RTD.DDG2.H) | **ALSTOM**: CASTRES SAINT MARTIN Nicolas, PERROCHEAU Sophie | **ANSALDO STS S.p.A**.: MAZZINO Nadia, TROMBETTA Antonella | **AZD Praha s.r.o**: KAMPIK Vladimir, PAVEL Michal| | **Bombardier Transportation GmbH**: OGIER Philippe, FRENCH Richard | **Construcciones y Auxiliar de Ferrocarriles S.A.**: GALARZA Aitor, GORTAZAR Josè | **Deutsche Bahn AG**: EULER Kay, MARXEN Ralf | **EUropean Rail Operating community Consortium (EUROC)**: CLEMENTE Jose, PETRASCHEK Thomas | **HaCon Ingenieurgesellschaft mbH**: DEITERDING Lars, GOOSSMANN Rolf | **INDRA SISTEMAS S.A.**: SANCHEZ Jose Miguel Rubio, LIZANO Javier Rivilla | **Knorr-Bremse Systems für Schienenfahrzeuge GmbH**: FREGIEN Gert, GRÜBER Johannes | **Network Rail Infrastructure Limited**: DOHERTY Andy, HOPKINS Graham | **Smart DeMain (SDM) consortium**: SAMSON Henk, DIAZ Javier Bonilla | Siemens Aktiengesellschaft: EDEL Roland, SCHLATH Juergen | **Smart Rail Control (SmartRaCon) consortium** : zu HÖRSTE Michael Meyer, MELENDEZ Juan | **Société Nationale des Chemins de Fer Français Mobilités (SNCF Mobilités)** : DESNOST Carole, CHERON Christophe | **THALES** : PARRONDO Alberto, PERREAL Yves | **Trafikverket**: OLSSON Bo, LOFVING Christer | **Virtual Vehicle Austria consortium+ (VVAC+):** KITANOSKI Filip, STOCKER Erik

ALL-ENCOMPASSING NETWORK

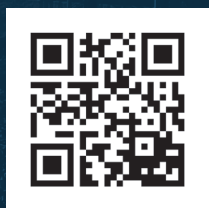# BRINGING THE RAILWAY WORLD TOGETHER

![Shift2Rail]

In accordance with Article 20 of the Statutes of the S2R JU annexed to Council Regulation (EU) No 642/2014 and with Article 20 of the Financial Rules of the S2R JU.

The annual activity report will be made publicly available after its approval by the Governing Board.

www.shift2rail.org

Shift2Rail_JU

Shift2Rail Joint Undertaking

Horizon 2020
European Union Funding
for Research & Innovation