Rail 2030 – **Research and innovation priorities**

Brief version

ERRAC brings together all stakeholders in the railway sector to place rail transport as the backbone of Europe's mobility. Through research and innovation, we develop a sustainable, competitive and customer-friendly railway as part of Europe's multimodal transport system.

ERRAC
The European Rail Research Advisory Council

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ERRAC – Research and Innovation

The vital importance of Rail Research and Innovation

ERRAC is the European Technology Platform for the railway sector, bringing together all its stakeholders - train operators, infrastructure managers, train builders and other suppliers, urban transport providers, academics and scientific experts and many more with an interest in rail research. In a single strong voice it articulates to the European institutions the needs of the sector for research and innovation.

In December 2017 ERRAC published "Rail 2050 Vision" setting out a progressive view of what a fully technically transformed railway could look like, and the much wider role it could play in meeting the needs of European citizens and business.

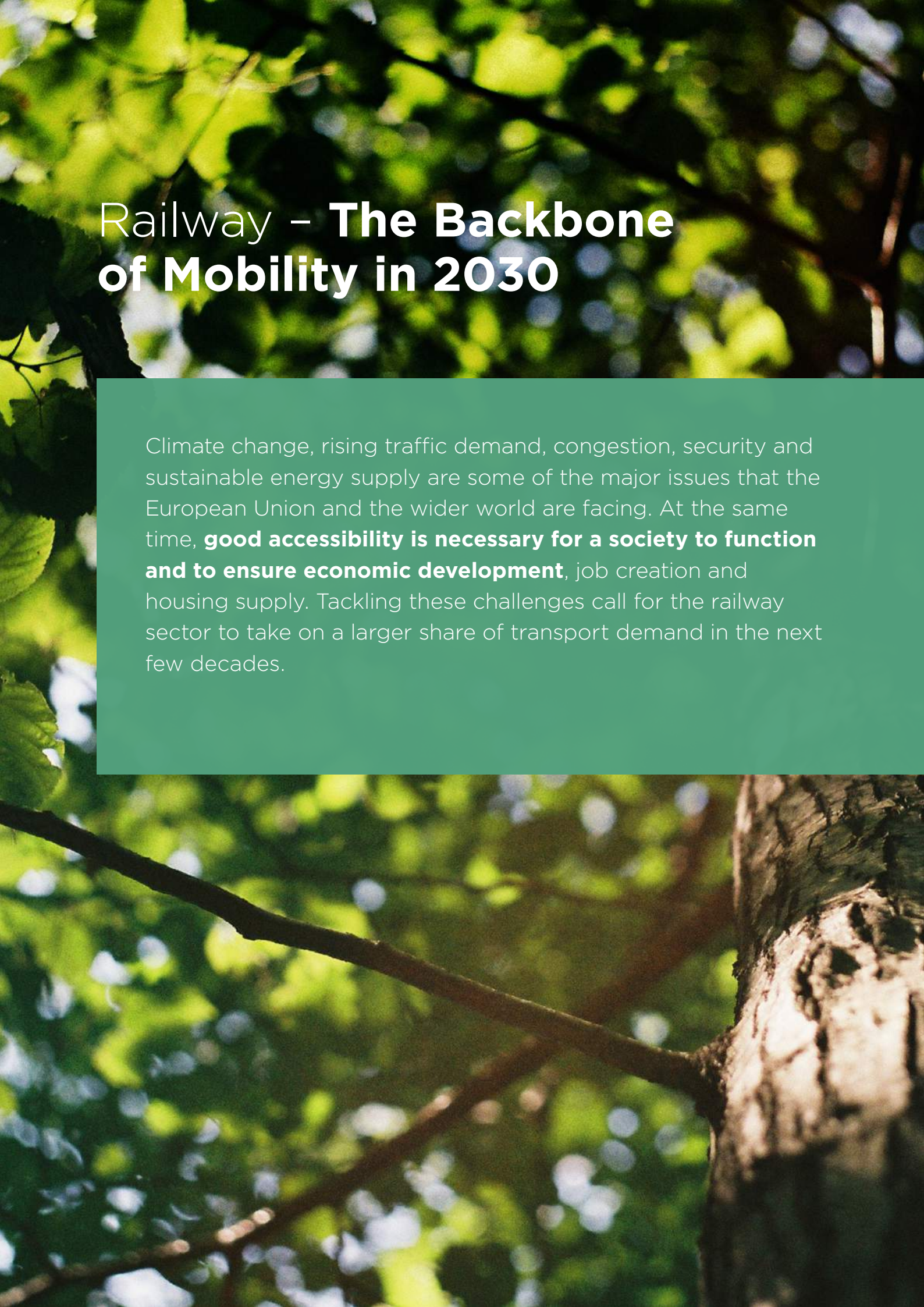
The Vision acknowledged the key role being currently played by the Shift2Rail Joint Undertaking, which operates within the framework of Horizon 2020 and is the principal delivery mechanism for rail innovation today. It has already made a very significant contribution to the sector, enabling it for the first time to federate its efforts in a way unparalleled in other sectors, bringing together a broadbased representation of train service and infrastructure operators, manufacturing industry and other suppliers, academia and research institutes in a unified research and innovation programme. This approach has accommodated sensible risk-taking for cutting-edge research, impossible if left to individual actors operating alone. It has also provided the scale and critical mass to justify engagement with technology developments beyond the railway sector, such as Silicon Carbide electronics. Critical to the success of these early moves to implement the Vision is a supportive regulatory and standardisation environment. So Shift2Rail and the European Rail Agency (ERA) are working together to ensure not only that new solutions are interoperable by design but also that they can be introduced quickly.

The railway sector sees it as vital to continue the successful work to achieve the goals set out in the Vision. Finding solutions addressing the key factors - the attractiveness, convenience and affordability of the railway offer, and its environmental sustainability – is critical to providing customers (passengers and freight businesses) with easy access to a portfolio of sustainable multi-modal mobility options with the railway as their backbone.

This document gives a short description of how the sector can meet these challenges and the priority actions required towards establishing the railway as Europe's mobility backbone, even as early as 2030. It is a good investment – for us, for society and for future generations.

Alberto Parrondo, Chairman ERRAC

The full report **"Rail 2030 Research and Innovation Priorities"** can be downloaded from **https://errac.org/**



Railway – **The Backbone of Mobility in 2030**

Climate change, rising traffic demand, congestion, security and sustainable energy supply are some of the major issues that the European Union and the wider world are facing. At the same time, **good accessibility is necessary for a society to function and to ensure economic development**, job creation and housing supply. Tackling these challenges call for the railway sector to take on a larger share of transport demand in the next few decades.

The political goals of economic development, improved social cohesion while protecting the environment, require base of much improved mobility. Only railway can provide the backbone of this mobility in a multimodal context.

There are opportunities for radical system improvements based on the expansion of innovative technical capacity. This means attractiveness and convenience in real-time, tailored environment through an integrated door-to-door mobility system that provides a punctual, reliable, safe, secure and cost efficient service for citizens and businesses. As the railway is the cleanest mode of transport, promoting modal shift towards rail will also support the reduction of emissions.

Addressing these challenges, the railway will become the backbone of mobility by 2030. The current technological and social context offers specific opportunities to act in this direction. But, in order to promote a modal shift from road to rail and to achieve a more competitive and resource-efficient common European railway area, increased investment and central funding are needed – it´s a good investment for Europe.

Research Priorities towards 2030

ERRAC's Vision 2050 presented a clear view of how Europe's railway system could maximise its contribution to mobility for Europe's citizens and logistics, based on technical innovation, and the need for a supportive research environment. Taking account of the global and European trend of migration towards key urban areas, the challenges and opportunities faced by the rail system will increase. It is therefore the right time, from now to 2030, to set down the foundations of the solutions which will address them in a proper way. The sector proposes a set of time focused concrete plans based on the identification of the right questions to answer in each ten-year time period and setting meaningful and influential milestones in a logical, coherent chain.

Digitalization and Automation of the Railway System

Today, the deployment of **European Rail Traffic Management System** is a basis towards a progressively more automated interconnected railway system. This new traffic management system combined with **Automated Train Operations** and other new technologies, as Artificial Intelligence, **digital information sharing and embedded sensors and telematics makes the system ”smarter”** and more effective.

The digital railway will drive the integration of the overall **mobility-digital eco-system** for all transportation modes.

AUTOMATION AND ARTIFICIAL INTELLIGENCE: Advanced interoperable train control systems will deliver more flexibility in operation therefore better real-time adaptation to the demand and economic competitiveness by increased capacity.

Real-time management of the operation, along with new concepts such as virtual coupling and platooning, will support the increase of flexibility in operations. Autonomous trains and automated freight operation will bring additional predictability and versatility.

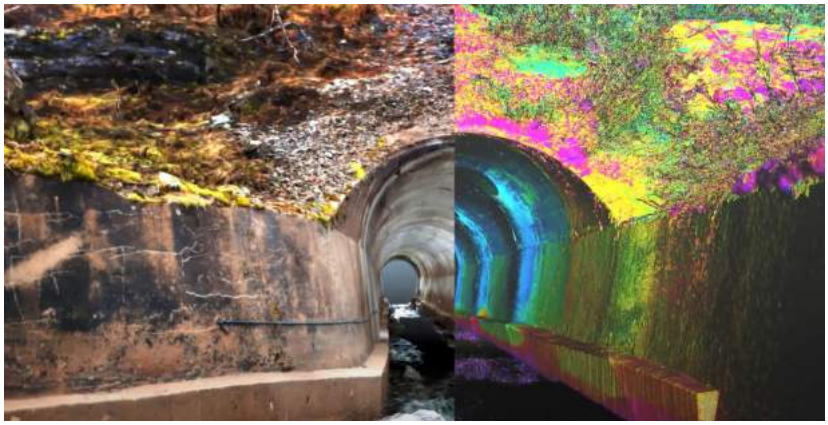
The flow in the tracks is positively influenced and can be further streamlined as the trains can safely move closer to each other by means of smart communication. The logistics chain can be automated and on suitable stretches and times, such as night time, trains can be self-driving, overcoming the challenge of driver shortage.

All these elements together will support an increase of the capacity and resiliency of the system without major infrastructure investments. It will also lead to more end-user/citizen satisfaction from improved traffic management enabling better punctuality and comfort and more flexibility for real-time demand fulfilment.

Intelligent Assets
Lifecycle Management

Digital Asset Management will be the base for digital end-to-end mobility for passengers and freight, supported by a resilient and powerful telecommunication network.

Maintenance is quite manual today, executed with the support of machines. **In a future digital system, the machines will be more and more able to do the maintenance themselves,** reducing the costs, risks and the lead time before the actual repair. The knowledge will also feed back into the design and construction or manufacturing loop.



Maintenance can be done by mobile units, robotics, satellite and drones or by the components themselves. This further will reduce down time, especially at odd hours. Punctuality and capacity can be increased so that more trains, both person and freight, can be driven. Overall, this contributes significantly to increased cost efficiency.

DIGITAL TWINS: *Digital twins (digital copies) of a physical product, such as a railway track, a bridge or tunnel makes it possible to follow the plant's function and simulate circum-stances such as weather, traffic volume, vehicle weight/load and so on. The collected information is used to plan maintenance activities exactly at the right time. That is, before it affects performance or compromises safety, but also when it gives the least impact on traffic.*

”Door to Door” Mobility Ecosystem

The usage of real-time information and data sharing will provide an accurate status within the full transport system and allow an overall optimization of the transport offer. **The emergence of new transports- and communication possibilities allows cities and regions to propose multimodal mobility-as-a-service solutions** (focus on shared and on demand) to address the traffic congestion issue and enhance the attractiveness of the public transport. The development of tools for public administration also provides valuable information to optimize the layout of stations and to refine the procedures for incidents. **With rapid development and disruptive solutions**, we can also expect both simpler and cheaper solutions than the now established technology.

People are always connected and expect mobility offers which are versatile, resilient, selected in one click, with fully transparent information, going more and more towards “on demand” door to door integrated mobility. For the customer, a personalized, real-time information gives access to the services associated to seamless end-to-end journeys, including various transaction systems for payment, Railway is integrated with the other modes of transport providing a continuous support during the whole journey.

Also, comfort factors such as less vibration and noise in the train and better IT services are under development.

For rail freight modular, freight wagon designs allows a seamless and efficient horizontal change of goods and loading units. Intelligent freight wagons are connected to intermodal terminals, marshalling yards, end-users/citizens sidings and cross modal nots to provide a high-performance access to the rail system.

ONE

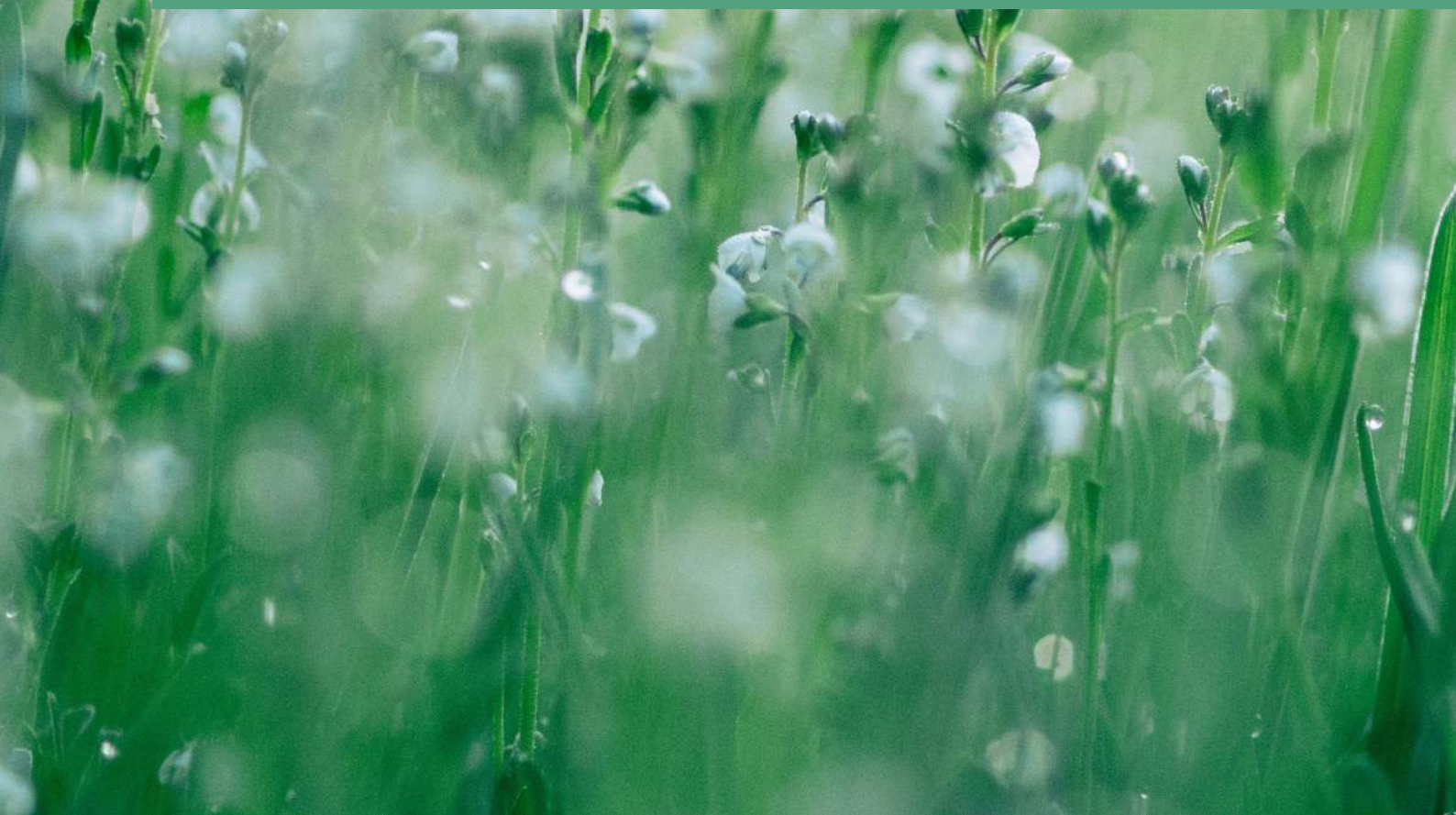
job in railway transport creates more than

ONE

other job in indirectly dependent economic activities.

Environmental Sustainability **and Carbon Free Mobility**

As the railway is the cleanest mode of transport, promoting modal shift towards rail will support the reduction of emissions. But this is not enough, and rail will implement new light materials, new technical solutions for non-electrified lines and further increase its energy efficiency. **Improving the integration of transport systems in populated areas by reducing noise, vibration and carbon emissions** will be essential to increase social acceptance in urban environments and beyond. Indeed, rail systems are contributing to mitigating the climate change challenge.



Additional research and innovation actions will improve the current situation from the environmental perspective. For instance to develop smart energy infrastructure. On board and line-side energy storage technologies and charging technologies will make it possible to recover a big amount of the braking energy and will support balancing the flow of energy. Electricity supply using SMART Grid technologies coupled with increasing the residence and variety of supply resources (e.g. main grid, local renewable, recovered, etc.), can be applied not only for rail traction systems but also for road usage and stations. Another example is the necessity of work from an early phase on the adaption of regulation and standards to consider (and even favour) the use of the cleanest technology being developed.

RAIL IS 9X LESS CO_2
intensive than road for freight
and air travel for passengers.

Safety and **security**

Interoperability and safety enhance and ensure the seamless and safe circulation of passengers and goods on railway vehicles across the European Union and even beyond its borders.

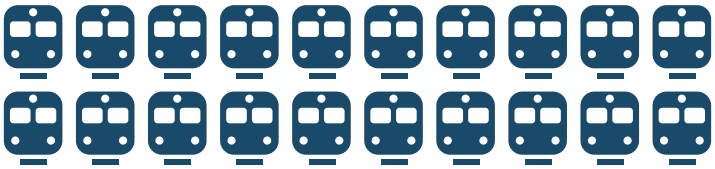
The objective is to ensure that every European rail transport network is secured properly and can detect efficiently security incidents. To achieve this, a precondition is to enhance European collaboration so that more trains, both person and freight, can be driven safe and secure.

The railway's local environment is also subject to security-building measures. Development of public administration tools creates valuable information to optimize the layout of the stations so that they are accessible and safe to everyone, even in case of evacuation.

New concepts aimed at verifying access rights to rail services and infrastructure using intelligent wireless technology, ticket detection systems and biometrics also increase safety and security. For freight, track-and-trace solutions support security issues efficiently.

Rail is more than

20 x safer



than road.

In the digital era, the protection of every subsystem against cyber-attacks is becoming critical, as most of the systems are now connected. The rail sector will not develop specific cyber protection but will use the best of the existing technologies. The Directive on security of network and information systems (NIS Directive) has initiated regulations that enforce cyber-security system accreditation.

Railway – The Backbone of Mobility **in Europe's multimodal transport system**

The 2030 rail system will interact with other transport modes, and with local, regional, national and European economic activities in transformational societal changes and trends. **Safe, reliable, comfortable and efficient rail services will influence and benefit many different areas**, such as lifestyle, spatial planning, people's everyday experience and a better general standard of living.

Rapid deployment of innovation to market

The sector has a strong commercial focus and awareness of the maturity levels of new technologies. Component-driven development and modularised products are key elements of a rapid deployment of innovation to market. An ecosystem for R&I, based on effective collaboration, the provision of greater technology demonstrations capability, and the rapid integration of technology into the railways, moves barriers to the adoption of new technologies and decrease time to market.

We have a momentum – now is the time to act!

Through wise investments today in the railway, the most environmentally-friendly mode of transport, we can create a sustainable, inclusive, affordable and accessible alternative for tomorrow's people and goods.

Together with other modes of transport, we will build and develop a multimodal system with the railroad as the back-bone of mobility.

It is a good investment – for us, the society and for future generations.

Data is sourced from CER statistics, UIC, EEA, EU Agency for Railways, the European Commission statistical pocketbook 2018 “EU Transport in Figures”, Eurostat energy statistics, Eurostat transport statistics, Eurobarometer.

ERRAC brings together all stakeholders in the railway sector to place rail transport as the backbone of Europe's mobility. Through research and innovation, we develop a sustainable, competitive and customer-friendly railway as part of Europe's multimodal transport system. Visit errac.org