#### **OBJECTIVES**

The overall aim of the Mat4Rail project is to lay the foundation for:

- Reducing train weight by replacing metal parts with Fibre Reinforced Polymers (FRPs)
- Increasing capacity and passenger comfort via built-in modularity of train interior design

The objectives of the Materials work stream are to develop FRPs that meet all the railway environment requirements regarding Fire, Smoke and Toxicity, mechanical performance and cost effective manufacturing, to develop structural joints for FRPs, and to innovate the access door system by reaching improvements in term of weight, acoustic attenuation, thermal performances and cost.

The Interior Design work stream is addressing the challenges and shortcomings of current rolling stock in terms of modularity in use to meet the changing passenger demand during the 30-40 years of an in-service operating life-cycle of a train. This work stream is aimed towards tackling this challenge in three distinct sub-systems: innovative plug & play systems, innovative seats and innovative driver's desk.

Parallel to the Mat4Rail project runs the complementary Shift2Rail JU project, PIVOT - Performance improvement for vehicles on track. Mat4Rail and PIVOT aim at achieving innovations which respond to the rail industry's needs and requirements through frequent interaction and knowledge sharing between the two projects.

### **KEY FACTS**

Project Duration:

01/10/2017-30/09/2019

**Project Budget:** 

3.5 million euro

Project Website:

www.mat4rail.eu



This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 777595.

### **PROJECT COORDINATOR**



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### **PARTNERS**































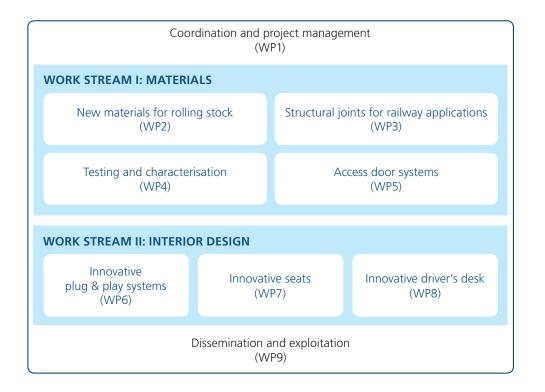


### **ACTIVITIES**

Mat4Rail aims to develop innovative materials and technologies, as well as design concepts within two independent work streams. Work Stream I of the project concentrates on materials, whereas Work Stream II addresses interior design.

The Materials work stream is structured into four work packages (WP): Resin development, fibre selection and manufacturing of first composite samples and parts (WP2), Investigation of joining technologies of composites parts with other composites parts as well as with metal parts (WP3). Testing and characterisation of novel materials and joints (WP4). Investigation of new materials, architectures and manufacturing processes for the door leaves of a train's access doors (WP5).

The Interior Design work stream includes "Innovative plug & play systems" (WP6), "Innovative seats" (WP7) and "Innovative driver's desk" (WP8).



#### **WORK STREAM I: MATERIALS**



# New materials for rolling stock (WP2)

WP2 is focused on the development of improved resins (epoxy, benzoxazine and hybrid chemistry) and further manufacturing of their fiber reinforced composites to fulfil the stringent requirements for the fabrication of carbody parts for the railway sector in terms of cost, mechanical and FST (Fire, Smoke and Toxicity) requirements. Currently 24 new composites have been manufactured and assessed within WP4.



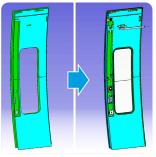
# Structural joints for railway applications (WP3)

WP3 aims at the development of joining concepts based on adhesive and hybrid bonded joining whilst laying the foundation for homologation procedures for railway applications. Proposed concepts have: (i) proven the operational stability of adhesive bonding under static and fatigue loads, (ii) shown to be suitable for dissimilar and polymeric materials, (iii) followed requirements for maintenance, repair and refitting.



# Testing and characterisation (WP4)

The new improved fibre reinforced composites and joints are characterised for fire and mechanical properties in WP4. Design load assumptions for fatigue strength assessments of components are developed on the basis of measurements. Static load and fatigue properties are determined for the new components and additionally for repairs. To date, Mat4Rail has already selected 3 FRPs that passed Hazard Level 2 classification for external structural parts (R7, 8 and 17) according to EN 45545-2.



## Access door systems (WP5)

WP5 addresses the search for new materials for access door systems (composites, metallic alloys, etc.) and their integration techniques ("one-shot" processes, welding & adhesive processes...) through innovative approaches, considering production costs, manufacturing aspects & railway constraints. Partners expertise from relevant industrial sectors (e.g aeronautical) is also being implemented in this WP, in order to integrate innovative materials and processes for the railway sector.

#### **WORK STREAM II: INTERIOR DESIGN**



## Innovative plug & play systems (WP6)

Work package plug & play presents a new and innovative technology structure, that allows for low voltage, seamless provision of energy, communication and sensory to act as a cost-effective offering to user and operator demands. Driven by consumer needs, this grid solution can be easily changed and upgraded. Based on printed electronic foiling that work as a final ply and the new coil connection, the energy tiles will generate a paradigm of interior space usage. Refit dynamics and behaviour zoning drive the various energy and sensory tile offerings.



## Innovative seats (WP7)

Work package super light seat system offers a radical change of seating technology structures and seating flexibility and much more, reducing seat weight by 60%. New structural and informal layout principles as well as new way of manufacturing and material application will be able to create this new standard. Reflecting consumer needs for comfort and privacy, the design solution and functional prototype developed within work stream 7, proves this in a sustainable, circular-economic, flexible and visually new manner.



## Innovative driver's desk (WP8)

With increasing grades of automation, the requirements for train drivers' desks are changing completely. After analysing the different industry stakeholder needs, Mat4Rail's WP8 focuses on proposing novel design concepts for cabin. Innovative technologies and a modular design are applied in order to enable new on-demand modes of driving and the application of visionary human-machine-interfaces, while offering passengers new perspectives.