

Making the railway system
work better for society.

ERJU System Pillar – Prerequisites from the perspective of the Agency

1. *Background*

The ambitions of Europe's Rail Joint Undertaking (ERJU) are to make the most environmentally friendly mode of transport, rail, more efficient and more customer-oriented through:

- *Europeanisation of the Railway System,*
- *Efficiency through organisational improvements, and*
- *Innovation.*

The proposal for the ERJU includes a novel element, the System Pillar which is intended to accelerate innovation uptake.

As network-wide innovation in a shared network such as the European railway system can only work through regulation, the System Pillar shall also significantly accelerate the development of those regulation, including:

- *the assessment of cost/benefits;*
- *the appropriate changes to operational procedures, and*
- *a well-conceived migration planning.*

In order to function properly, a number of prerequisites are necessary for the System Pillar, both regarding organisation and governance, and in terms of a reference framework for the architecture of the European railway system.

2. *The Relevance of a System Architecture Framework*

A System Architecture Framework is essential for both ERJU and the Agency. Such framework shall help to align the sector to focus the activities and to evaluate concrete achievements. In order to align with the ambition mentioned above, the system architecture framework shall support the concepts of:

- *Interoperability in space and time, and*
- *Economies of scale.*

In order to allow for the proper definition of the scope of the System Pillar, the System Architecture Framework should be established with priority and cover at least the functional aspect of railways as a socio-technical system.

3. *Definition of the European Railway System*

The European railway system is an open, shared, dynamic structure composed of assets that are fixed in space and mobile, whereby both types of assets are owned and managed by different actors. Geographic position, speed and operational conditions of mobile assets matter. Mobile assets have either local interaction with fixed assets, and/or through a wide-area communications network. Both types of assets can be connected to a control network for operations and maintenance.

The vision of the European railway system is:

- *Freedom of movement, i.e. no technical and operational boundaries for trains, standardisation (economies of scale), safety (including learning from information sharing) and resilience;*
- *Synchronised deployment, and*
- *No misalignment with the target*

4. Prerequisites

4.1. Starting point

As the European railway system already exists, the right balance needs to be found between the emerging architecture and a target architecture. The starting point needs to be set correctly in order to give the right direction for subsequent activities.

4.2. Consistency

The System Architecture Framework used by the System Pillar needs to be structurally and logically consistent.

The System Architecture Framework needs to reflect the structural reality that, currently, there is no single European railway system. However, the aspiration of technical and service integration into a seamless European rail system needs to be maintained and high-level interfaces need to be defined accordingly.

4.3. Consistency with European rail regulations

Consistency with the definitions in the Interoperability Directive, in particular the various Subsystems and Interoperability Constituents, need to be maintained. However, these definitions may evolve based on the results delivered by ERJU.

4.4. Specificities of rail

The System Architecture Framework needs to be fundamentally linked with the specificities of rail:

- *Low friction at the wheel-rail interface, leading to low energy consumption and the ability to carry high loads, but conversely to long braking distance, specific safety requirements*
- *Guided transport system, leading to the necessity to avoid derailment, either by too high speed or by moving switches under the running train, and to avoid collision*
 - *As per Appendix B1 of the TSI OPE, for safety reasons, a secured train path is required at three length scales: movement authority for a single train, route (in station) and train path (end-to-end)*
 - *The physical reality is relevant. The secured train path is the interface between the infrastructure and the train/vehicles.*

4.5. Layers of control

In the System Architecture Framework, appropriate layers of control need to be distinguished, i.e. at individual train level, at collective level and at network wide level with the necessity to also define lower-level interfaces.

4.6. *The time dimension*

The System Architecture Framework needs to appropriately consider the different scales of lifetime for the various types of assets in the railway system (bridges, rail vehicles, propulsion systems, passenger information systems, other) and consider the management of obsolescence.

4.7. *Complexity and transparency*

The railway system needs to operate safely, therefore, the System Architecture Framework needs to be transparent and avoid unnecessary complexity.

5. *Technical Decision Making*

The governance of the System Pillar needs to establish adequate technical decision making, aligned with the role of the Agency as System Authority.

To ensure efficient alignment between the System Pillar outputs and the inputs for the Agency's regulation drafting, TSIs, other EU rail regulations, an agreed and shared calendar planning is crucial.