Rail Baltica

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Rail Baltica Global Project
Corridor Synergies Study

Final Report

Executive Summary

11/04/2022

Co-financed by the Connecting Europe Facility of the European Union

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1 SCOPE OF THE RAIL BALTICA SYNERGIES STUDY

The objective of this study is to analyse and provide policy recommendations for the maximisation of the benefits for the Rail Baltica corridor from the "**Dig Once" perspective**, in order, to calibrate precisely the necessary infrastructural design elements, future functionalities, and related developments to assess and promote the potential future business cases for various services/offerings, as well as provide insights to national governments on opportunities to co-synchronise relevant infrastructure developments with the delivery of Rail Baltica. The study extensively draws on European and global best practice cases for the **maximisation of commercial and synergy opportunities in such a corridor**, as well as emerging opportunities stemming from innovation and digitalisation.

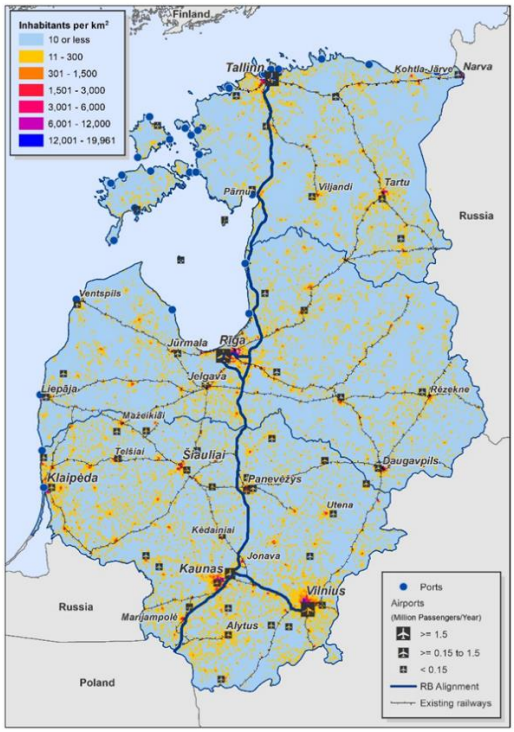
Rail Baltica is a greenfield rail transport infrastructure project with the goal to integrate the Baltic States in the European rail network. As part of the EU's North-Sea Baltic TEN-T corridor, Rail Baltica will eliminate the North-South railway axis' missing link, ensuring full integration of Estonia, Latvia and Lithuania into the Single European Railway Area (SERA). Apart of the railway connection between the three Baltic states, the project includes the connection with Poland as well as, indirectly, Finland.

However, Rail Baltica is not only about building a railway line. The infrastructure shall rather serve as an enabler for the emergence of a whole **new economic corridor**, that will provide a comfortable, safe and environmentally friendly alternative for passenger mobility and a modern multimodal logistics ecosystem, enhancing regional integration and connectivity, and prepare this part of the **TEN-T corridor infrastructure for dual-use** in view of improving both civilian and military mobility.

Furthermore, Rail Baltica, as an EU transport flagship project, has **innovation and digitalisation as its key strategic enablers**, **alongside with de-carbonisation and cross-border connectivity**. The Rail Baltica Global Project delivery is expected to act as a catalyst for sustainable economic development in the Baltic region, through a greenfield UIC-gauge, double-track, 25kV AC electrified, ERTMS-equipped, mixed-traffic railway line and related infrastructure which will enhance market accessibility and trade competitiveness.

Additionally, the study provides insights to national governments and EU on opportunities to **co-synchronise relevant infrastructure developments** with the delivery of Rail Baltica through a **single backbone perspective**, an efficient and competitive market cooperation and integration that can create added value promoting the potential future business cases for various services/offerings and improving the socio-economic benefits.

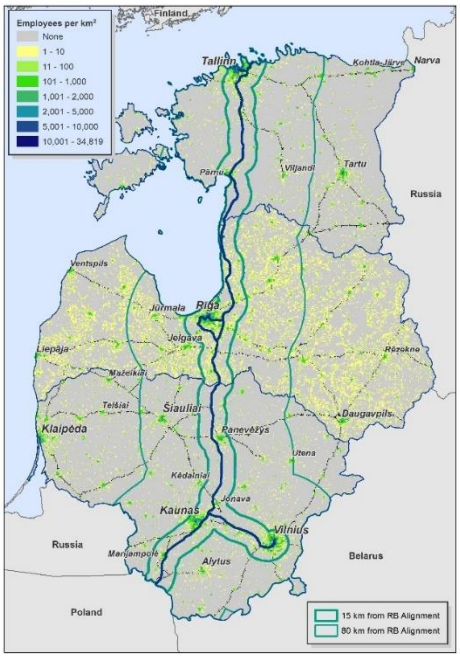
Figure 1: Transport Network (Airports and Railway) and Inhabitants per km² in the Rail Baltica Wider Economic Corridor



Source: Based on Rail Blatica alignment from Rail Baltica GIS.

It is also clear that strategic planning, together with **innovation and digitalisation**, can help maximise **long-term socio-economic benefits**, employability and, importantly, ensure their **broader and equitable distribution**.

Figure 2: Connectivity to Rail Baltica HSR from Employees' Workplaces in the Rail Baltica Wider Economic Corridor (15 km – 80 km)



Source: Rail Baltica Global Project Corridor Synergies Study (2021) based on Rail Baltica alignment from GIS

Figure 3: Rail Baltic NUTS3 vs. GDP per Inhabitant Percentage EU27 Average

Source: Rail Baltica Global Project Corridor Synergies Study (2021) based on Rail Baltica alignment from Rail Baltica Web GIS, GISCO – Eurostat and Eurogeographics data

2 EUROPEAN AND GLOBAL BEST PRACTICE AND OPPORTUNITIES

Synergies	Best Practices
Open Access Networks	The Rail Baltica Global Project ("RBGP") could set the general conditions for service providers to have access to dark fibre optic as well as 5G mobile infrastructure
Digital Infrastructure	• Deployment of 5G mobile networks • Deployment of fibre optic high-speed backbone networks • Smart Stations, deployment of communications and advanced services • Deployment of edge computing centres
Energy Infrastructure	• Installation of renewable energy generation sources • Utilisation of the energy subsystem to transfer electrical energy generated by the infrastructure manager(s) or third parties • Development of battery electrical vehicle charging infrastructure (BEV) • Development of fuel cell electrical vehicle (FCEV) infrastructure
Local Connections	Construction of railway branches in order to facilitate accessibility for relevant industrial, defence and/or logistics areas

3 SYNERGY COMPONENTS OF CEF AND OTHER DEVELOPMENT PROGRAMMES

The European Union is looking for synergies between the different Union funds with regard to amplifying the investments and their impact on competitiveness, jobs and growth in the EU, combining different forms of innovation and competitiveness support, or carrying innovative ideas further along the investment cycle or value chain to bring them to the market.

European infrastructure policy is supported by a dedicated funding tool, the Connecting Europe Facility (CEF) for transport, energy and digital infrastructures in order to achieve its targets of sustainability, cohesion and economic development for transport. CEF supports investments that enable the TEN-T objectives: a core network consisting of nine multimodal core network corridors completed by 2030, an extended core network with deadline in 2040 and a comprehensive network for the purpose of facilitating the accessibility of all European regions to be put in place by 2050.

Actions contributing simultaneously to the achievement of one or more CEF objectives shall be implemented through work programmes addressing at least two sectors. Therefore, the CEF allows, within each sector, the possibility to consider as eligible some synergetic elements pertaining to another sector, where such an approach improves the socio-economic benefits of the investment. Synergies between sectors will be incentivised through the award criteria for the selection of actions[1], as well as through increased co-financing[2].

Sector	Actions
Transport Sector	(i) contribute to the development of projects with common interest relating to efficient, interconnected and multimodal networks and infrastructure for smart, interoperable, sustainable, inclusive, accessible, safe and secure mobility in accordance with the objectives of Regulation (EU) No 1315/2013 (ii) adapt parts of the TEN-T for the dual use of the transport infrastructure with a view to improving both civilian and military mobility
Energy Sector	(i) contribute to the development of projects of common interest relating to further integration of an efficient and competitive internal energy market, interoperability of networks across borders and sectors, facilitating de-carbonisation of the economy, promoting energy efficiency and ensuring supply security (ii) facilitate cross-border cooperation in the area of energy, including renewable energy
Digital Sector	contribute to the development of projects with common interest regarding the deployment of and access to safe and secure very high-capacity networks, including 5G systems and to the increased resilience and capacity of digital backbone networks on Union territories by linking them to neighbouring territories, as well as to the digitalisation of transport and energy networks.

As mentioned previously, an important objective of the CEF is to deliver increased synergies and complementarity between the transport, energy and digital sectors, thus enhancing the effectiveness of Union actions and minimising the cost of implementation.

The development of Rail Baltica, as one of Europe's multimodal core network corridors, can help deliver connectivity and support a range of additional projects, aligned with EU initiatives and funding requirements, in order to co-synchronise relevant infrastructure developments with new business opportunities that can serve all Rail Baltica stakeholders, including the general population of the Baltic States.

[1] Art 14. 1.e of Regulation 2021/1153 of the European Parliament and of the Council

[2] Art 15. 5 of Regulation 2021/1153 of the European Parliament and of the Council

4 APPLICABILITY OF KEY RECOMMENDATIONS

In the framework of a greenfield project, such as Rail Baltica, systems can be designed with a modern approach, using more sustainable solutions, and other similar approaches to help reduce the lifecycle cost of the infrastructure and its operation, as well as strengthen the long-term business case.

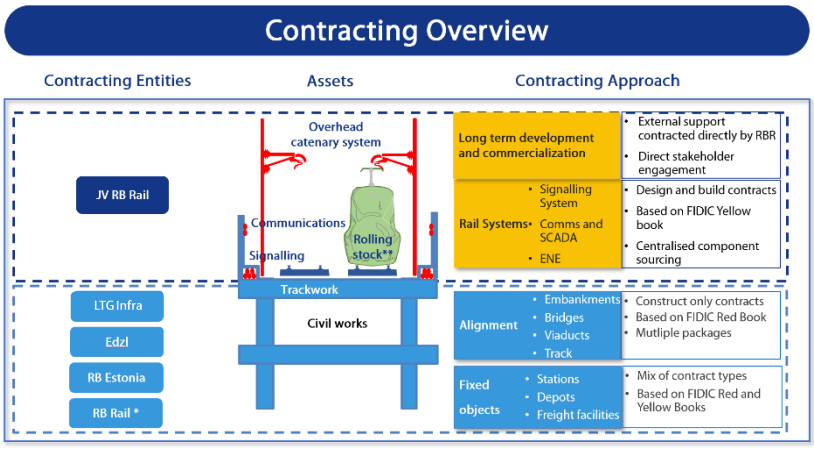
All new investment opportunities would have to take into account the transport infrastructure requirements regarding safety and security, as well as specific requirements or its possible connection to industrial and defence areas taking into account the previous Rail Baltica studies, spatial planning and preliminary designs and the local urban development plans, in order to establish a coordinated dialog between railway managers, local and regional authorities, investors, transport providers as well as users.

The Rail Baltica Global Project is an example for implementation of cross-border projects with a high degree of complexity regarding the planning, the contracting approach and the implementation. The integration is achieved by the establishment of RB Rail AS ("RBR"), a joint venture, with an interstate joint governance structure. This structure allocates competencies to RBR and national implementing bodies for the provision of construction works of Rail Baltica HSR assets (Figure 4: Provision of Construction Works of Rail Baltica HSR).

The implementation of these synergetic actions will involve complex work as it should address evolving standards in specific areas of railway activity which should involve the coordination and contribution of specialists from the Rail Baltica Global Project, coordinator and lead implementor (RBR, which is also an implementing body in key areas), and Rail Baltica Project national implementing bodies (Rail Baltic Estonia OU (Estonia), Eiropas Dzelzceļa līnijas SIA (Latvia), LTG Infra (Lithuania) and the final beneficiaries of the RBGP (the three Member States represented by the ministries responsible for transport: Estonia's Ministry of Economic Affairs and Communications, Latvia's Ministry of Transport and Lithuania's Ministry of Transport and Communications).

All construction is carried out by the implementing bodies is under the supervision of RB Rail and is based on common procurement principles, rules and contract templates.

Figure 4: Provision of Construction Works of Rail Baltica HSR Assets



Source: Rail Baltica Industry Day (2021)

Therefore, due to the governance bodies and integration procedures set up by the beneficiary states, there should in theory be the possibility to ensure a high level of integration of planning, design, procurement strategy and implementation of investments. The holistic vision is also expected to be projected onto the operation phase of the cross-border project. This foundation will allow funding and prioritisation of any of the synergetic elements proposed in RB Global Project Corridor Synergies Study (2022).

5 KEY RECOMMENDATIONS FOR RAIL BALTICA

The proposed areas that could be implemented without significant change in terms of impact on project timeline or CAPEX are:

1. Telecommunication wayleaves
2. Deployment of a cross-border 5G mobile network (Neutral Host approach)
3. Deployment of a cross-border fibre optic backbone transport network (Neutral Host approach)
4. Implementation of smart stations and installation of smart stations digital infrastructure and provision of smart services.
5. Deployment of edge computing infrastructure
6. Installation of renewable energy generation sources. PV modules and mini wind turbines
7. Utilisation of the energy subsystem (mainly traction substations) to transfer renewable electrical energy to the electrical grid
8. Development of battery electrical vehicle charging infrastructure (BEV)
9. Development of fuel cell electrical vehicle infrastructure (FCEV)
10. Construction of local connections in order to facilitate accessibility for relevant industrial, defence and/or logistics areas

The following tables sum up the future functionalities and related developments, assess the potential future business cases, as well as provide insights to national governments and European institutions on opportunities for co-synchronising relevant infrastructure developments with the delivery of Rail Baltica.

This study is based on current designs, guidelines and timelines and is to focus on areas which will not cause significant issues with respect to the Global Project timeline or existing designs.

Telecommunications Wayleaves

Synergy Scope

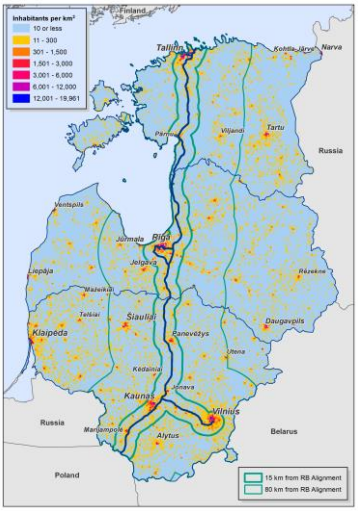
The railway operator, IM and/or RUs, is the one responsible for the asset where the railway is framed for conditions of reliability, availability, maintenance, safety and security and be the one who grant accessibility to third-party providers (such as telecom providers) for example via the bidding process of contract or lease agreement.

This would be consistent with European CEF Digital regulations which aims to guarantee open access, in which the consumers should benefit from a truly cross-border open network where competition is ensured.

The demand of the private sector is huge, and the railway operator should focus on extending the open communications networks, this can also be with the means of a commercial partner.

The demand of private sector and the railway operator should be focus on extending the open cross-border communications networks. This can also be with the means of a commercial partner to operate the communication part.

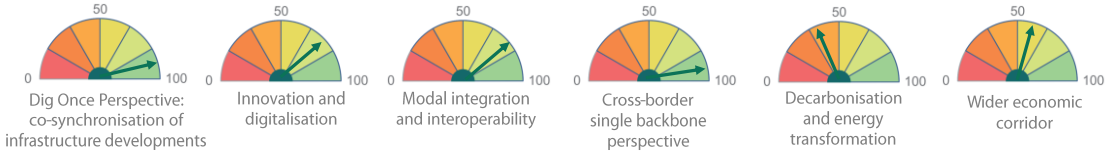
Rail Baltica as a Digital and Economic Corridor in Rural and Urban Areas



"Dig Once" benefits

In Europe the planning and development of railway cross-border networks usually is carried out by a ministerial body. Construction and maintenance are typically carried out by a designated infrastructure manager. New public railway lines generally need to be approved by parliaments as they are typically major investments that will have extensive influence on the entire transport network in a region. Policy-making and decision-making processes are usually very comprehensive and complex for new railway lines and often take very long.

Connectivity and access to digital services are a key element for invigorating the EU's rural and regional communities. This kind of investment has positive impacts on the telecommunications infrastructure and industry, through enabling the creation of a neutral telecommunications infrastructure operator at a cross-border wide level as well as the integration of the European fibre optic networks, improving the quality and performance of services.



EU Funding

CEF Transport ☒

CEF Digital ☒

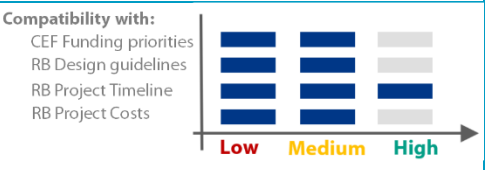
The synergic opportunity is fully aligned with EU funding objectives. Mainly because this 5G mobile technology requires a fixed network with many additional sites, especially antennas and microcells connected through fibre. CEF digital will fund connectivity projects of common EU interest and contribute to deploying gigabit and 5G networks across the EU.

A trans-European 5G network, deployed for providing high bandwidth digital mobile access services and helping to extend 5G, is aligned with EU funding objectives.

Article 8 and Article 9 of Regulation (EU) 2021/1153.

Compatible with Rail Baltica Work Program

It shall be noted that Rail Balitca Design Guidelines do not include concepts such as "rights of way", "wayleaves" or similar since these are not engineering matters but rather a regulatory and legal framework issue. One of the objectives of this action is to deliver increased synergies and complementarity enhancing the effectiveness of one or more policy actions at national level and minimising the cost of implementation improving the socio-economic benefits.



It is recommended to seek legal advice at national level before entering into any sort of agreement in this matter given the complexity and the long-term impact this may have. As a result, it is of utmost importance for all operators to know beforehand which are the applicable laws, which entity has jurisdiction to grant public rights of way and which entity is responsible for resolving disputes. In many countries, authorisation to use public lands may also be subject to legislation aiming at meeting other objectives, such as environmental protection or the preservation of historic sites etc.

Best Practices

Rail operator Iarnród Éireann, Ireland. "A number of telecom companies have approached rail operator Iarnród Éireann seeking to use its communications lines to develop their own networks. https://www.irishtimes.com/business/telcos-approach-irish-rail-over-network-development-1.1006746

ADIF's Railway Fibre Optic Open Access, Spain. ADIF is currently designing a new business model intending to manage its share of fibre optics. The intention is to take part in the promotion of 5G technology, like Reintel, and participate in the digitalisation of both urban and rural environments.

https://www.ree.es/en/press-office/news/press-release/2020/12/ADIF-av-and-reintel-renew-their-commitment-maintenance-and

Deployment of 5G Mobile cross-border Network (Neutral Host Approach)

Synergy Scope

Deployment of a 5G mobile network along the railway line providing advanced 5G services, installed and operated by a neutral host.

The 5G mobile network should support advanced high bandwidth 5G services, so it needs to be deployed at mid (2.1-2.6 GHz, 3.3-4.2 GHz) and high (e.g., 26 GHz and 40 GHz) spectrum bands.

Decision makers are national governments and the European institutions because it is a cross-border project, and an opportunity for co-synchronising relevant infrastructure developments with the delivery of Rail Baltica.

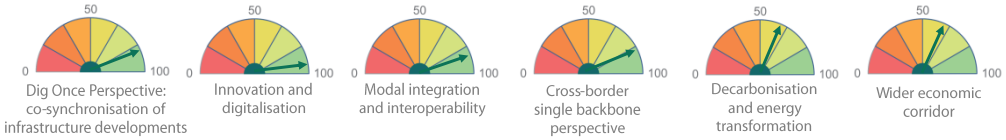
5G Site Supporting Smart Road Infrastructure

"Dig Once" Benefits

A 5G network installed along the railway line will contribute to the deployment of gigabit and 5G networks across the EU, as well as to enabling access to safe and secure very high-capacity digital networks and 5G systems.

The implementation of 5G advanced services included in performance and business applications, such as video on-demand, require rolling out a 5G network, providing mid and high spectrum radio coverage all along the corridor.

Potential stakeholders benefiting from the 5G cross-border network deployed and operated by the Neutral Host are at least the following entities are Municipalities and local governments in the proximity of the Baltic corridor. Mobile network operators, Administrators and operators of roads and highways in the proximity of the Baltic corridor, Industrial players, Logistic areas, Defence, nodes, technology parks, university campuses, ports, mining, construction sites, commercial areas, venues and other entities and the Rail Baltica railway administrator itself.



EU Funding

CEF Transport ☒

CEF digital will fund connectivity projects of common EU interest and contribute to deploying of gigabit and 5G networks across the EU.

CEF Digital ☒

A trans-European 5G network, deployed for providing high bandwidth digital mobile access services as well as helping to extend 5G, aligns with EU funding objectives.

Article 8 of Regulation (EU) 2021/1153 states projects of common interest in the area of digital connectivity infrastructure compatible with related deployment of 5G networks, high-capacity broadband backbone networks and digital infrastructure.

Article 9 of Regulation (EU) 2021/1153 indicates several eligible actions for CEF2 funding which would fit to related deployment 5G networks, high-capacity broadband backbone networks and digital infrastructure, as they are actions supporting the deployment of and access to very high-capacity networks, including 5G systems, capable of providing gigabit connectivity.

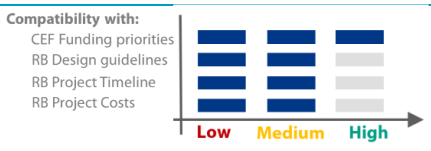
Section 2.3. of Commission Implementing Decision on the financing of the Connecting Europe Facility – Digital sector and the adoption of the multiannual work programme for 2021-2025 lists key topics targeting specific types of deployment projects which can be supported by CEF Digital, including:

- the deployment of and access to very high-capacity networks, including 5G systems, capable of providing Gigabit connectivity in areas where socioeconomic drivers are located
- uninterrupted coverage with 5G systems of all major transport paths, including the trans-European transport networks

Section 3.1.3. of *Commission Implementing Decision on the financing of the Connecting Europe Facility – Digital sector* mentions that "Funding of sharing models regarding both passive and active infrastructure is encouraged to increase the efficient use of funds provided under this programme. The sharing by network operators of passive, but also active equipment (e.g., through a neutral host model) should aim at substantially reducing network deployment costs and at the same time at facilitating the energy efficient use of resources when deploying and operating the 5G infrastructure."

Compatible with Rail Baltica Work Program

Design and installation of a 5G network along the railway line, installed and operated by a neutral host, does not impact directly on the railway operator´s mobile network (FRMCS) design.



Best Practices	**Haifa Nazareth LRT Project. Mobile Communication Network.** "*The mobile communication system for Haifa–Nazareth LRT Project consists of an LTE Advanced Pro network compliant to 3GPP Release 15 (supporting NSA-5G) including voice, data and video*". https://www.transisrael.co.il/ContentPage?id=97 **5GMED: Figueres – Perpignan Mediterranean Cross-Border Corridor.** *"Network infrastructure deployed by MNOs, neutral hosts, as well as road and rail operators, based on 5G and offering support for AI functions".* https://5g-ppp.eu/5gmed/ **Cellnex On Tower France Acting as a Neutral Host.** *"On Tower France offers co-location services, installing its own infrastructure and allowing for mobile carriers to install their telecommunications and wireless radio broadcast equipment".* https://www.cellnextelecom.com/on-tower-france/ **Cereixal Smart Tunnel.** *"5G Galicia (Spain) Pilot project promoted by the Ministry of Economic Affairs and Digital Transformation".* https://www.revistaitransporte.com/testing-of-smart-tunnel-and-assisted-driving-with-5g/ https://www.ineco.com/webineco/en/news/ineco-promotes-smart-roads-collaborating-deployment-5g-cereixal-tunnel **Spanish Railway Administrator (ADIF) Mobile Network Sharing Model.** *"Spanish Railway Administrator (ADIF) provides mobile network resources to MNOs through a Neutral Host model, building an independent and separated passive infrastructure to share by all the interested MNOs".* http://www.adifaltavelocidad.es/es_ES/infraestructuras/telecomunicaciones/telecomunicaciones.shtml

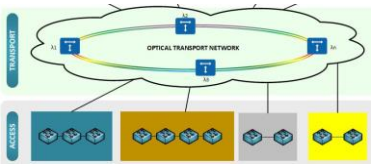
Deployment of a FO Backbone Transport cross-border Network (Neutral Host Approach)

Synergy Scope

Deployment of a fixed backbone transport network based on fibre optic technology along the railway line, providing broadband access and transport communication services, installed and operated by a neutral host.

Deployment of an optical transport network helps creating a managed optical backbone transport network along the Rail Baltica corridor suitable for other (non-rail) uses. This network could be used for offering communication networks and access services in areas along the line and in its proximity. Local connections with particular relevance in the field of dual use of infrastructure would be an independent network connecting all defence facilities along the corridor and in the field of solving market failures would be the deployment of FO connections to rural areas.

FO Transport Backbone Network Schematic Architecture

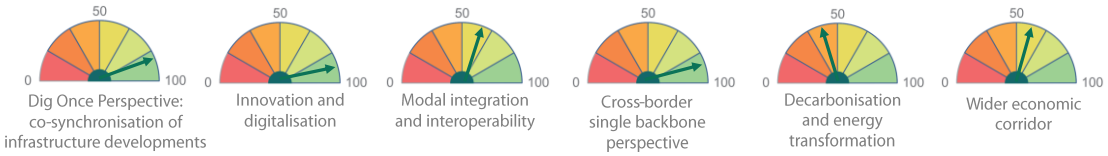


"Dig Once" Benefits

A backbone transport (in the telecommunications sense) network based on fibre optic technology installed along the railway line will contribute to the deploying of gigabit and 5G networks across the EU and to the deployment of access to safe and secure very high-capacity digital networks and 5G systems.

The introduction of modern fixed network technology will increase the railway communication backbone network capacity, releasing bandwidth and allowing to create synergies with telecommunication and internet providers.

A communication transport network operated by a neutral host for offering transmission services to other entities, contributes to the deployment of broadband access in rural and less populated areas.



EU Funding

CEF Transport ☒

CEF Digital ☒

CEF digital will fund connectivity projects of common EU interest and contribute to deploying gigabit and 5G networks across the EU.

A trans-European high-capacity communication transport network, deployed for providing digital data transport, is in line with EU funding objectives.

Article 8 of Regulation (EU) 2021/1153 states projects of common interest in the area of digital connectivity infrastructure which would fit to related deployment of 5G networks, high-capacity broadband backbone networks and digital infrastructure.

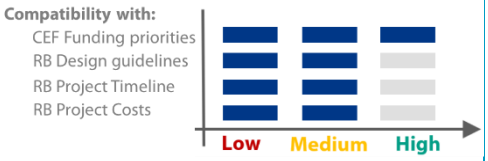
Article 9 of Regulation (EU) 2021/1153 indicates several eligible actions for CEF2 funding which would fit to related deployment 5G networks, high-capacity broadband backbone networks and digital infrastructure, as they are actions supporting the deployment of and access to very high-capacity networks, including 5G systems, capable of providing gigabit connectivity.

Section 2.3. of Commission *Implementing Decision on the financing of the Connecting Europe Facility – Digital sector and the* adoption *of the multiannual work programme for 2021-2025* lists key topics targeting specific types of deployment projects which can be supported by CEF Digital, including:

- Deployment of new or significant upgrade of existing backbone networks including submarine cables, within and between Member States and between the Union and third countries, to the extent to which they significantly contribute to the increased performance, resilience and very high capacity of the electronic communications networks.

Compatible with Rail Baltica Work Program

A fibre optic backbone transport network can be designed to be deployed as an independent project interconnected with separated optical resources, in order to avoid any impact on current network designs.



Best Practices

Haifa Nazareth LRT Project. FO Backbone Transport Network. *"The communication backbone network at Haifa Nazareth project provides a transmission medium for all voice, data and video traffic between all LRT System facilities".*

https://www.transisrael.co.il/ContentPage?id=97

Installation of Smart Station Infrastructure and Provision of Smart Services

Synergy Scope

The development of "Smart Station" digital infrastructure and digital services at the Rail Baltica Railway corridor stations, implementing the systems and technologies required for the provision of smart services, and increasing the digitalisation and connectivity of the corridor railway stations.

The digitalisation of the railway stations should consist of two main parts:

- Deployment of digital and telecommunication infrastructures consisting mainly of broadband backbone communication networks all over the railway station
- Implementation and provision of advanced digital services.

Smart Station Service

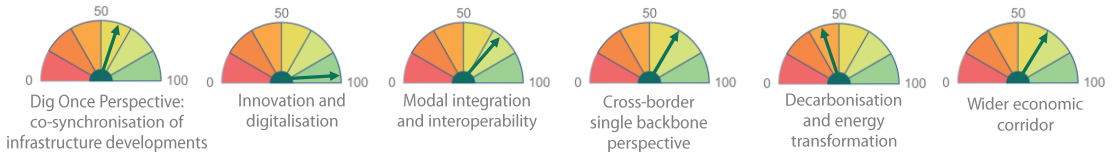
"Dig Once" Benefits

Smart stations, included in the Smart City strategy, contribute to the digitalisation of the society. Smart Stations foster the digitalisation of transport modes and cities.

The correct integration of the Smart Station with the Smart City strategy is key for optimising intermodal transportation.

Smart stations increase customer satisfaction and improve the rail customer experience (CX).

Smart stations allow the generation of additional revenues with provision of new high-value services, reducing the station's operation and maintenance cost. They should also be part of renewable energy potential and could have higher decarbonization rating.



EU Funding

CEF Transport ☒

CEF Digital ☒

CEF digital will fund connectivity projects of common EU interest and contribute to deploying gigabit and 5G networks across the EU. Smart stations, included in the Smart City strategy, contribute to the digitalisation of the society and aligns with EU funding objectives.

Article 8 of Regulation (EU) 2021/1153 states projects of common interest in the area of digital connectivity infrastructure which would fit to related deployment of 5G networks, high-capacity broadband backbone networks and digital infrastructure.

Article 9 of Regulation (EU) 2021/1153 indicates several eligible actions for CEF2 funding which would fit to related deployment 5G networks, high-capacity broadband backbone networks and digital infrastructure, as they are actions supporting the deployment of and access to very high-capacity networks, including 5G systems, capable of providing gigabit connectivity.

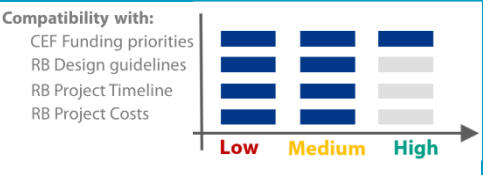
Section 2.3. of *Commission Implementing Decision on the financing of the Connecting Europe Facility – Digital sector and the adoption of the multiannual work programme for 2021-2025* lists key topics targeting specific types of deployment projects which can be supported by CEF Digital, including:

- The implementation of digital connectivity infrastructures related to cross-border projects in the areas of transport or energy and/or supporting operational digital platforms directly associated to transport or energy infrastructures.

Compatible with Rail Baltica Work Program

Deployment of the Smart Station infrastructure can be carried out simultaneously with station construction.

Costs in the deployment of Smart Station communication networks and services are high, but they are costs that will have to be mandatory addressed in the mid-term.



Best Practices

Maria Zambrano "Smart Station" Advanced Services. *"Implementation of new use cases based in 5G or fixed broadband access at the high-speed rail station Maria Zambrano (Málaga)".*

https://www.europapress.es/andalucia/malaga-00356/noticia-vodafone-concluye-casos-uso-5g-desplegados-estacion-maria-zambrano-malaga-20211020160253.html

Deployment of Edge Computing Infrastructure

Synergy Scope

The Deployment of edge computing infrastructure along the railway, offering edge computing services, operated by a Neutral Host which operates the edge data centre hardware or offers space for installing third-party data centres.

For the deployment of low latency 5G services, 5G networks have introduced edge computing data centres located at the same site as new radio Centralised Units (CU). The provision of low latency services will require service applications running on edge data centres instead of in the "cloud".

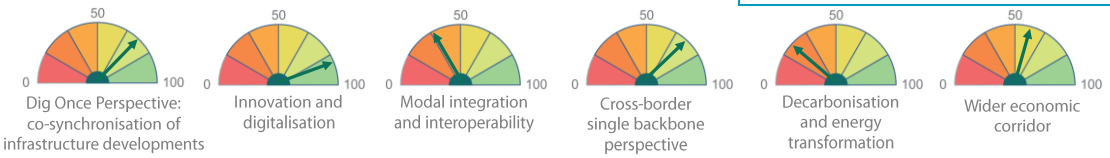
Deployment of Low Latency 5G Services and 5G Networks

"Dig Once" Benefits

Edge compute locations are necessary for the deployment of efficient 5G networks, as well as for contributing to the digitalisation of society. Edge computing infrastructure and 5G networks can be deployed simultaneously.

Edge computing enables the provision of new high-value services.

Edge computing centres shall support a 5G network interconnecting the Baltic states with a high-bandwidth network.



EU Funding

CEF Transport ☒

CEF Digital ☒

CEF digital will fund connectivity projects of common EU interest and contribute to deploying gigabit and 5G networks across the EU. Edge computer centres are necessary for the deployment of efficient 5G networks, contribute to the digitalisation of the society and are aligned with EU funding objectives.

Article 8 of Regulation (EU) 2021/1153 states projects of common interest in the area of digital connectivity infrastructure which would fit to related deployment of 5G networks, high-capacity broadband backbone networks and digital infrastructure.

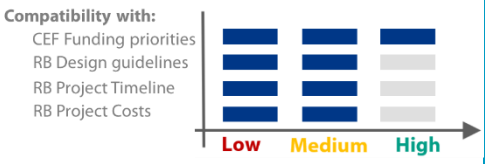
Article 9 of Regulation (EU) 2021/1153 indicates several eligible actions for CEF2 funding which would fit to related deployment 5G networks, high-capacity broadband backbone networks and digital infrastructure, as they are actions supporting the deployment of and access to very high-capacity networks, including 5G systems, capable of providing gigabit connectivity.

Section 2.3. of *Commission Implementing Decision on the financing of the Connecting Europe Facility – Digital sector and the adoption of the multiannual work programme for 2021-2025* lists key topics targeting specific types of deployment projects which can be supported by CEF Digital, including:

- The implementation of digital connectivity infrastructures related to cross-border projects in the areas of transport or energy and/or supporting operational digital platforms directly associated to transport or energy infrastructures.

Compatible with Rail Baltica Work Program

Edge computing centres are part of the 5G network and the design and installation of a 5G network along the railway line operated by a neutral host, does not impact directly on the railway mobile network design.



Best Practices

Cellnex France Edge data centres services. *Cellnex own and operate more than 180 data centres throughout the country to host all types of sensitive data and applications.*
https://cellnextelecom.fr/en/home-page/products-services/edge-datacenters/

American Tower Edge data centres solution. *American Tower Edge Data Centres offer edge data centre services in US.*
https://www.americantower.com/us/solutions/data-centers/edge/

Installation of Renewable Energy Generation Sources: PV Modules, Wind Turbines

Synergy Scope

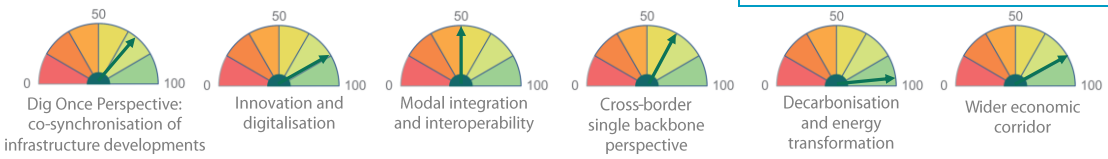
The objective is installing mini wind turbines and PV modules in Rail Baltica properties to generate electric energy to be consumed in non-traction power supply systems. The preferable option is self-consumption with selling the surplus (energy that cannot be consumed simultaneously in Rail Baltica's electrical installations) to electricity companies.

Mini Wind Turbine for Telecommunications

"Dig Once" Benefits

Installation of renewable energy generation sources such as PV modules and wind turbines along the Rail Baltica railway corridor match with Rail Baltica synergies priorities as follows:

- the impact on the timeline is low when considered from the beginning of the systems design phase and developed parallel to the rest of the works with the appropriate means
- the system is digitalised, so consumption data, purchased energy, surplus energy, etc. can be monitored remotely
- the grid becomes more meshed
- contribution to de-carbonisation of the railway environment
- reduction of the amount of energy that must be purchased from the grid
- the energy not consumed instantly is sold to the grid
- transport losses are avoided
- it is a proven and low-cost technology



EU Funding

CEF Transport ☒

CEF Energy ☒

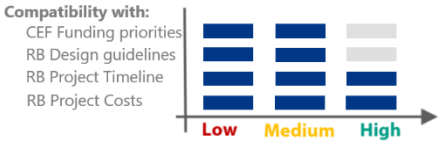
Article 3.2.b of the CEF

I. to contribute to the development of projects of common interest relating to further integration of an efficient and competitive internal energy market, interoperability of networks across borders and sectors, facilitating de-carbonisation of the economy, promoting energy efficiency and ensuring security of supply

II. to facilitate cross-border cooperation in the area of energy, including renewable energy

Compatible with Rail Baltica Work Program

The installation of small renewable energy generation plants only affects "Railway Energy. Part 3: Non-traction power supply". The current guideline includes the possibility of supplying energy generated by solar panels and mini wind turbines. If small renewable energy generation plants are considered in the systems design phase, their construction must be compatible with the expected timeline. It involves an additional cost but is compatible with CEF funding priorities and contributes to achieve the objectives of "Fit For 55".



The new points of renewable energy generation should be located close to the consumption's points, thus reducing the energy transport losses and achieving greater energy efficiency.

The most notable points in relation to this issue are:

- the equipment to build solar and wind plants (PV modules, mini wind turbines, inverters etc.) is a proven technology
- the CAPEX (Capital Expenditures), OPEX (Operational Expenditures) and LCC (Life Cycle Costs) of solar and wind plants are lower than other solutions of generating renewable energy
- the average useful life of the solar plants and mini wind turbines is 30 and 25 years respectively
- both kinds of plants are easy to design, build, operate and maintain
- the supply and commissioning of the equipment and installations of the solar and wind plants could be carried out by a lot of companies as it is a liberalised market

Best Practices

Small Renewable Energy Parks in Spanish Railway Administrator (ADIF) Properties. "Fight against climate change".

Belgium's Solar Tunnel. "An international milestone: It is connected to the rail infrastructure services and with the traction system"

Helsinki Station Solar Power Plant. "Renewable energy to maintain trains"

Mini Wind Turbines in ADIF Properties. "Using the energy of the wind"

Höflein Lower Austria Wind Power Plant to Produce Traction Power. "A future project"

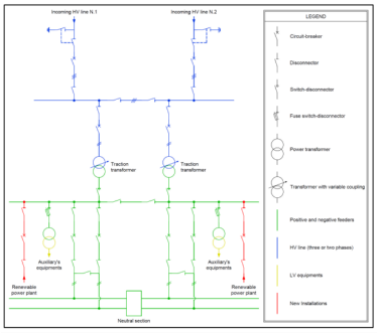
The Green Valley Lines in Wales. "A viability study about installing PV and wind plants to decarbonizes the Green Valley train lines"

Utilisation of the Energy Subsystem to Transfer Renewable Electrical Energy to the Electrical Grid

Synergy Scope

The aim is using the Rail Baltica electrical infrastructure connections to the electrical grid, mainly TSS, to transfer the energy generated by Rail Baltica or third parties in renewable power plants (generating e.g. solar, wind and hydraulic energy), located close to the Rail Baltica infrastructure to the electrical grid. It is preferable that the renewable power plant using the TSS belongs to Rail Baltica because the energy could be consumed in railway installations and any excess sold to DSO and TSO.

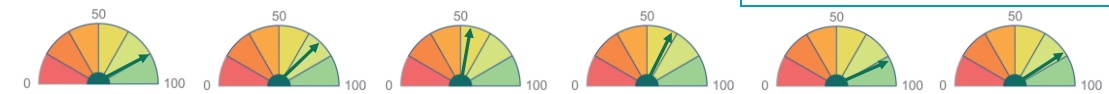
Layout of Connection to the 2x25 kV (Positive and Negative Feeders) Busbar



"Dig Once" Benefits

Utilisation of the energy subsystem to transfer renewable electrical energy to the electrical grid along the Rail Baltica railway corridor match with Rail Baltica Synergies priorities as follows:

- the necessary works to implement this synergy can be perfectly integrated with the rest of the project
- the installations will be completely digitalised, so all data can be monitored and managed remotely
- the grid becomes more meshed
- contribution to de-carbonisation of the railway environment
- economic benefits from renting the part of the TSS used to transfer the energy to the electrical grid if the renewable plants belong to third parties
- reduction of the energy purchases to the grid and the sale of surpluses if the renewable plant belongs to Rail Baltica
- improvement of the efficiency of the traction power supply system



EU Funding

CEF Transport ☒

CEF Energy ☒

Article 3.2.b of the CEF

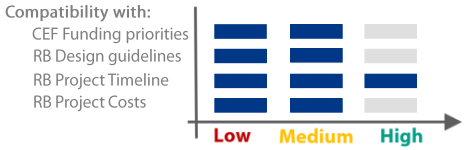
I. to contribute to the development of projects of common interest relating to further integration of an efficient and competitive internal energy market, interoperability of networks across borders and sectors, facilitating de-carbonisation of the economy, promoting energy efficiency and ensuring security of supply.

II. to facilitate cross-border cooperation in the area of energy, including renewable energy

Compatible with Rail Baltica Work Program

Some sections of the design guideline "Railway Energy. Part 1: Traction Power System" must be reviewed in order to include the new functionality of the TSS, which can work like a generator, not only as a consumer.

The biggest benefit of this synergy can be obtained if the renewable energy power plant belongs to Rail Baltica, as when the energy is generated in nearby plants. It can be consumed in the railway installations and the excess can be sold to the electrical companies (DSO and TSO). In this case, the business model should be based on maximising self-consumption of the energy produced, as well as the sale of surpluses to the market.



Best Practices

Dual Use of TSS. RENFE and ADIF. "Adaptation of the TSS to transfer the electricity produced in newly built PV plants belonging to the railway administrator".

Development of BEV Charging Infrastructure

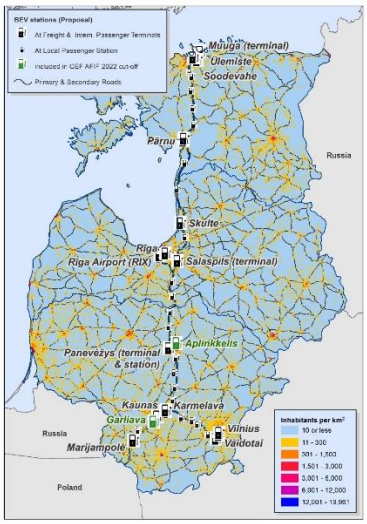
Synergy Scope

The synergy involves capturing the energy from the electric infrastructure to supply electric car chargers, in order to connect charging points throughout the three Baltic states with the objective of creating a BEV charging infrastructure.

There are different options to feed this charging point, the most viable are:

- feed from direct current or alternating current traction substations
- feed from transformation centres (substations MV/LV, medium voltage / low voltage) in stations

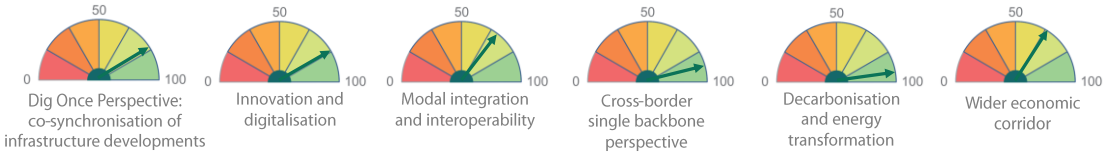
BEV Charging Infrastructure Proposal



"Dig Once" Benefits

This BEV charging infrastructure will promote electro-mobility meeting the de-carbonisation objectives of "Fit for 55" that requires EU Member States to ensure sufficient recharging stations for BEV. The European regulation also includes requirements such as that the maximum distance between charging stations should not exceed 60 km.

In addition, Rail Baltica will obtain additional incomes by renting out these charging points or by selling energy to recharge BEV from the energy purchased in high voltage at a lower price so benefits can be obtained.



EU Funding

CEF Transport ☒

CEF Energy ☒

The main sectors that contribute to the achievement of objectives of CEF are transport and energy.

Transport: Article 3.2.a of the CEF

I. to contribute to the development of projects of common interest relating to efficient, interconnected and multimodal networks and infrastructure for smart, interoperable, sustainable, inclusive, accessible, safe and secure mobility in accordance with the objectives of Regulation (EU) No 1315/2013.

Energy: Article 3.2.b of the CEF

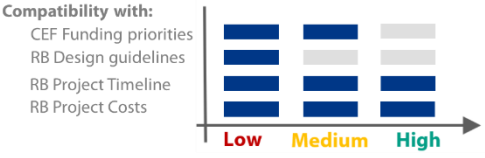
II. to contribute to the development of projects of common interest relating to further integration of an efficient and competitive internal energy market, interoperability of networks across borders and sectors, facilitating de-carbonisation of the economy, promoting energy efficiency and ensuring security of supply.

III. to facilitate cross-border cooperation in the area of energy, including renewable energy.

Support from CEF Transport through the Alternative Fuels Infrastructure Facility (AFIF)

Compatible with Rail Baltica Work Program

Railway Energy. Part 1: Traction Power System and Railway Energy: Part 3: Non-traction Power Supply. Both guidelines do not include supplying power to BEV chargers, since those are high demanding power consumers they should be included.



Considering the construction in the design phase, it is possible to minimise the impact on the project´s timeline.

BEV chargers are high demanding power consumers and therefore the traction and non-traction power supply systems should be dimensioned to transport the necessary power for this equipment from the design stages. There is no universal solution to feed BEV chargers, therefore several proposals must be analysed in the design. Electric car chargers could be fed from:

- non-traction power supply system: installations such as medium voltage cable lines and MV/LV substations installed along the tracks
- traction power supply system: installations such as traction substations and autotransformer centres

Best Practices

ADIF BEV Charging Infrastructure. "*Installation of 400 charging points in stations*"

Development of FCEV Infrastructure

Synergy Scope

The synergy consists in the deployment of a significant part of the fuel cell vehicle infrastructure network of the three Rail Baltic countries taking advantage of the "Dig Once" perspective of the Rail Baltica Global Project. This network infrastructure is one of the main new requirements that will enter into effect with the amendment of DIRECTIVE 2014/94/EU on the deployment of alternative fuels infrastructure stating that Member States shall ensure that, in their territory, a minimum number of publicly accessible hydrogen refuelling stations to be put in place by 31 December 2030.

The proposal currently under negotiation requires that Member States shall ensure that accessible hydrogen refuelling stations with a minimum capacity of 2 t/day and equipped with at least a 700 bars dispenser are deployed within a maximum distance of 150 km between them along the TEN-T core and the TEN-T comprehensive network.

The boundaries of our synergy implementation scope are the one defined for the rail corridor. Although, for the purposes of framing actions in the regional context and in the resolution of policies such as fit 5050 maps have been developed that cover the road environment and locations outside the rail corridor.

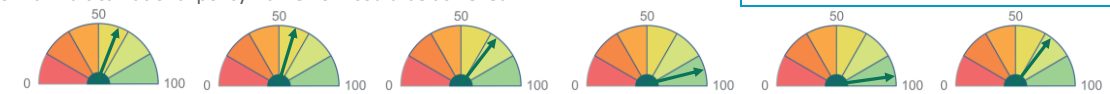
Members states shall ensure that by 31 December 2030 at least one publicly accessible hydrogen refuelling station is deployed in each urban node. An analysis on the best location shall be carried out for such refuelling stations that shall particularly consider the deployment of such stations in multimodal hubs where also other transport modes could be supplied.

The transport of hydrogen by rail as compressed gas in multi-element gas containers (MEGCs) can be presented as a new specialised infrastructure for the transport of green hydrogen in large quantities and for the deployment of hydrogen mobility (a virtual pipeline, as cited by some road transport market players).

Hypothetical FCEV Charging Infrastructure Proposal

"Dig Once" Benefits

The achievement of the "Fit for 55" goals and the European Green Deal is a clear way to boost intermodal national, regional and local mobility, including improved access to TEN-T and cross-border mobility, for hydrogen vehicles in rural and urban areas of the Rail Baltica economic corridor. With this approach the following goals of Rail Baltica national policy framework could be achieved:



Dig Once Perspective: co-synchronisation of infrastructure developments

Innovation and digitalisation

Modal integration and interoperability

Cross-border single backbone perspective

Decarbonisation and energy transformation

Wider economic corridor

EU Funding

CEF Transport ☒

CEF Energy ☒

The article 3.1 of Regulation (EU) 2021/1153 establishes that the Connecting Europe Facility emphasis on facilitating the synergies among the transport, energy and digital sector.

The Article 7.3 of CEF states that studies that aim to develop and identify cross-border projects in the field of renewable energy shall be eligible for funding.

Art 7.4 highlights that cross-border projects in the field of renewable energy are eligible for Union funding if they meet the following additional criteria:

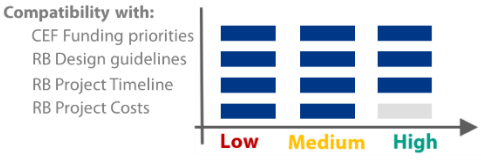
Transport

Article 3.c of Regulation (EU) 2021/1058 on the European Regional Development Fund and the Cohesion Fund propose a more connected Europe by enhancing mobility (PO 3) by developing and enhancing sustainable, climate resilient, intelligent, intermodal, national, regional and local mobility, including improved access to TEN-T and cross-border mobility.

Compatible with Rail Baltica Work Program

At present, the design guidelines do not incorporate aspects related to this system.

When considered from the delivery phase, its implementation with the rest of the infrastructure is simpler and does not imply any change in the timeline.



Best Practices	**Transport of Hydrogen as a Compressed Gas in Multiple-Element Gas Containers (MEGC).** https://blog.lea-hessen.de/wp-content/uploads/2020/08/Potenzialbeschreibung-Wasserstofftransport-%C3%BCber-das-Schienennetz.pdf **Fuel Cell Buses for Aberdeen, Scotland**. Aberdeen City Council has implemented Europe's largest fleet of hydrogen fuel cell buseshttps://www.ballard.com/docs/default-source/motive-modules-documents/aberdeen-bus-case-study-website.pdf?sfvrsn=6151c280_8 **FCEV Powered Trains: Coradia iLint Hydrogen Fuel Cell Powered Train,** Alstom. Fuel cell trains can play a key role in the transition to a zero-emission economy where electrification is not justified. With careful design there can also be synergies with these refuelling facilities and the distribution of hydrogen to such locations.

Local Connections for Industrial Areas

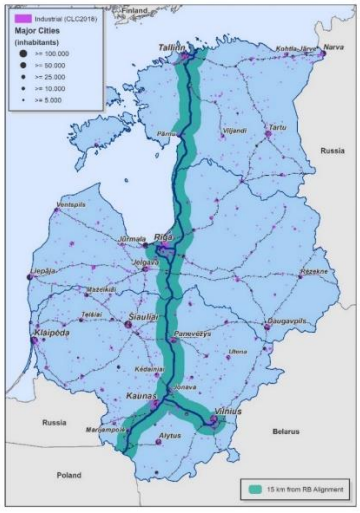
Synergy Scope

Construction of dedicated railway branches in order to provide accessibility for relevant private industrial or logistics areas.

- Construction of railway branches to connect freight hubs with the Rail Baltica network
- Improvement of existing privately owned rail sidings, or construction of new ones, as well as their adaptation to the standard gauge.
- Accessibility to military nodes and facilities.
- The usage of gauge changing facilities and innovative freight wagons would be an opportunity to extend the range of Rail Baltica to railway sidings.

Connection of relevant industrial nodes close to Rail Baltica alignment would strengthen intermodal transport, as well as other freight transportable by rail, such as bulk freight.

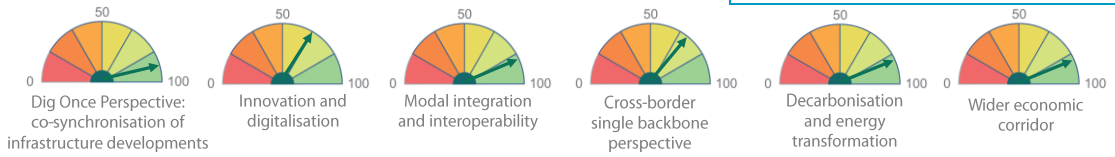
Location of Industrial Areas in Proximity of the Rail Baltica Network



"Dig Once" Benefits

Railway branches with relevant freight hubs would enhance new commercial opportunities related to both, the domestic and international market. The new infrastructure could provide an alternative way of freight transport, transferring part of the goods moved by road transport to rail transport.

- Synergies with private companies improving the logistic supply chain
- New rail branches to industries will contribute to the deployment of 5G network and boost the eligibility of Rail Baltica projects applying for CEF funds
- Increase of rail freight traffic in Rail Baltica project
- External costs saving from modal shift from road to rail
- Higher safety of freight transport
- Railway branches to military bases would allow military mobility



EU Funding

CEF Transport ☒

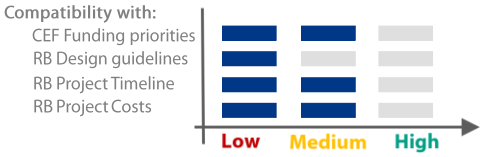
Article 9 of Regulation (EU) 2021/1153 indicates several eligible actions for CEF2 funding in the period 2021-2027 concerning railway branches and industrial sidings, such us actions relating to efficient, interconnected, interoperable and multimodal networks for the development of railway infrastructure, actions supporting sustainable freight transport services or actions promoting an increase in freight traffic.

The EU funding promotes the modal shift to rail, which is aligned with the construction of railway branches connecting industrial sidings or logistic/military areas to the Rail Baltica network.

Compatible with Rail Baltica Work Program

The design of railway branches from the Rail Baltica network to industrial or logistic areas should follow the existing Rail Baltica Design Guidelines and the Rail Baltica Operational Plan, although some specific recomendations to be applied, should preferable be gathered in a dedicated guideline.

- Maximum length of railway branches from industrial areas to Rail Baltica alignment: 15km
- Minimum freight traffic: 5 trains/week (each way)



- Design of industrial siding: Minimum number of loading/unloading tracks: 2; Length of tracks: 1050 m (minimum of 750 m), Electrification of access to the siding

In the case of existing industrial sidings or terminals that are currently connected to the conventional rail network (1520 mm) and considered relevant for the Rail Baltica project, specific rail branches can be designed and built for connecting them to the RB infrastructure (1435 mm), implementing a gauge changeover installation in this new branch in order not to interfere with traffic in both networks.

Another possible solution for railway connections to industrial nodes with an existing access to 1520 mm rail network and with a significant volume of traffic between this node and a specific destination in standard gauge (through Rail Baltica network) would be to establish a rolling highway (piggyback rail services) between these two points, including an interchange terminal between both networks where trucks (or semi-trailers using a tractor unit) could transfer from one railway platform to another in an efficient way. This way standardised processes / procedures can be put in place for truck drivers / fleet operators and automated tractor tugs could carry out transhipment between 1520 & 1435 rail networks, although specific investments and technical requirements should be considered as analysed in the "Piggyback Transportation Services and Related Areas" study.

As for military transport, operational conditions related to exceptional oversized rail services should apply, with special facilities for loading of military vehicles and a respectively aligned layout of the track systems, taking into account aspects of confidentiality indicated in Rail Baltica Operational Plan.

Rail Baltica should undertake a dedicated survey of options for industrial connections, resulting in concrete list of recommendations for implementation and also principles / guidance for assessing such connections in the future.

Best practices

Europe - National strategies for the promotion of rail freight and combined transport:

- Germany: *https://www.bmvi.de/SharedDocs/EN/publications/rail-freight-masterplan.html*
- France: *https://www.ecologie.gouv.fr/sites/default/files/210909_Strategie_developpement_fret_ferroviaire.pdf*
- Spain: *https://www.mitma.gob.es/ferrocarriles/mercancias-30*

US Railroad Companies - UPRR, BNSF and CSX have dedicated sections on their websites, including documents describing the processes, defining the rules which apply to any private rail section: UPRR: *https://www.up.com/customers/ind-dev/index.htm* ; BNSF: https://www.bnsf.com/ship-with-bnsf/rail-development/build-rail-served-facility/