EU Strategy for the Adriatic and Ionian Region
EUSAIR

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European Regional Development Fund - Instrument for Pre-Accession II Fund
EUSAIR FACILITY POINT

EUSAIR Transport MasterPlan

Feasibility Study

Corridor VIII completion

Contents

Introduction

In this section is represented an overview of the project interventions and missing links concerning EUSAIR Countries involved in Pan-European railway Corridor VIII. The purpose of the document is to analyze the potential impact that this strategic transport infrastructure projects could generate and how it is integrated in the strategic framework of different action plans. After having systematically presented the context and the characteristics of Corridor VIII, the priority projects which insist on it are analyzed. The evaluation of the impact of the selected planned interventions on the area and the related cost-benefit analysis are presented here.

1 Reference context

The Pan European Corridors were designed to provide physical continuity between the TEN-T Trans-European Networks and the Eastbound axis on which transport demand has built up in the course of history and will potentially grow in the future.[1]

Corridor VIII is one of the ten Pan-European Corridors identified and defined in the Pan-European Conferences on Transportation held in Prague (1991), Crete (1994) and Helsinki (1997). It represents the main East-West axis connecting the South part of the Mediterranean basin to the South-eastern Balkans, as well as to the regions of the Caucasus.

Figure 1 Map of the ten Pan-European transport corridors. [Source: Wikipedia.org]

[1] Source: "Where does TEN-T Corridor VIII Stand?", Interreg-IPA CBC,2021. https://www.italy-albania-montenegro.eu/sites/default/files/inline-files/Position%20paper_Corridor%208_compressed.pdf

As concern Adriatic-Ionian Region, Corridor VIII has a length of about 601 kilometers of which 357 in Albania and 244 in North Macedonia. It represents a hinterland East-West connection between the Ionian and the Black Seas. The route of Corridor VIII runs through the Countries of Albania, North Macedonia and Bulgaria, connecting the following main cities: Bari/Brindisi - Durrës/Vlore (Adriatic Sea) - Tiranë – Skopje - Sofia - Plovdiv - Burgas - Varna (Black Sea).

The eastern part of Corridor VIII from Skopje to the Black Sea is part of the indicative extension of the TEN-T Core Network, while the western part from Skopje to the Ionian Sea is part of the Comprehensive Network.[2]

Railway Corridor VIII is only partly complete. At present there is a single-track line in Albania, also in parts of North Macedonia. The line from Durres to Lin is already in existence in Albania, although upgrading will be needed. From Lin to Kičevo (66 km) new construction will be required, and reconstruction of section from Skopje to Kičevo (103km) in North Macedonia. Implementation of this project will start following significant progress on the eastern part of Corridor VIII.

Therefore, the construction of new railway lines on this corridor, mainly in North Macedonia, is crucial, together with modernization of part of the existing railway lines which are in bad shape, especially in Albania.

Following an overview of regional plans for network development, and of Transport Project Based on Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans, active planning on the corridor, selected in the Master Plan, is presented.

[2] Source: "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022. https://www.transport-community.org/wp-content/uploads/2022/09/Five-Year-Rolling-Work-Plan-for-Development-of-Indicative-TEN-T-Extension-of-the-Comprehensive-and-Core-Network-in-Western-Balkans.pdf

Figure 2 Pan-European Corridor VIII, main nodes connected. [Source: CAREC 2020 Preparatory Senior Officials' Meeting, Baku, Nov. 22, 2011. https://www.carecprogram.org/uploads/Pan-European-Corridor-VIII.pdf]

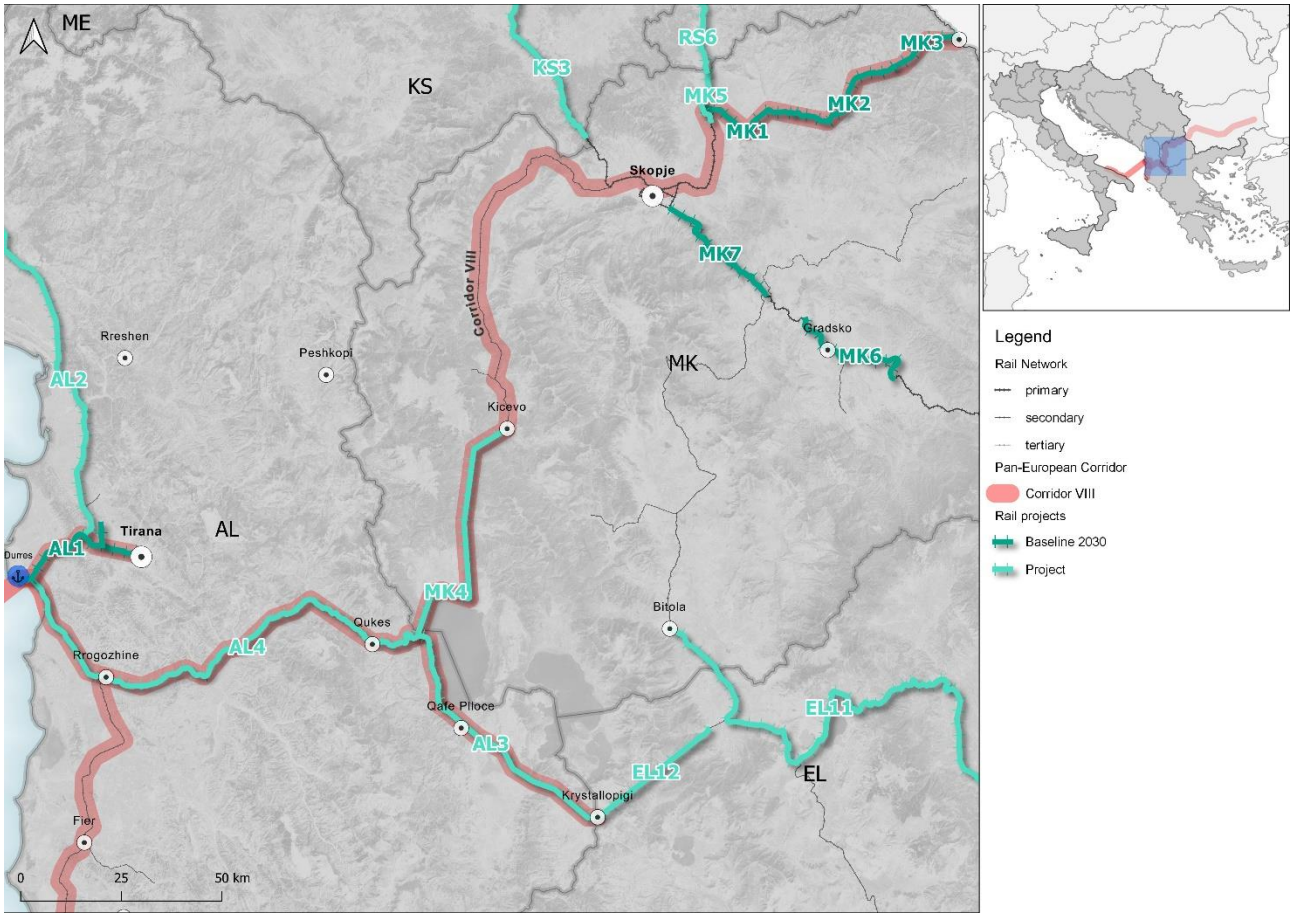

Figure 3 Active planning on Corridor VIII in EUSAIR Countries

Table 1 List of rail interventions on Corridor VIII from EUSAIR Masterplan database

ID	Object	Level	Country	Project	Mode	Node	Scenario
AL3	New construction	Planned	Albania	Construction of a new railway line Pogradec - Korçë border to Greece (Krystallopigi)	Rail	(Rail C VIII)	Project
AL4	New construction	Planned	Albania	Rehabilitation of Durrës - Pogradec - Lin railway line and construction for a new railway line Lin - border to North Macedonia (part of rail Corridor VIII)	Rail	(Rail C VIII)	Project
MK1	New construction	Under construction	North Macedonia	Construction of a new railway section Kumanovo - Beljakovce (30.8 km) of the rail Corridor VIII (Orient/East-Med Corridor) Kumanovo - Deve Bair	Rail	Orient/East-Med Corridor (Corridor VIII)	Baseline 2030
MK2	New construction	Planned and financed	North Macedonia	Construction of a new railway section Beljakovce - Kriva Palanka (34 km) of the rail Corridor VIII (Orient/East-Med Corridor) Kumanovo - Deve Bair	Rail	Orient/East-Med Corridor (Corridor VIII)	Baseline 2030
MK3	New construction	Planned and financed	North Macedonia	Orient/East-Med Corridor: Construction of Rail Corridor VIII, Kriva Palanka to the border with Republic of Bulgaria	Rail	Orient/East-Med Corridor (Corridor VIII)	Baseline 2030
MK4	New construction	Planned	North Macedonia	Orient/East-Med Corridor: Construction of Rail Corridor VIII, Kicevo to the border with Albania	Rail	Orient/East-Med Corridor (Corridor VIII)	Project

According to EUSAIR Transport Masterplan database, on Pan-European Corridor VIII insist 7 interventions located in Albania and North Macedonia. Below is an overview of the interventions based on document: "Overview of Transport Project Based on Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans".

Permanent Secretariat of Transport Community divide projects into three categories:

- On-going projects – projects with funding ensured and for which construction is either ongoing or under tendering or preparation.
- Priority projects eligible for funding – mature projects for which a comprehensive evaluation is available based on a completed feasibility study, and if available, a full set of project documentation, in accordance with EU procedures for Programming and Procurement Rules.
- Priority projects for preparation – non-mature projects which require full project preparation and evaluation to determine their feasibility. These projects are not ready for implementation, but funding is required to carry out preparatory work.

As concern mature projects, the Transport Community document (see Table 2) provides the list of all the priority projects preidentified by the regional partners in their planning and considered strategically relevant with reference to the extension of the TEN-T network, including them in the proposed flagship objectives. More technical details are also provided in Table 3.

Table 2 List of pre-identified Flagship transport projects. [Source: Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans]

Flagship	Sector	Project	EIP 2027 milestones
Flagship 1 - Connecting East to West	Road	Nis – Prishtina "Peace Highway"	Prishtina – Medare (Kosovo section): completed Nis – Merdare (Serbia section): substantially advanced
	Railway	Railway Corridor X modernization	Nis Railway bypass: completed Belgrade Main Railway Station: completed Belgrade – Sid (HR border): substantially advanced Nis – Presevo: substantially advanced Joint Railway Border Crossing Station Tabanovce: completed
		Railway Corridor VIII modernization	Skopje – Bulgarian Border: substantially advanced
	Inland Waterways	Improving navigation conditions on Danube and Sava rivers	Demining of the Sava river: advanced Addressing bottlenecks on the Danube river: in preparation/advanced
Flagship 2 - Connecting North to South	Road	Corridor Vc Motorway	75% of the Corridor completed at motorway standards
		Belgrade – Boljare – Bar Motorway	Podgorica bypass: substantially advanced
		Sarajevo – Podgorica connection	Enhanced
	Railway	Railway Route 4 Belgrade – Podgorica – Bar	Serbian border – Port of Bar: fully rehabilitated
		Railway Corridor Vc Ploce – Samac	Upgraded/ substantially advanced
		Railway Route 10 Prishtina – Kraljevo – Stalac	Pristina – Mitrovica: construction works Serbian side: preparation of the technical documentation
Flagship – 3 Connecting the Coastal Regions	Road	The "Blue Highway"	Tirana bypass: completed Two road sections in Albania and Budva bypass in Montenegro: substantially advanced
	Railway	Railway Route 2 (Podgorica – Tirana – Durres)	Vora - Hani Hotit: construction works Tirana – Durres - completed Podgorica - Tuzi - Cross Border Albania: preparation of the technical documentation

Table 3 Annex I, Flagship project[3]

Project 3: Modernisation of the Rail Corridor VIII					
Regional Partner: North Macedonia					
Section: Skopje – Deve Bair (Bulgarian border)					
Project description	Technical maturity	Current stage	Actions needed	Key milestones	
				2023	2026
The project on the eastern part of Rail Corridor VIII involves three Sections: - Section I (Rehabilitation of 30.8 km of the Kumanovo – Beljakovce section) with an estimated cost of EUR 48.9 million - Section II (Rehabilitation and new construction of the 34 km Beljakovce – Kriva Palanka section) with an estimated cost of EUR 145 million - Section III (New Construction of the 24 km Kriva Palanka – Bulgarian Border section) with an estimated cost of EUR 420 million	The tender procedure for construction works is at an advanced stage for Section I and II. Detail design is prepared for Section III.	The expected deadline for completion of the tender procedure for Section I and II is April 2022. Following this, construction works could start by May 2022. The deadline for the completion of the works on the first two Sections is 2026. The estimated deadline for completion of the third Section is 48 months after commencement, i.e. 2030.	Speed up the procedure for engaging a construction company once the tender procedure is closed, for first two Sections. The Tender procedure for selection of the Contractor and Supervision Engineer to start as soon as possible for Section III.	- For Section I and II: Construction works ongoing - For Section III: Financing fully secured and Contract with selected Construction companies and Supervision Engineer concluded.	Works completed on Section I and II, and construction in advanced stage for Section III.

As concern rail Corridor VIII, his modernisation is part of "Flagship 1: Connecting East to West", and milestone project identified is on railway section Skopje - Deve Bair (Bulgarian border). Information required are therefore related to previously seen Baseline 2030 interventions with IDs: MK1, MK2, MK3.

Focusing now on planned project belonging to the Project Scenario, which include not financed interventions, in-depth research was carried out among the investments considered as a priority in the document: "Overview of Transport Project Based on Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans". Priority planned project that insist on Corridor VIII are presented in following table, with details on location and cost.

[3] Source: https://www.transport-community.org/wp-content/uploads/2022/09/Five-Year-Rolling-Work-Plan-for-Development-of-Indicative-TEN-T-Extension-of-the-Comprehensive-and-Core-Network-in-Western-Balkans.pdf

Table 4 Priority planned railway projects on corridor VIII.

ID	Corridor/Node	TEN-T Network	Country	Project name	Mode	Project cost (M €)[4]	Scenario
MK4	Corridor VIII	Comprehensive	North Macedonia	Orient/East-Med Corridor: Construction of Rail Corridor VIII, Kicevo to the border with Albania	Rail	426	Project
AL3	Corridor VIII	Comprehensive	Albania	Construction of a new railway line Pogradec - Korçë border to Greece (Krystallopigi)	Rail	240	Project
AL4	Corridor VIII	Comprehensive	Albania	Rehabilitation of Durrës - Pogradec - Lin railway line and construction for a new railway line Lin - border to North Macedonia (part of rail Corridor VIII)	Rail	78+220	Project

Based on the project progress, interventions MK4 and part of AL4 (rehabilitation of section between Durres and Rrogozhine) are considered by Transport Community as mature, while AL3 and the remained part of AL4 are considered non-mature.

Mature projects are described in the Five-year Work Plan with separate project fiches shown in following Figure 4, no in-depth analysis is dedicated instead to non-mature projects.

[4] Economic and investment plan for western Balkans presented on TEN-T project in "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022.

Regional Partner:

Albania
North Macedonia

Double track sections

0 % or 0 km

Includes green and digital elements:

Electrification
ERTMS
ETCS Level 1

Overview of priority project on Railway Corridor VIII

Priority Project Name	Construction works on the Kicevo – Albanian Border railway section along Corridor VIII		
Regional Partner North Macedonia	Length (km) 62	Estimated cost (M€) 426	Type of works New Construction
Core Network segment No	Strategic Projects National strategies, Single Project Pipeline		Technical status Detailed Design
Project Description	The objective of this project is to build a railway line from Kicevo to the border with the Republic of Albania. Construction of the line together with other missing sections of Corridor VIII would provide the population and national economy with cheaper and faster transportation. Connecting the Republic of North Macedonia with neighbouring countries by rail would contribute to economic development and strengthen economic and trade activities in the country and the region. The new link will improve the life and economic status of the local population, particularly in the areas served by railway stations It would also contribute to regional development in general (western Macedonia). Additionally, the line will connect the Republic of Macedonia with the Republic of Albania, providing way access to the Adriatic ports of Durres and Vlore. This is of great importance for North Macedonia, a landlocked country.		
Expected Benefits	o Would form part of the transnational route connecting the Mediterranean/Adriatic Transport Area with the Black Sea Transport Area; o Facilitation and boosting of trade exchanges between Bulgaria, North Macedonia and Albania; o Improvement of rail passenger services along the project section and to/from destinations such as Tirana, Skopje, and Bulgaria. EIRR: 6.67%		

Priority Project Name	Corridor VIII Railway Albania: Reconstruction of Durres to Rrogozhine		
Regional Partner Albania	Length (km) 34	Estimated cost (M€) 78	Type of works Upgrade/Reconstruction
Core Network segment No	Strategic Projects National strategies, Single Project Pipeline, EC Economic and Investment Plan (indirectly Flagship 3 as continuation of Podgorica-Tirana-Durres line)		Technical status Detailed Design
Project Description	The overall objective of the project is to contribute to the upgrade of the TEN-T railway network in Albania, which will result in improved transport connectivity, increased railway traffic (and decrease of road traffic), thus contributing to railway modal shift, reduction of environmental impact, strengthening of green economy, reduction of rail and road accident rates.		
Expected Benefits	The completion of Corridor VIII on the Albanian side. The project will establish for the first time a direct railway connection between Rrogozhina, Lekaj, Kavaja, and Golem to Tirana, via connection to the new Durres-Tirana line which is contracted for construction. Conversely, the inhabitants of Tirana would for the first time be able to access the very pretty and developed coastal area of Albania between Durres, Golem and Kavaja by train, without changing mode of transport. This is expected significantly to change current transport patterns between the most populous city of Albania and its most important tourist destination. EIRR: 9.2%		

Figure 4 Annex II – Railway priority project fiches[5]

1.1 Analysis of the connection gap in the area of interest

The importance of the intervention is highlighted by the connectivity analysis carried out thanks to the use of the multimodal model developed for the transport analyzes of the master plan.

Rail Interconnectivity Indexes are particularly low in Western Balkans, due to the poor conditions of the rail infrastructure and presence of areas not linked to the rail network.

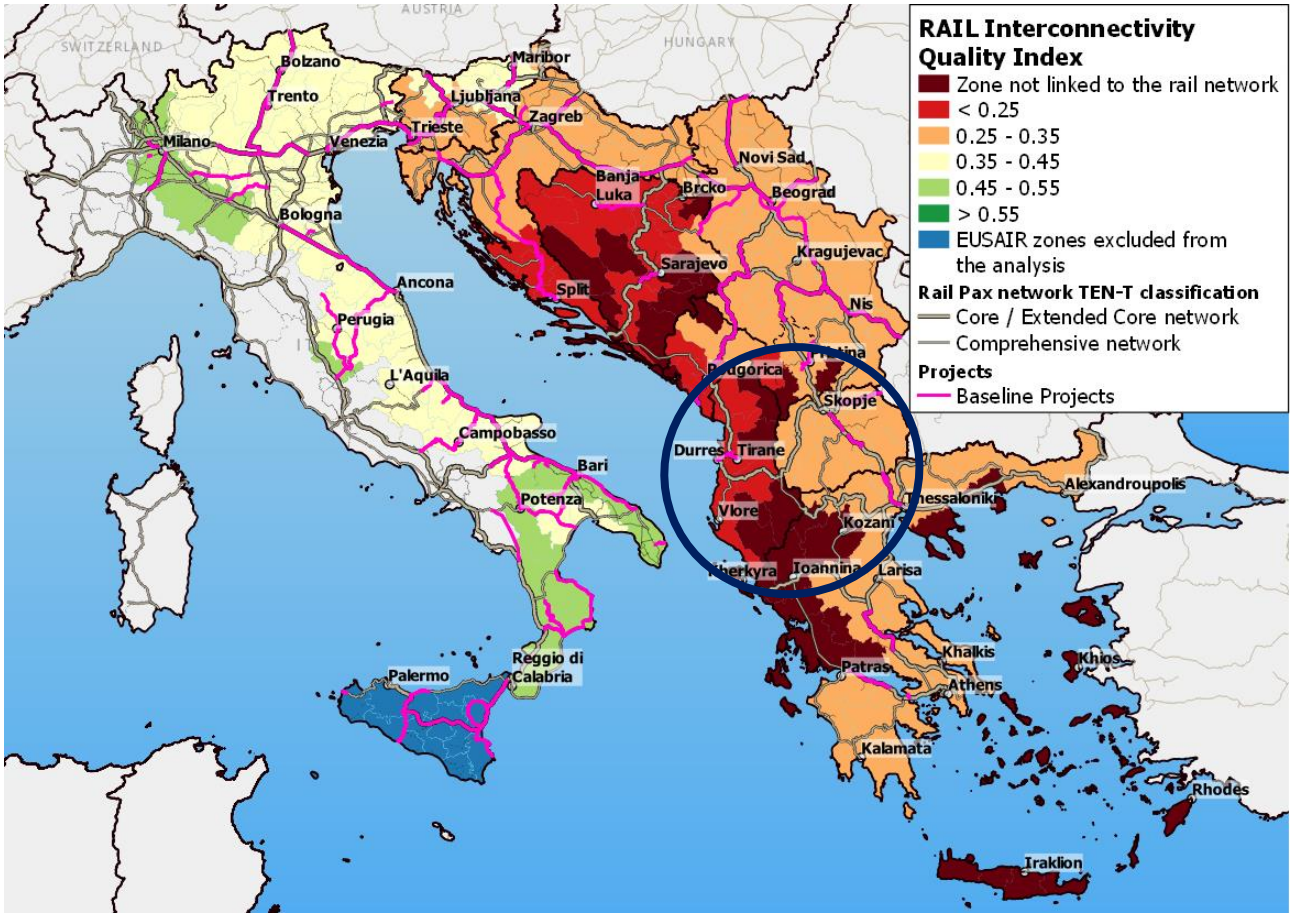

Figure 5 Rail interconnectivity quality index.

The intervention aims to fill the gaps especially for the highlighted countries in Figure 5: Greece, Albania, Montenegro and Bosnia and Herzegovina.

The interventions, in addition to bridge these connection gaps, will also support filling the gaps in the railway service.

[5] Source: https://www.transport-community.org/wp-content/uploads/2022/09/Five-Year-Rolling-Work-Plan-for-Development-of-Indicative-TEN-T-Extension-of-the-Comprehensive-and-Core-Network-in-Western-Balkans.pdf

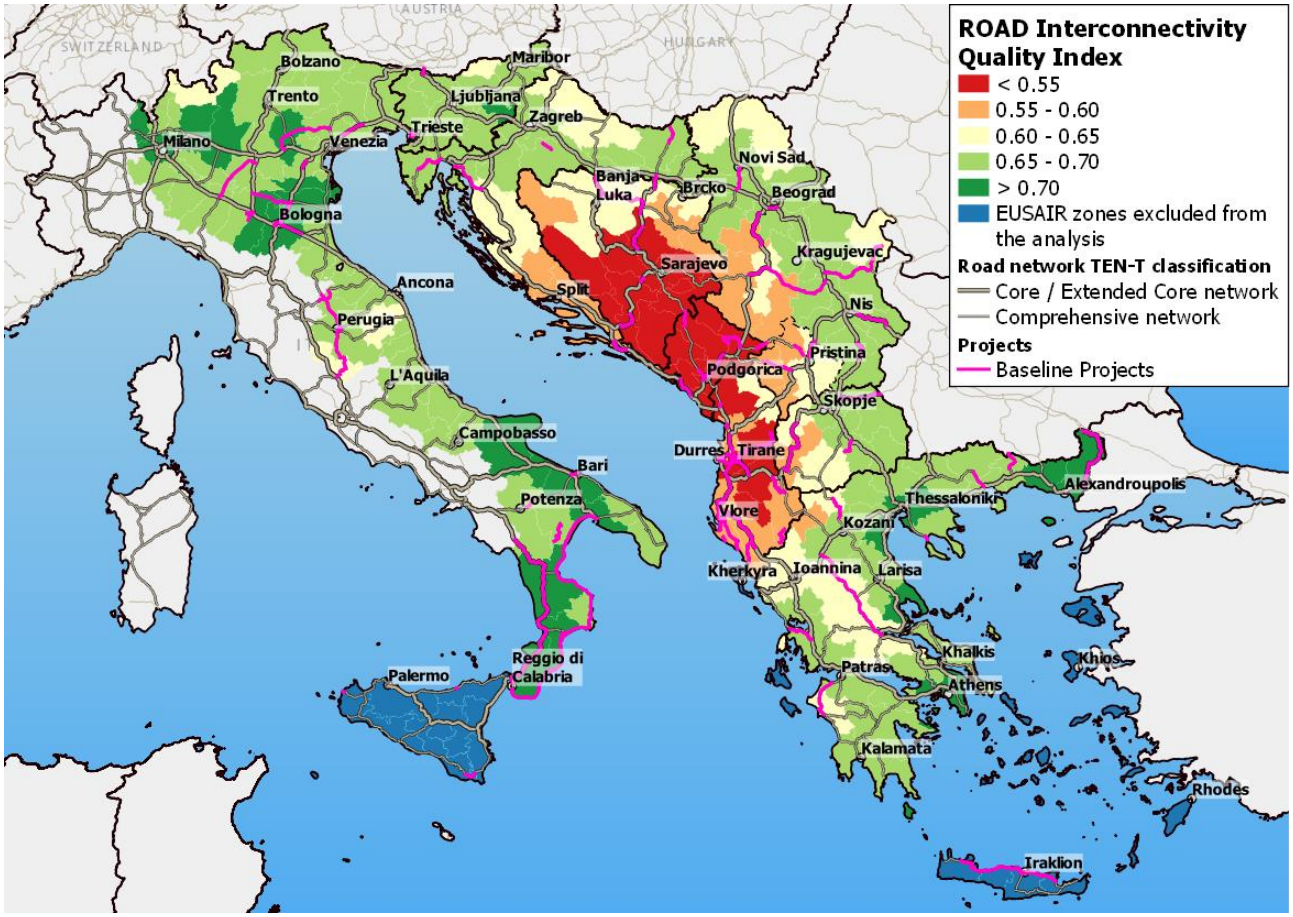

Figure 6 Road interconnectivity quality index.

Road Interconnectivity Indexes are particularly low in Western Balkans, due to the poor conditions of the road infrastructure.

2. Intervention impact evaluation in the area of interest

The impact analysis of the projects selected for the corridor, projects extensively described in chapter 1, were carried out thanks to the multimodal model built for the simulations of the projects envisaged in the master plan. In particular, two scenarios were compared:

- Baseline 2040
- Baseline 2040 + project interventions

The impact analysis was based on four transport indicators described below:

- Annual Average Daily Traffic Light Vehicles expressed as:
  - Total traffic flows
  - Mileage (veic*km)
  - Time spent on the network (veic*hour)
- Annual Average Daily Traffic Heavy Vehicles expressed as:

  - Total traffic flows
  - Mileage (veic*km)
  - Time spent on the network (veic*hour)
- Daily rail passengers expressed as:
  - Total traffic flows
  - Travel frequency (pax*km)
  - Time spent on the network (pax*hour)
- Tonnes transported by rail, per day expressed as:
  - Total traffic flows
  - Mileage (tonnes*km)
  - Time spent on the network (tonnes*hour)

The indicators were analyzed taking into account two different areas of influence. both the entire area of analysis (Figure 6) and the area of direct influence of the interventions reported in Figure 7 were considered.

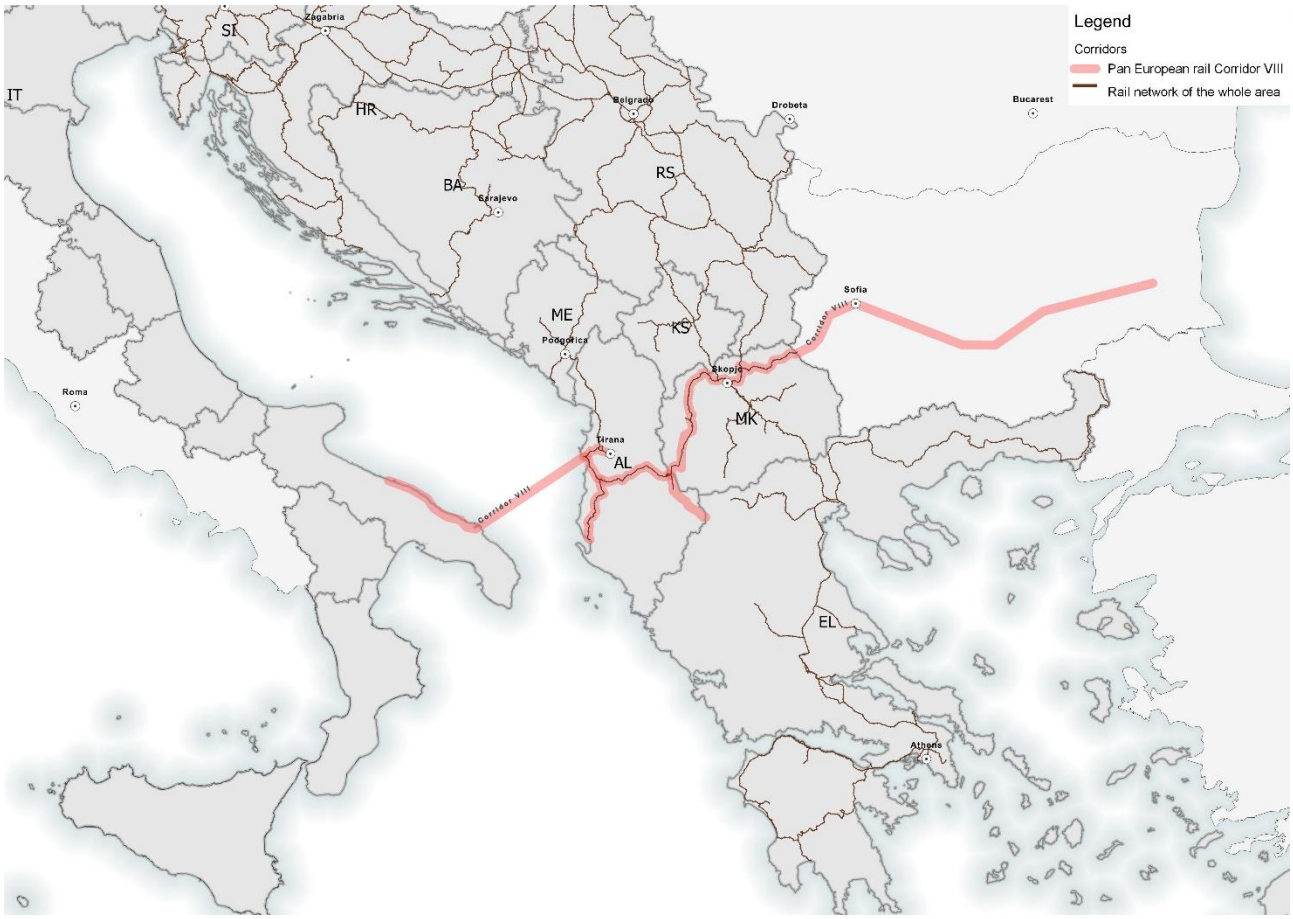

Figure 7 Overall analysis area.

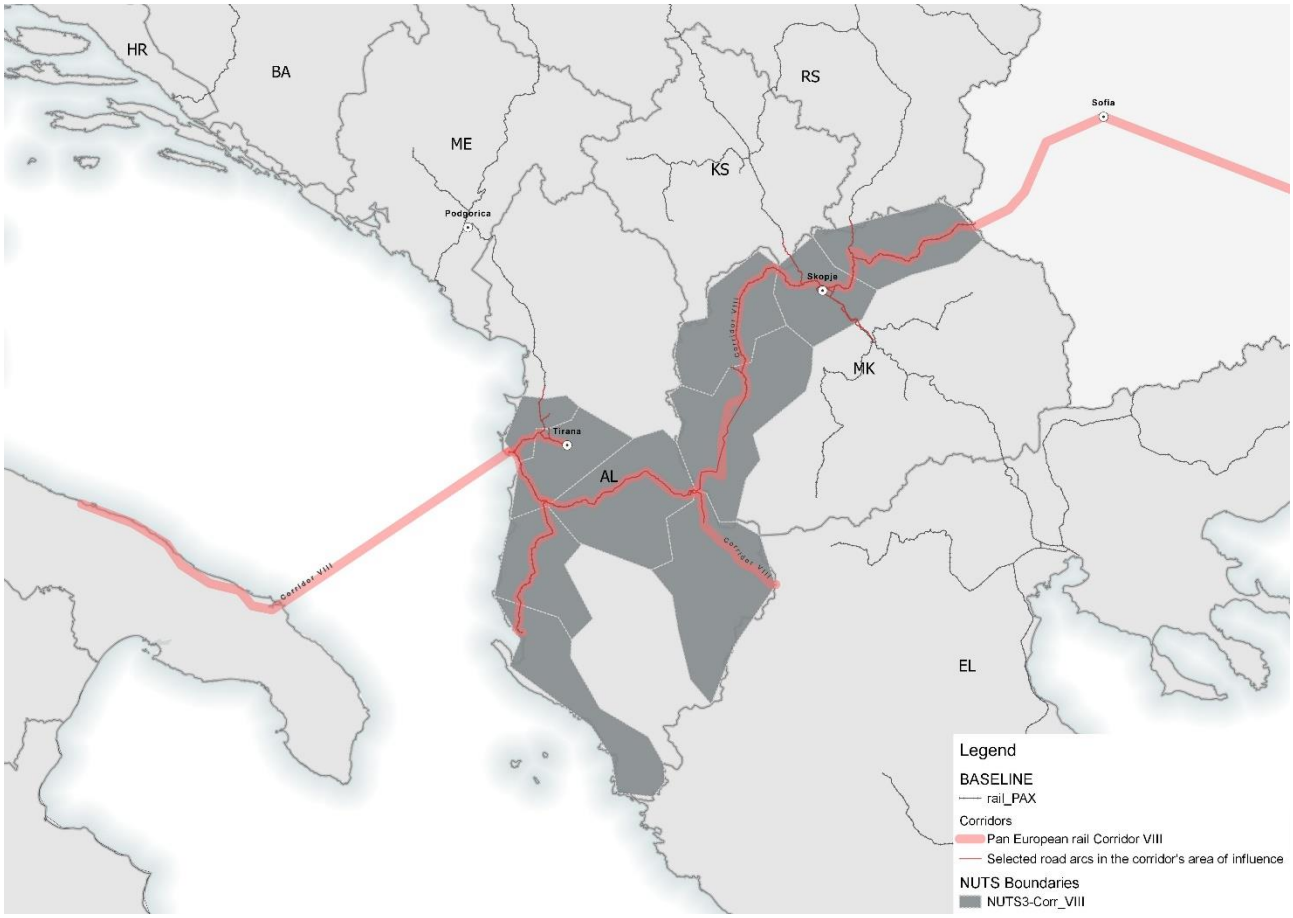

Figure 8 Area of influence of the interventions considered on the corridor.

The following tables show the values of the transport indicators analysed.

Table 5 Transport indicators of the analysis area.

		BASELINE	CORRIDOR VIII	CORRIDOR VIII vs BASELINE	
		Abs. value	Abs. value	Abs. value	Perc. value
Annual Average Daily Traffic Light Vehicles	Tot	19'952'799	19'934'214	-18'585	-0,093%
	Veic*km	230'903'499	230'663'331	-240'168	-0,104%
	Veic*hour	4'012'431	3'996'420	-16'011	-0,399%
Annual Average Daily Traffic Heavy Vehicles	Tot	1'756'889	1'752'559	-4'331	-0,246%
	Veic*km	22'051'014	21'992'276	-58'738	-0,266%
	Veic*hour	326'967	325'598	-1'370	-0,419%
Daily rail passengers	Tot	1'573'318	1'640'103	66'785	4,245%
	Pax*km	18'402'364	18'950'949	548'584	2,981%
	Pax*ora	381'208	394'238	13'030	3,418%
Tonnes transported by rail, per day	Tot	5'334'818	5'389'109	54'291	1,018%
	Tonn*km	76'836'862	77'241'572	404'710	0,527%
	Tonn*ora	1'942'145	1'942'996	851	0,044%

Table 6 Transportation indicators of the area of influence.

		BASELINE	CORRIDOR VIII	CORRIDOR VIII vs BASELINE	
		Abs. value	Abs. value	Abs. value	Perc. value
Annual Average Daily Traffic Light Vehicles	Tot	1'810'911	1'804'514	-6'398	-0,353%
	Veic*km	18'598'000	18'500'640	-97'360	-0,523%
	Veic*hour	338'088	324'804	-13'285	-3,929%
Annual Average Daily Traffic Heavy Vehicles	Tot	82'066	80'987	-1'079	-1,314%
	Veic*km	1'028'712	1'013'750	-14'961	-1,454%
	Veic*hour	15'467	14'705	-762	-4,927%
Daily rail passengers	Tot	77'831	136'359	58'528	75,198%
	Pax*km	518'245	945'954	427'709	82,530%
	Pax*ora	12'563	22'398	9'835	78,285%
Tonnes transported by rail, per day	Tot	128'534	230'471	101'937	79,308%
	Tonn*km	996'462	2'128'211	1'131'749	113,577%
	Tonn*ora	41'949	68'218	26'269	62,622%

Analyzing the results in relation to the area of direct influence of the interventions, a significant impact can be seen in terms of diversion towards the railway mode both for passengers and for the transport of goods, with increases in terms of distances and time spent on the order of 80% and for goods transported by rail even more significant in terms of mileage. On the other hand, there is a contraction in the use of the road network both in terms of light vehicles and goods which also determines a reduction in the time spent on the network greater than the reduction in journeys.

3. Economic analysis of the project's impact

In order to provide an analysis of the project's impact from the social point of view, it is useful to adopt the techniques available within the methodological framework of the Cost-Benefit Analysis.

3.1 Methodological framework

The analysis is based on the indications of the "Guide to Cost-Benefit Analysis of investment projects" published by European Commission – Dg Regio . Cost-Benefit Analysis (CBA) is an analytical tool for assessing the economic advantages or disadvantages of an investment decision by assessing its costs and benefits in order to assess the welfare change attributables to it.

The CBA is especially helpful to apply the economic assessment also from a non-financial perspective and to adopt the point of view of society as a whole for evaluating the social benefits beyond the mere financial-economic items.

The CBA methodological framework, hence, provides techniques which can be applied in the present case to provide a quantification, in monetary terms, of **social benefits such as the reduction of the environmental impacts of transport as well as the time savings associated with new infrastructure layout for final users**.

The Cost Benefit Analysis relies on a relevant methodological principle which is the so called "differential approach": the analysis aims to quantify the difference between two alternative scenarios: the "Baseline Scenario" defines the situation "without the project", i.e. with evolutions of traffic and operations that can be considered reasonable in the investigated context should the project not be implemented; the "Project Scenario" entails the realisation of the project and the deriving conditions for users.

3.2 Project's effects

As illustrated in Chapter 2, the main targeted impact of the project is the **optimization of transport flows**, by means of an improvement of available multimodal connections along the corridor. This will especially allow rail traffic (for both passengers and freight) to grow along the corridor in the project scenario, as it becomes more competitive than in the baseline scenario; two main types of positive effects are attained:

1) **A higher modal share for rail as compared to road along the corridor;**
2) **A reduction of travel times along the corridor for passengers and goods.**

Both effect brings about a decrease of the social and environmental impact of transport (as the rail is a less impactful mode than rail), and are therefore very favorable from a social point of view.

The present analysis is aimed at **quantifying in monetary terms the combined impact of the two effects to represent the overall social benefits** deriving from the realization of the project.

3.2 Variation of externalities of transport

The social and environmental impact of transport operations are defined "externalities" or "external costs" in that they represent social costs which are not usually monetized in market prices. The categories of externalities commonly used for assessment are the following:

- Climate change: impact in terms of global warming caused by CO_2 emissions of transport operations;
- WTT (Well-to-tank): impact in terms of global warming caused by CO_2 emissions of the activities leading to the availability of the energy sources for transport operations;
- Air pollution: impact in terms of emission of air pollutants (SO_2, NO_X and PM) from transport operations;
- Noise: impact in terms of acoustic pollution produced by transport operations;
- Accidents: impact in terms of accidents occurring during transport operations;
- Congestion: impact deriving from congested traffic and represented by the costs of the increased consumption of material of transport vehicles (deadweight loss - NB: depending on the application, the congestion parameter may include also costs for the time delay caused by congestion – it is not the case in the present analysis, because the estimation of transfer time-related effects is carried out separately).

The estimation of externalities of the concerned transport flows (as represented by the indicators presented in Chapter 2) are calculated by applying the unit parameters of marginal external cost of transport by road, rail to the presented transport flows measured in terms of veic*km (or vkm), pax*km (or pkm), and ton*km (or tkm).

The unit parameters are elaborated on the basis of data presented in the 2019 update of the EC's *Handbook for the estimation of external costs of transport*[6] (EU average values) and are presented in the table below, for all concerned transport modes and indicators[7].

Table 7 Applied external cost parameters

	Road (pax)	**Rail (pax)**	**Road (pax)**	**Rail (pax)**	**Road (freight)**	**Rail (freight)**	**Road (freight)**	**Rail (freight)**
	€/vkm	€/vkm	€/pkm	€/pkm	€/vkm	€/vkm	€/tonkm	€/tonkm
Climate change	0,018	-	0,012	-	0,072	-	0,018	-
WTT (Well-to-tank emissions)	0,006	1,174	0,004	0,007	0,016	1,417	0,004	0,002
Air pollution	0,009	0,011	0,006	0,000	0,064	0,043	0,015	0,000
Noise	0,000	0,224	0,000	0,001	0,005	0,203	0,000	0,000
Accidents	0,070	0,746	0,045	0,005	0,052	0,341	0,013	0,001
Congestion (only deadweight)	0,041	-	0,026	-	0,001	-	0,000	-
Tot	**0,103**	**2,156**	**0,065**	**0,013**	**0,208**	**2,003**	**0,050**	**0,003**

By applying the above parameters to the transport indicators presented in Chapter 2, it is possible to derive the costs generated by transport flows in the two alternative scenarios (with and without the project) and to compare them.

The following table show such estimations for a typical year of operation (a factor of 330 – as per industry standard – is applied to move from average daily indicators to yearly figures).

Table 8 Yearly external costs generated by road passenger transport (Euro)

Euro	**Road pax transport**	
	BASELINE SCENARIO	**PROJECT SCENARIO**
Climate change	111.239.290	110.656.954
WTT (Well-to-tank emissions)	34.924.266	34.741.438
Air pollution	53.202.889	52.924.373
Noise	2.742.280	2.727.925
Accidents	430.375.181	428.122.173
Congestion (only deadweight)	251.820.377	250.502.100
Total external costs	**884.304.283**	**879.674.962**

[6] European Commission, "Handbook for the estimation of external costs of transport", 2019.

[7] The parameters are calculated as averages of specific parameters attributed to the different vehicle technologies; and they refer to inter-urban transport.

Table 9 Yearly external costs generated by road freight transport (Euro)

Euro	Road freight transport	
	BASELINE SCENARIO	**PROJECT SCENARIO**
Climate change	24.532.714	24.175.917
WTT (Well-to-tank emissions)	5.396.688	5.318.200
Air pollution	21.576.248	21.262.449
Noise	1.695.825	1.671.161
Accidents	17.538.446	17.283.372
Congestion (only deadweight)	462.385	455.660
Total external costs	**71.202.306**	**70.166.759**

Table 10 Yearly external costs generated by rail passenger transport (Euro)

Euro	Rail pax transport	
	BASELINE SCENARIO	**PROJECT SCENARIO**
Climate change	0	0
WTT (Well-to-tank emissions)	1.255.180	2.291.084
Air pollution	11.996	21.897
Noise	91.461	166.944
Accidents	797.810	1.456.244
Congestion (only deadweight)	0	0
Total external costs	**2.156.447**	**3.936.168**

Table 11 Yearly external costs generated by rail freight transport (Euro)

Euro	Rail freight transport	
	BASELINE SCENARIO	**PROJECT SCENARIO**
Climate change	0	0
WTT (Well-to-tank emissions)	611.748	1.306.551
Air pollution	13.153	28.092
Noise	127.061	271.372
Accidents	213.994	457.041
Congestion (only deadweight)	0	0
Total external costs	**965.955**	**2.063.055**

As shown in the tables, since the project scenario facilitates multimodal transport, the rail traffic increases and therefore its associated external impacts also increase; however, such traffic is shifted away from the road mode, so that the overall traffic externalities decline in the project scenario. Overall, **the project scenario generates a -2.8 M€ variation of external costs per year**:

- Road pax transport -4.6 M€
- Road freight transport -1.0 M€
- Rail pax transport +1.8 M€
- Rail freight transport +1.1 M€
- **Total transport** **-2.8 M€**

3.3 Time savings

The second main effect of the optimization of flows in the project scenario is the possibility to reduce the transfer times for both passengers and goods. The saved hours have been presented in Chapter 2.

In order to monetise this effect, parameters representing the unit value of time pof passengers and goods have been derived and applied. Data available from the mentioned EC's 2019 Handbook have been used, which are relevant for the present analysis and regard, among EUSAIR countries, Croatia, Greece and Slovenia; values for Bulgaria are also included in the calculation due to the proximity and relevance for the corridor. To simplify the analysis, for passengers we apply an average value between the available ones, also considering the two different travel purposes presented in the handbook (business and personal trips).

Table 12 Value of time for passenger transport (€/pax*hr) (source: EC, 2019)

Average = 7,3 €/pax*hr	**Inter-urban distances**	
	Business purposes	Personal purposes
Bulgaria	8,3	3
Croatia	9,6	3,7
Greece	11,4	4,1
Slovenia	13,2	5,1

In order to apply such unit value to indicator to indicators representing time for vehicles (veic*hr or vhr), we consider, prudentially, an average factor of 1,2 pax per vehicle.

For freight transport, the following values have been considered.

Table 13 Value of time for freight tranport (€/ton*hr) (source: EC, 2019)

Average = 1,3 €/ton*hr	**Value per ton**
Bulgaria	0,7
Croatia	0,8
Greece	1,9
Slovenia	1,8

In order to apply these values to indicators expressed in terms of weight (ton*km), a factor of an average weight of goods per truck of 4.12 ton/vehicle, resulting from elaborations on the presented external cost parameters.

The application of such unit values to the transfer times resulting from the simulations in the alternative scenario determines the following results in terms of cost of time employed for transport, per mode and per category, per year. **The overall time saving per year can be valued at 4.8 M€**.

Table 14 Value of time employed for transport, per year

Euro	BASELINE SCENARIO	PROJECT SCENARIO	Difference
Road pax transport	977.345.502	938.942.171	-38.403.330
Road freight transport	27.321.031	25.974.991	-1.346.040
Rail pax transport	30.264.008	53.956.106	23.692.098
Rail freight transport	17.996.165	29.265.711	11.269.546
Total transport	1.052.926.706	1.048.138.979	**-4.787.727**

3.3 Results

The results confirm that the project's aim to increase the competitiveness of multimodal transport, by providing improved rail connectivity in the corridor, on one hand entails less external costs of transport for 2.8 M€ per year, and on the other hand optimises transfer times for both passengers and freight, generating time savings for 4.8 M€ per year.

The completed multimodal corridor VIII allows determines **an overall convenience in terms of monetized socio-economic impacts for a combined 7.6 M€ per year**.

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