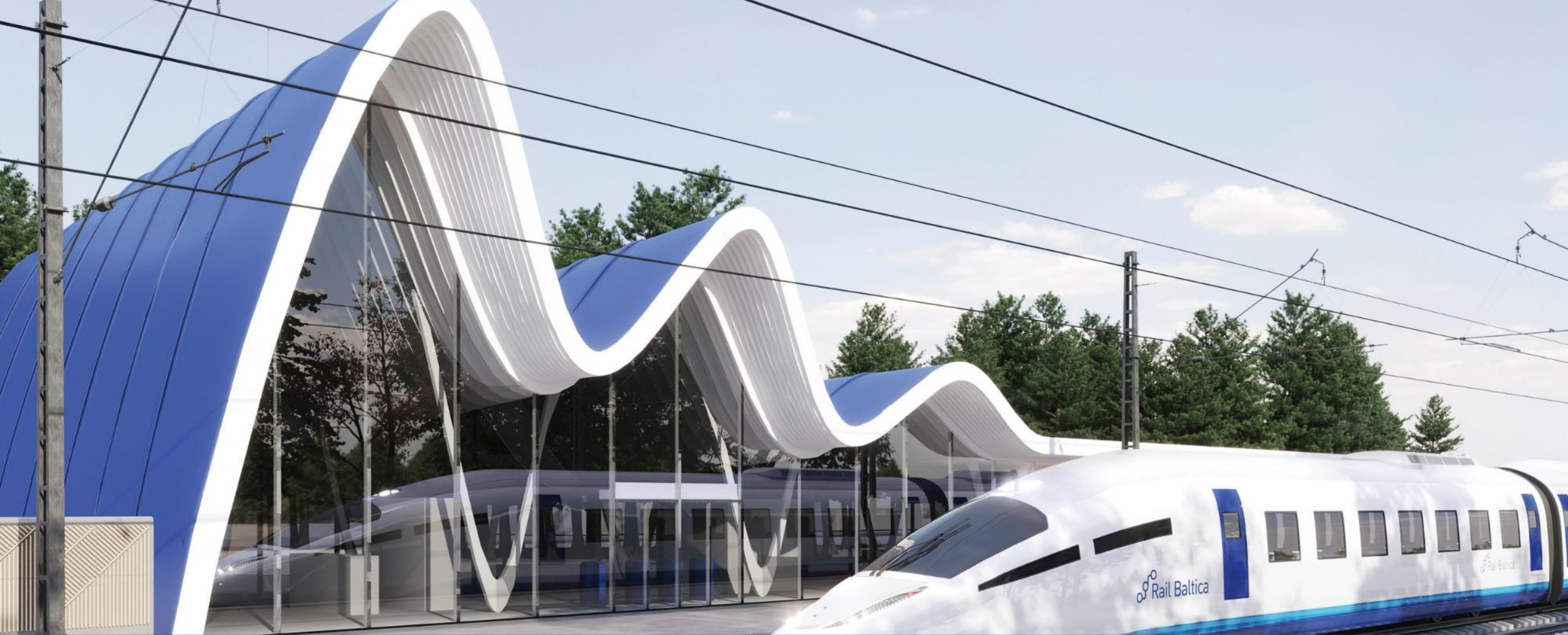

Rail Baltica

Environmental Impact Assessment & Sustainability Impact Assessment

NOVA SCHOOL OF BUSINESS & ECONOMICS

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Project Overview

The infrastructure project of the century in the Baltics

Project Scope & Coverage

- High-speed rail transport infrastructure project (2010-2030)
- Links Baltics to broader European railway network, spanning 870km
- Aims to connect the cities of Helsinki, Tallinn, Pärnu, Riga, Panevežys, Kaunas, Vilnius, and Warsaw
- Three new large **multimodal terminals** in the Baltic countries: Estonia, Latvia and Lithuania
- **85%** from **EU funds** (linked to CEF and TEN-T) and up to **15%** from **state budgets**

Strategic Impact

- Connects regions previously weakly linked due to underdeveloped infrastructure, **unlocking unrealized economic potential**
- Integrates the **Baltics** into the **TEN-T** core network, improving access to EU markets and global competitiveness
- Supports **low-emission transport** and **modal shift**, supporting EU Green Deal goals

Sources: Vaicunas & Steisunas (2017); Pomykala (2018); Rail Baltica (2023)

Earth Assessment

Decreased soil quality and threats to biodiversity and ecosystems expected for both stages

Construction Stage

Potentially Significant Impacts:	Assessment*:
1. Soil Sealing & Compaction: Sealing leads to permanent soil degradation; compaction reduces infiltration	grey, grey, red
2. Habitat Fragmentation: Linear infrastructure creates barriers to migration and gene flow	grey, grey, red
3. Peatland Disturbance: Drainage of peat soils causes CO_2 emissions and habitat loss	grey, grey, red
4. Invasive Species: Disturbed soils enable spread of species like Japanese knotweed (Fallopia japonica)	grey, yellow, red

Operational Stage

Potentially Significant Impacts:	Assessment*:
1. Biodiversity Stressors: Noise, light and vibrations continue to disturb fauna	grey, yellow, red
2. Maintenance Effects: Mowing and vegetation control prevent natural succession	grey, yellow, grey
3. Microplastic & Litter: Operational waste enters soil ecosystems over time	grey, yellow, grey
4. Inadequate Wildlife Crossings: If not implemented, fragmentation remains a long-term issue	grey, yellow, red

*Preliminary assessment based on existing reports and measurements

Legend: ● Positive Impact ● Moderately Negative Impact ● Negative Impact

Sources: Forman & Alexander (1998); Joosten (2015); EEA (2019); Krigere et al. (2024)

Water Assessment

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Reduced water quality and heightened flood risks anticipated across both project stages

Construction Stage

Potentially Significant Impacts: | **Assessment*:**

1. Groundwater Drawdown: Tunnel/bridge works lower groundwater levels; wetlands dry out

2. Water Pollution from Sites: Diesel, oil, concrete additives leak into watercourses

3. Disruption of Small Streams: Bridge/dam construction alters flow dynamics and sedimentation

4. Fine Particle Load: Sediments impair photosynthesis and oxygenation of aquatic vegetation

Operational Stage

Potentially Significant Impacts: | **Assessment*:**

1. Sealing & Runoff: Less infiltration causes pluvial floods and reduces groundwater recharge

2. Heavy Metal Emissions: Rail abrasion releases copper, zinc etc. into water via runoff

3. Drinking Water Risks: Shallow aquifers in rural areas threatened by long-term recharge decline

4. Monitoring Gaps: Lack of integrated stormwater and governance systems across countries

*Preliminary assessment based on existing reports and measurements

Legend: Positive Impact Moderately Negative Impact Negative Impact

Sources: Gossel et al. (2011); Bressi et al. (2013); Kalvans et al. (2015); CC Final Report (2019)

Air Assessment

Air pollution threatens human health and environmental integrity despite sustainability measures

Construction Stage

Potentially Significant Impacts: | **Assessment*:**

1. GHG & Pollutants: High emissions from cement/steel production, logistics and machinery

2. Particulate Matter (PM): Dust from site work and dry materials affects health

3. VOC & NO_x from Diesel: Cause smog and ground-level ozone under sunlight

4. Dust & Air Quality: Exceeds WHO thresholds near construction zones

Operational Stage

Potentially Significant Impacts: | **Assessment*:**

1. Electrified Transport: If powered by renewables, CO_2 reduction possible

2. Rail Abrasion Emissions: Copper and zinc enter the air and adjacent ecosystems

3. Lifecycle/Upstream Emissions: Embedded CO_2 in materials and imports affects climate balance

4. Dependence on Grid: Estonia's fossil-based electricity mix poses risk for green reputation

*Preliminary assessment based on existing reports and measurements

Legend: Positive Impact · Moderately Negative Impact · Negative Impact

Sources: Peters & Hertwich (2008); Andrew (2019); WHO (2021); Eurostat (2023)

Life Cycle Assessment

Significant emissions emerge across all lifecycle phases despite green objectives

	Raw Material Extraction	Production	Distribution / Logistics	Use	Disposal & Recycling
Impact	• High energy consumption / embodied carbon • Depletion of land and water resources	• CO_2 emissions and fossil fuel consumption • Long ecological “payback period”	• Emissions due to long transportation routes • Shift from outsourced emissions	• Actual emissions depend on electricity mix • Emissions caused by abrasion and maintenance	• Waste generation → new sources of air and water pollution • Time consuming separation of materials
Mitigation	• Affected by mitigation efforts during production phase	• Use of recycled steel and regional materials • Energy-optimized prefabrication processes	• Combined logistic centers • Transparency in supply chain	• Renewable energy use & smart energy management • Modal Shift	• No accessible dismantling strategy yet

Sources: UIC (2016); European Commission (2020); RB Climate Impact Study (2023)

Socio-Economic Assessment

Positive long-term regional impact, but localized burdens during construction

Construction Stage

Potentially Significant Impacts: | **Assessment*:**

1. Community & Land Disruption: Physical division of villages, 1,600+ expropriations, emotional loss, insufficient mitigation

2. Stakeholder Engagement & Governance: Weak early consultation, protests in Estonia (Aarhus), project delays and fragmented coordination

***3.* Short-term Economic Stimulus:** ~13,000 direct + ~23,000 indirect jobs, benefit for local firms – but temporary without transition plans

Operational Stage

Potentially Significant Impacts: | **Assessment*:**

1. Regional Integration & Growth*:* Faster travel, economic uplift (+0.5–0.7% GDP), real estate appreciation, increased tourism

2. Inclusive Mobility & Accessibility*:* Benefits for 350,000 low-income and 59,000 mobility-impaired citizens – but affordability (~€38) is critical

3. Distribution & Transition Challenge: Bypassed rural areas risk exclusion; weak last-mile infrastructure and poor local integration limit access; existing transport providers face economic disruption

4. Strategic Positioning: Strengthens EU integration (TEN-T, defense, climate), adds long-term resilience and geopolitical value

*Preliminary assessment based on existing reports and measurements

Legend: Positive Impact | Moderately Negative Impact | Negative Impact

Sources: EC (2021), RB Rail AS (2021, 2024), Rail Baltica (2023), ELC (2020), NAO (2023)

Recommendations Earth & Water

Integrating sustainable planning practices, optimizing resource use, and collaborating with local authorities

Earth

Potentially Significant Recommendations:

Integrate ITLU-LCA: Combine Life Cycle Assessment with transportation planning to assess environmental impacts

Develop transit-oriented neighborhoods: To reduce emissions and enhance green spaces

Protect Biodiversity: Use wildlife overpasses, underpasses, and fencing to prevent habitat fragmentation

Restore Ecosystems: Replant indigenous vegetation in areas affected by construction

Water

Potentially Significant Recommendations:

Water-Saving Technologies: Use low-water equipment and efficient management systems

Source Water-Efficient Materials: Prioritize materials produced with water-efficient processes

Optimize Water Use: Minimize consumption in high-water infrastructure components

Collaborate with Local Authorities: Ensure sustainable water management in affected areas

Sources:Jehanno et al. (2011); Chester et al. (2013); Kimball et al. (2013); Cheng et al. (2020)

Recommendations Air & Socio-Economic

Focusing on energy use, emissions reduction, risk management, and cross-border cooperation.

Air

Potentially Significant Recommendations:

Use Renewable Energy Mix: Prioritize renewable energy sources (solar, wind, hydro) to power the rail network

Electric-only Trains: Powered by renewable energy to reduce emissions

Reduce Construction Emissions: Use low-carbon materials and improve construction efficiency to cut emissions

Monitor and Report Emissions: Use real-time emissions monitoring and public dashboards for transparency

Socio-Economic

Potentially Significant Recommendations:

Implement Unified Risk Management: Integrate a system to monitor risks effectively and provide clear descriptions for actionable decision-making

Improve Communication: Ensure better coordination between project stakeholders

Develop Change Management System: Establish a framework to manage project alterations

Enhance Cross-Border Cooperation: Avoid duplication and resolve conflicts efficiently

Sources:Chester & Horvarth (2009); Chester & Ryerson (2013); Piterina & Masharsky (2019)

Final Impact Overview: Challenges & Opportunities across Project Phases

From disruption to integration: How Rail Baltica can turn environmental and social challenges into long-term resilience

Stage	Impact Dimensions	Potentially Significant Impacts	Assessment*	Recommendations
Construction Stage	EARTH	▪ Sealing and compaction of peatlands ▪ Habitat fragmentation ▪ Barrier effects on species migration		▪ Integrate ITLU-LCA ▪ Transit orientated neighborhoods
	WATER	▪ Groundwater Drawdown ▪ Water Pollution from Sites (contamination from runoff)		▪ Source water efficient materials ▪ Collaborate with local authorities
	AIR	▪ High GHG Emissions (cement, diesel) ▪ Dust and Air Quality (exceeds WHO thresholds)		▪ Reduce construction emissions
	SOCIO-ECONOMIC	▪ Expropriations (1600+); village division ▪ Temporary Job Gains ▪ Stakeholder Mistrust		▪ Implement unified risk management ▪ Improve communication
Operational Stage	EARTH	▪ Biodiversity Stressors (noise, light and vibrations) ▪ Inadequate Wildlife Crossings		▪ Protect Biodiversity (wildlife passes ,…) ▪ Restore ecosystems (replant)
	WATER	▪ Drinking water risks ▪ Sealing & Runoff (pluvial floods)		▪ Water efficient management system
	AIR	▪ Lifecycle Emissions (embedded CO_2 in materials) ▪ Electrified Transport		▪ Monitor and report emissions ▪ Use renewable energy mix
	SOCIO-ECONOMIC	▪ Regional growth: GDP +0,5 – 0,7% (tourism, real estate) ▪ Accessibility for low-income and mobility-impaired users ▪ Strategic value: EU integration (TEN-T, climate resilience)		

*Preliminary assessment based on existing reports and measurements


Thank you for your attention!
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