Rail Baltica

RBDG-MAN-027-0105

Design guidelines

Environment

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1. Introduction

These guidelines concerning environmental measures aim:

- to provide the main design requirements for the environmental measures
- to propose key points of focus based on the different regulations and experience feedbacks in environmental design of measures specific to the High Speed Lines
- to highlight the main environmental/technic design interfaces

The technical requirements from the local authorities are included in the Environmental Impact Assessment (EIA). The design shall comply with the requirements from EIA. If some requirements are not included in the EIA, the designer shall then liaise with the Client and the local authorities to define these requirements.

2. Key environmental issues

The following table presents the key environmental points developed in this manual.

Key environmental issues	Concerned items	Consequences or constrains for design
Ecology and biodiversity	Protected or heritage fauna and flora species and their natural habitats Invasive species	Authorizations conformity (protected areas or species) Wildlife crossing structures Special requirements for fencing Mitigation measures design Protection measures (works environmental management)
Water resources	Surface waters (watercourses, ponds, water bodies, …) Wetlands Groundwater and their uses Fishing and fish farming	Special devices for aquatic animal in crossing structures (coverts, bridge, viaduct…) Watercourses diversions design Protection measures during works Mitigation measures design Water quality monitoring
Mineral resources and fertile soils	Induced impacts of excavating and refilling material: deposit sites Quarry's opening Polluted soil	Requirements of material for embankments and structures Soil remediation
Climate change	Climatic hazards Climatic constrains Greenhouse gas emission	Adapted structures and devices Carbon balance optimization (during works and operation phases) Less climate change footprint for works material choices
Human health	Noise Vibration Electro-magnetic radiation	Acoustic barriers Anti-vibration devices Anti-electro-magnetic radiation devices Protection measures during works stage

This document is not dealing with following points, but these points shall be considered in the overall process for the project:

- environmental management systems (EMS), e.g.: ISO 14001 processes,
- consultation with stakeholders,
- social and economic impacts,
- energy, water or communications networks,
- land use planning constrains and impacts,
- landscape design,
- planning and scheduling of environmental authorizations,
- environmental monitoring,
- environmental performance indicators.

3. General requirements

Any environmental measures will have to be applied in full compliance with:

- the different laws, regulations, standards, technical specifications relative to the environmental issues,
- the previous commitments to the environment (typically presented in the EIAs or other environmental authorizations).

To ensure a good traceability of constraints and requirements, a global listing and cartography of all these environmental requirements shall be followed in a specific tool to manage and report the progress of implementation (effectively and quantifiably). The tool shall be at least a dashboard connected to GIS.

To optimize the design time and the costs of the project, the interfaces between technical design and environmental requirements or constrains shall be anticipated and managed, typically:

- at the beginning of the detailed design stage, listing of environmental requirements per area and the possible needs of additional investigations (fauna, flora, water quality, archaeology survey, …),
- Iterative approach at detailed design stage with the project stakeholders.

The studies shall provide the compliance with the different environmental requirements and anticipate the difficulties, e.g.:

- additional costs due to not planned mitigations measures (preventive rather than corrective measures),
- delays due to the repair of environmental damages during the works,
- non-compliances to environmental requirements causing legal risks.

4. Specific requirements: ecology and biodiversity

4.1. EU regulations

About conservation of natural habitats and of wild fauna and flora:

The Habitats Directive (Directive 92/43 on the conservation of natural habitats and of wild fauna and flora, amended by Directive 97/62/CE) established a European network: Natura 2000. It comprises 'Sites of Community Interest'/'Special Areas of Conservation' designated by Member States, and 'Special Protection Areas' classified pursuant to Directive 2009/147 on the conservation of wild birds (also applicable to areas without special protection). Target 2 of EU biodiversity strategy 2020 is "ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems".

Invasive alien species

Tighter controls on invasive alien species are one of the six targets of the EU biodiversity strategy to 2020. Invasive alien species cause damage, not only to ecosystems but also to crops and livestock, disrupting local ecology and affecting human health.

- Regulation n° 1143/2014/ CE of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. It comprises regulations about prevention, emergency measures, early detection and eradication, ….
- Commission Implementing Regulation (EU) 2016/1141 of 13 July 2016 adopting a list of invasive alien species of union concern pursuant to Regulation (EU) n° 1143/2014 of the European Parliament and of the Council
- Commission Implementing Regulation (EU) 2017/1263 of 12 July 2017 updating the list of invasive alien species of Union concern established by Implementing Regulation (EU) 2016/1141 pursuant to Regulation (EU) N°1143/2014 of the European Parliament and of the Council

4.2. Guidelines for the environmental design

4.2.1. Impacts reducing and measures on ecological protected areas

The proposed design shall:

- Optimize the alignment design to minimize or eliminate the footprint of the HSR specially on the natural habitats of Community interest (Natura 2000 sites) but also other natural protected areas (nature reserves supporting rare or endangered fauna and flora species)
- Define the monitoring indicators for impacts on protected areas (impacted total surface e.g.), in order to verify compliance with the EIA commitments. That for different scales: for each protected natural area, each country or each section
- Realize the detailed analysis of the incidences of the various phases of works, particularly the preliminary works (utilities diversion, clearing, archaeological surveys, …). These cause generally the main direct impacts on the natural areas. Therefore, adapted protection measures shall be defined: installations of fences and appropriate signage around the protected areas
- Define environmental protection measures for the works period (location of works sites, construction methods, adaptation of the work schedule works, temporary rainwater drainage, …), specially:

  - to ensure that no construction work or construction material storage sites are carried out in the protected area (temporary marking),
  - to only allow a minimal contact with vulnerable rivers, such as habitats of rare flora and fauna,
  - to provide for works periods which do not overlap with the reproduction, rearing and migratory stages of rare or protected species. It is highly recommended to plan and anticipate those schedules where different animal taxa require periods of work prohibition at various seasons (generally in alluvial corridors).
- Complete the detailed impacts assessment including all related works or structures (service roads, telecommunications equipment, material deposit sites, quarries, maintenance embankments, …) and define the specific protection measures
- Minimize the dimensions of railway embankment height and width as small as possible

Ecologists (fauna and flora specialists) shall be involved for a co-design for this topic.

4.2.2. Wildlife crossing structures

4.2.2.1. *Impact of fences*

Fences around the HSL or other safety systems shall be implemented and following impacts shall be considered for fences:

- a positive impact for the railways operations and the animals: to prevent damages on the trains due to entry of wild life animals on the railway embankments, particularly large mammals;
- no negative impact due to the death or injuries of mammals by overriding or hitting (except for birds, bats and flying insects due to the high speed of the trains)
- a negative impact on the ecological corridors: the installation of the railway line with a fence is creating a barrier, with impacts on the migration of mammals, and cause a fragmentation of natural habitats.

For which types of fence and noise barriers to be applied on different surrounding please refer to the schemes in RBDG-MAN-031F.

4.2.2.2. *Location and sizing general criteria*

The location and the sizing of the mammal passes and green bridges depend on the main factors below:

- requirements of the EIAs,
- compliance with other requirements (national regulations or technical recommendations e.g.: COST 347, Infra Eco Network Europe, …),
- expert advices (while conducting the ecological studies) to locate the main corridors and the technical solutions,
- the characteristics of the natural corridors:
  - main type of corridor: aerial, terrestrial or aquatic,
  - concerned species: their diversity and particular ecological needs,
  - type of habitats (open-field landscape, forest areas, large alluvial corridors, wetlands, suburban zones, …),
- intensity and frequency of the animal passages,
- the possibilities of impacts on populations of rare or protected species.

4.2.2.3. *Different type of passages*

In order to mitigate the fragmentation of the habitats of terrestrial animals, various solutions of structure exist:

- under- or over-pass specific structures for the main corridors and large mammal species (the feedback shows that overpasses are generally more efficient)

Examples of overpass structures: the two pictures on left side show a specific structure for the passage of animals, and the picture on right side shows an oversizing for animal passage associated with a road (Rhine / Rhone HSR in France, pictures: Systra)

- road crossing bridges with an oversizing of some meters for the passage of animals
- hydraulic structure (culverts, bridges, hydraulic pipes, …) with an oversizing of approximatively from some decimetres to 5 metres for the passage of animals

Examples of hydraulic structures with oversizing for animal passage (Rhine / Rhone and East European HSR in France, pictures: Systra)

- small under structures specific for the passage of little mammals

Examples of specific structures for small animals (Rhine / Rhone and East European HSR in France, pictures: Systra)

4.2.2.4. *Underpass or overpass specific structures*

The following main design interfaces shall be considered to design the structure:

- the required visibility for animals between the two sides of the passage, the geometry of the earth works and the structure should offer an optimal unobstructed field of vision. The design may include 3D design to size and locate precisely the structure
- minimum topsoil depth for herbaceous plantations: 0.3 m; for shrub plantations: 0.6 m; for trees 1.5 mthe installation of visual wood screen in the case of over-structures
- the rainwater longitudinal drainage system
- the connection of the equipment, like the restraint systems, with the fences
- the landscape design in link with green engineers (planting of shrubs and trees, choice of species for the grassing, installation of wood and stone windrows to favour the passage of reptiles, insects or little mammals.

4.2.2.5. *Mixed passages hydraulics/fauna (hydraulic crossing structures)*

The mixed passages hydraulics/Fauna shall be designed considering following requirements:

- in the case of installing concrete, stone or wood made benches, these should be sized according to the ecological requirements. The benches should be designed to be at least 0,5 m above the water level for an annual flood. The height and the width of the benches is depending on the target species (little mammals, amphibians, reptiles, …). The type of material on the benches surface depends on the target species. Some of them, like *Lutra lutra,* require a suitable coating. For amphibian passes examples are as follows:

- special devices to reduce current speed (if the river course presents a torrential regime) may be planned for the fish transparency (see picture on the right)). Natural stones allow to reconstitute a natural bed. It's possible to plan concrete transversal bars, which at the same time will protect the slab.
- the earthworks geometry should be designed in concordance with the structures geometry to enable the escape of animals going out of the crossing structure and to facilitate the access to its entrance.
- the headworks structure is generally transversal to the longitudinal drainage system. It is recommended to plan stone, concrete or wood slabs, or another device, otherwise the ditches of drainage will be an obstacle to animals to the detriment of the efficiency of the work for the animals crossing. Similarly, the location of the fences shall be adapted, moved back behind the headworks structure.
- the landscape design should be also involved in the study process to ensure the efficiency of such crossing structures. For example, shrubs planned around the structure extremities will attract animals.

4.2.2.6. *Mixed passages roads / animal passage*

The mixed passages road/Fauna shall be designed considering following requirements:

- the traffic of cars on the road should be very low to reduce the risk of animal injury, ideally the road shall be a rural, forest or path way and not asphalted.
- the design of the restraint systems shall be in compliance with not only the road and HSR standards, but also the visual screen (see picture on the right).

4.2.3. Fencing

The present guidelines aim to describe some of the recommendations for the design of the fences for their only function of anti-penetration of the fauna on the HSR embankment.
For the visual design of the fences please refer to RBDG-MAN-031F.

4.2.3.1. *Location of the fences*

The fences are located:

- behind the drainage system and should not obscure the passage of animals where crossing structures are planned,
- on the top of crossing structures and follow the side walls
- At the bottom of the railway embankments and at the top of the cuttings, however with a backward of some meters to prevent the jumps of animals on the railway embankment (shall be defined according to the presence of ungulates and cervids)
- so as not to include "green areas" which may be interesting refuge habitats for the flora and fauna
- so as to include all HSR electronic, railway signalling or telecommunication equipment, for their protection against small rodents
- if crossing longitudinal ditches of drainage, a "harrow" composed by vertical metal rod (pins) spaced out by 5 cm maximum. These harrows are implemented across the ditch under the fence (see picture on the right).

The different types of fences (see below) are located according to:

- the identified type of ecological corridors
- the identified animal populations or faunal groups around of the HSR
- the morphology of the earthworks and the location of the HSR relative to the natural ground level.

4.2.3.2. *Type of fences*

These types of fences can be defined:

- fences to prevent the penetration of animals which could cause damage to the trains, particularly large mammals (deer, stags, wild boars, moose)
- fences to prevent the penetration of little animals, specially the small rodents
- fences to prevent the penetration of amphibians and reptiles for their protection

- special fences to encourage birds and bats to fly higher and so to limit the risks of collision with trains and the superstructures, notably the catenary.

4.2.3.3. *Fences for large mammals*

The fence can be enhanced of 0,5m in the case of crossing large forest areas or axis of tall mammal movement.
If the presence of deer is proved or in the presence of a strong population of deer, it is recommended to add shutters directed to the outside of the HSR embankment.
In the case of the presence of boars in forest areas, barbed wires are added near to the ground level. A specific anchorage device for the posts may be designed. The fence shall be buried up to about 50 cm under the natural ground or fastened with staples (see picture on the right). A particular care will be brought to the connection between the base of the fence and the natural ground. These recommendations aim at avoiding that the wild boars remove the fence and clear a passage.

4.2.3.4. *Fences for small animals*

The sizing of the progressive stenches depends on the type of fauna. The distance between each horizontal wire will be between 1 and 5 cm maximum. It should be kept at the minimum value in case of presence of amphibians.
Anti-amphibian nets should be implemented in areas with high amphibian presence.

4.2.3.5. *Access gates*

It is recommended to be vigilant about the connection between the basal part of the gate and the ground level to prevent animal passage there (see picture on the right).

4.2.4. Watercourses renaturation

4.2.4.1. *Waterbed diversion*

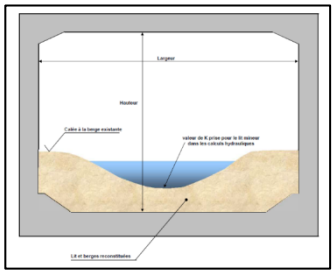
The diversion of watercourses shall be designed according to following requirements:

- at first, carry out the hydraulic sizing for the riverbed (wetted cross section and stream speed)
- define the stability of riverbanks and calculate the erosive force of the stream to design the adapted system for the slopes stability (geotextile, grassing, cover planting, willow fascines implementation, riprap…)
- launch a hydro-geomorphological study to ensure that the solid flow (specially the suspended materials) transits without forming limes, sands or gravel banks or, conversely, vertical incision in riverbed
- carry out then the green design for the riverbed renaturation
- also design the riparian vegetation.

These above requirements shall be presented in the same document for each diversion. The drawings shall represent sections at different points of the concerned river section to ensure the consistency check between the different earthworks (join earthworks between the hydraulic crossing structures, the railway embankment, the created riverbed and the natural ground level).

The environmental protection measures shall be defined during the design to prevent risk of pollution due to the works engines, the waterbed erosion and the earthworks. A water quality monitoring system shall be implemented for vulnerable rivers.

4.2.4.2. *In the hydraulic structures*



A "natural" waterbed shall be defined in the structures for vulnerable rivers with rare fish species or forming an aquatic corridor. As for the diversions, the environmental design is related to the hydraulic constrains. A 40-cm layer of material on the inside floor of the structure may be planned (see on the left the typical section of a waterbed renaturation in a hydraulic structure). The material granulometry is defined according to the stream conditions.

4.2.5. Structures used as passages for small fauna

The design of the structures shall take into account the morphological characteristics of the water course being crossed as well as the length over which it is covered by the railway line, meeting the requirements of the following principles:

Reconstitution of a bank or bench continuous with banks of the stream,

- Creation of minor bed inside under track structures for fish passage in case of low level water,
- Verification of maximum velocity in relation with fish swimming capacity,
- Reconstitution of natural bed inside under track structures,
- Creation of passages limiting reduction of light penetration.

4.2.6. Various measures for the biodiversity

The vegetal and animal species shall be inventoried before the works to define the preventive measures to implement during the forest clearing, topsoil-stripping, and earthworks.

Some alien vegetal species present health hazards (allergies) or invade natural habitats with rare species which are then threatened, particularly in case of bared soils. Also, burrowing animals may damage the earth structures.

The landscape, the planting and the grassing design shall integrate the following ecological requirements:

- Choice of plant species, seeds and cultivars with natural or local characteristics
- Recreation of ecological corridors with hedges or shrubs
- Implementation of hedges to deviate the birds or bats flight higher or in direction to crossing passages and cutting areas
- Specific design for the large fauna passages or the riverbed of diversions
- Creation or renaturation of orchards, wetlands, …

The local environmental organizations shall be consulted to specific items of ecological design, especially for the mitigations measures.

4.3. Mitigation measures (compensating measures)

This chapter refers to the mitigation measures in the sense of the ecological compensation to be committed after the implementation of the avoidance and reduction or protection measures. It is thus the compensation of the residual impacts.

The mitigation measures taken in the EIAs should be updated according to the detailed impacts assessment (including the evolutions of the project due to the detailed design).

In any case, the mitigation measures for biodiversity shall be performed as specified in the EIA (creation of ponds, renaturation of natural habitats, placing of nesting boxes, conservation management of natural sites, …).

The implementation of these measures shall be engaged to be in compliance with deadlines required by the environmental authorizations (e.g.: some of mitigation measures require to be realized before the beginning of the works, to offer a compensative habitat for impacted species of fauna).

The different stages of the mitigation measures implementation are described below:

1. Search of possible sites for the mitigation measures, prioritization of locations depending on ecological criteria and land property management possibilities
2. Site selection
3. Definition of management plan for the selected sites based on ecological inventories (baseline conditions)
4. Potential interfaces analysis with the civil works
5. Detailed design (ecological engineering) of each site.

The preliminary and detailed design of these sites shall be presented to the Environmental Authorities and other concerned stakeholders for review.

5. Specific requirements: water resources

5.1. EU regulations

The EU Water Framework Directive (WFD EU 2000/60), adopted in 2000, takes a pioneering approach to protecting water based on natural geographical formations: river basins. It sets out a precise timetable, with 2015 as the deadline for getting all European waters into good condition.

The WFD is complemented by other, more specific, /EC laws:

- The Environmental Quality Standards Directive (EU 2008/105/EC)
- The Marine Strategy Framework Directive (2008/56/EC)
- The Floods Directive (EU 2007/60/EC)
- The Groundwater Directive (2006/118/EC)
- The Bathing Water Directive (2006)
- The Drinking Water Directive (1998)
- The Urban Wastewater Directive (1991)
- The Nitrates Directive (1991).

5.2. Guidelines for the environmental design

5.2.1. Ecological constrains and green engineering

See the previous chapter (chapter 4.1.4) for the hydraulic structures and diversion of watercourses design.

5.2.2. Ground water resources

All the groundwater wells or drillings situated close to the projected HSR alignment shall be inventoried before the works. A specific study shall define:

- The main characteristics of the pumped groundwater and aquifer
- the vulnerability to the project of the well or drilling (risk of groundwater depression or water pollution).

The level of detail of this screening and inventory is depending on the type of well or drill and their vulnerability. It aims to complete the geotechnical and hydrogeological survey. A complete zero state or baseline conditions shall be done for each water resource point which is potentially impacted during the works.

5.2.3. Watercourses

In addition to the environmental impact assessment data, each river, torrent or natural stream shall be inventoried and characterized. The main required environmental data are:

- Hydraulic data and flood data
- Fauna, flora and terrestrial habitats data, hydrobiological data, specially about fish
- Uses data (drinking water resource, shipping, fishery, sports, or other leisure, …).

For works which induce impacts on watercourse (hydraulic structure works or watercourse diversion for example), the less incidence technical construction solutions shall be designed to:

- preserve the waterbed and the associated habitats
- reduce the risk of pollution
- maintain the uses and the fish transparency.

5.2.4. Water resource monitoring

A particular attention shall be paid to water quality monitoring during the earthworks (for ground- and surface water). Its definition is depending on the initial level of quality. For each significantly impacted watercourse or aquifer, a complete zero state or baseline conditions on water quality before the beginning of the works shall be carried out.

If a quantitative impact is suspected, on a ground water resource, the survey shall integrate the monitoring of the piezometric levels or the flows of sources.

5.2.5. Public drinking water abstraction point

In case of a high-level risk of impact on a public drinking water abstraction point, the preventive measures shall be anticipated in consultation with the water resource point operator and the local authorities. The works may consist of creation of new water connection, of creation of a mitigated water resource point or new water reservoirs. The potential works on the water supply network shall be scheduled. In any case, a groundwater monitoring should be implemented during the works.

In case of agricultural or industrial uses of groundwater, the impacted points of pumping shall be moved and recreated.

5.2.6. Wetlands

The wetlands shall be located. The main recommended data are:

- Fauna, flora and terrestrial habitats data to locate the wetlands
- Uses data (drinking water resource, shipping, fishery, sports, or other leisure, …).

The induced impacts of the cuttings on the wetlands shall be considered. The longitudinal drainage system may have impacts on wetlands near the HSR's alignment. These impacts are related to the hydrogeological and hydrodynamics conditions of the aquifers and their relative location according to the risk of aquifer drawdown. Therefore, wetlands located upstream of cuttings are particularly vulnerable.
The ecological impacts and measures are previously mentioned (chapter 4.1.4). In case of main impacted wetlands areas, the mitigations measures (see chapter 4.2) shall be considered since early detailed design.

5.2.7. Fishing and fish farming

The impacts, particularly on the quality of the water, in link with those economic activities shall be precisely evaluated, a water monitoring downstream of the HSR's alignment is recommended.

6. Specific requirements: mineral resources and fertile soils

6.1. EU regulations

There is no specific directive about soils as natural heritage (a project of directive was intended).

The following directive concern the soil pollution or contamination:

- Directive 2006/12/EC of 5th April 2006 addresses the prevention of pollution from waste and defines any contaminated materials, substances or products resulting from remedial action with respect to land as waste
- EU Groundwater Directive (2002/118/EC) link to EPA's External Link Disclaimer aims to prevent or limit pollutants, including pollutants from historical contamination of land, into groundwater
- EU Integrated Pollution Prevention and Control Directive (2008/1/EC) Link to EPA's External Link Disclaimer requires the permitting of new or existing industrial and agricultural activities with a high pollution potential
- EU Directive 2004/35/EC establishes a liability regime for damage to the environment. The directive applies a "polluter pays" principle, according to which the polluter is responsible when environmental damage occurs.

6.2. Guidelines for the environmental design

6.2.1. Excavating and refilling material deposit sites

The excavating and refilling material deposit sites shall be located according to the environmental constraints defined in the EIAs.

There are several possibilities for valuing permanent deposit sites of materials (agriculture use, forest planting, ecological mitigation measure, economic activities area, …).

The design of such sites shall include:

- a proposed location in areas with the least environmental impact
- an environmental impact assessment for the selected areas
- a landscape design for the geometry and the planting

6.2.2. Polluted soil

The polluted soil zones shall be inventoried and located, according to a bibliographical and historic approach (identification of the potentially polluting activities). For area with potential pollution, field investigations shall be performed to define accurately the current situation. Finally, this study shall define the geotechnical borehole to identify the micropollutants and their concentration (oils, heavy metals, …). The potential interfaces with groundwater shall be studied. This approach is required for the depollution methods design. The preliminary works of depollution shall be planned and anticipated.

7. Specific requirements: climate change

7.1. EU regulations

Directive 2004/101/EC amending the Directive 2003/87/CE establishes a system of greenhouse gas emission quotas exchange. This directive provides that, in future, the transport's contributions to greenhouse gas will be included in the scope.

The 2020 package is a set of binding legislation to ensure the EU meets its climate and energy targets for the year 2020. The package sets three key targets:

- 20% cut in greenhouse gas emissions (compared to 1990 levels)
- 20% of EU energy from renewables
- 20% improvement in energy efficiency

This covers the sectors not in the ETS (Emissions trading system) – accounting for approx. 55% of total EU emissions – such as: housing, agriculture, waste and transport (excluding aviation).

2030 climate & energy framework
The 2030 climate and energy framework set three key targets for the year 2030:

- at least 40% cuts in greenhouse gas emissions (compared to 1990 levels)
- at least 27% share for renewable energy
- at least 27% improvement in energy efficiency

The framework was adopted by EU leaders in October 2014. It builds on the 2020 climate and energy package.
It is also in line with the longer-term perspective set out in the Roadmap for moving to a competitive low carbon economy in 2050, the Energy Roadmap 2050 and the Transport White Paper.
To achieve the at least 40% target:

- EU emissions trading system (ETS) sectors would have to cut emissions by 43% (compared to 2005) – to this end, the ETS is to be reformed and strengthened,
- non-ETS sectors would need to cut emissions by 30% (compared to 2005) – this needs to be translated into individual binding targets for Member States: this objective involves the transport sector.

The Transport White Paper.
Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system

By 2050, key goals will include:

- no more conventionally-fuelled cars in cities,
- 40% use of sustainable low carbon fuels in aviation; at least 40% cut in shipping emissions,
- a 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport,
- all of which will contribute to a 60% cut in transport emissions by the middle of the century.

The Transport 2050 roadmap sets different goals for different types of journey - within cities, between cities, and long distance.

1. For intercity travel: 50% of all medium-distance passenger and freight transport should shift off the roads and onto rail and waterborne transport.

- by 2050, the majority of medium-distance passenger transport, about 300 km and beyond, should go by rail.
- by 2030, 30% of road freight over 300 km should shift to other modes such as rail or waterborne transport, and more than 50% by 2050
- deliver a fully functional and EU-wide core network of transport corridors, ensuring facilities for efficient transfer between transport modes (TEN-T core network) by 2030, with a high-quality high-capacity network by 2050 and a corresponding set of information services... […]

These European texts justify the realization of the project but don't include particular legal requirements for the detailed design. No directive or European regulation imposes the realization of a carbon assessment.

7.2. Guidelines for the environmental design

7.2.1. Climatic hazards and constrains

The different climatic constrains to design the HSR (snow, freezing periods, rainfalls, wind, fog, …) are defined in the other guideline's items. It's recommended to consider the evolution of these thresholds due to the climate change. A study based on IPCC values should be carried out to assess the HSR resilience to the climate change, particularly considering the flood and soil stability sizing criteria.

8. Specific requirements: human health

8.1. EU regulations

8.1.1. Noise

Directive 2002/49/EC relating to the assessment and management of environmental noise (the Environmental Noise Directive – END) is the main EU instrument to identify noise pollution levels and to trigger the necessary action both at Member State and at EU level. The article 6 and the second annex of this directive define the noise indicator which shall be used for the noise impact of the project.

8.1.2. Electro-magnetic radiation

Council Recommendation (1999/519/EC) of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz).

8.2. National regulations:

8.2.1. Noise

Noise prediction model SRMII shall be used in Rail Baltica project with application of corrective factor + 2 dBA in order to be aligned with CNOSSOS-EU (Common NOise aSSessment MethOdS).

Latvia
The noise impact shall be implemented in compliance with the following regulation:
Cabinet of Ministers Regulations No.16, January 7, 2014 (prot. No. 1, No. 46)
Noise assessment and management procedures, issued in accordance with the Law "On Pollution", Article 18.1, third paragraph.

The following noise indicators shall be used for outdoor noise assessment:
- L24h - a 24-hour noise figure that describes the overall discomfort caused by environmental noise;
- Lday is a daily noise figure that characterizes the day's discomfort;
- L evening - an evening noise indicator that characterizes the discomfort that occurs in the evening;
- L night is a night-time indicator of night-time discomfort, including sleep disturbances;

The annex 1 and 2 give the noise limit contributions.

Lithuania
The following national regulation define the noise limits and the indicator for noise evaluation:
Hygiene Norm hn 33: 2011 (Jun 13, 2011) "Noise limits for nursing and commercial buildings in the environment and their environment", article IV

Estonia
Environmental noise is regulated by the following legal instruments in Estonia:

- Ambient Air Protection Act;
- Public Health Act;
- Regulation No. 32 of the Minister of the Environment of 3rd October 2016;
- Regulation No. 42 of the Minister of Social Affairs of 4th March 2002 “Standard Noise Levels in Residential and Recreation Areas, Dwellings and Public Buildings and Methods of Measuring Noise Levels”;
- Regulation No. 71 of the Minister of the Environment of 16.12.2016 "Standards for noise emissions in the ambient air and measurement, determination and measurement of noise levels assessment methods";
- Regulation No. 87 of the Minister of Social Affairs of 29 June 2005 “Minimum requirements for Content of Strategic Ambient Noise Maps and Action Plans for Reducing Noise Levels”.

8.2.2. Vibrations

Vibration impact is regulated by especially:

- in Lithuania, Lithuanian Hygiene Norm HN 50:2003 “Whole-body vibration: maximum permissible values and measurement requirements in residential, special and public premises”
- in Estonia, regulation No. 78 “Vibration limits for residential and public buildings and vibration measurement techniques”

8.3. Guidelines for the environmental design

8.3.1. Noise impacts and measures

The different stages of the mitigation measures relative to noise protection are described below:

1. Data collection about the environment: topography, existing buildings, climate parameters, noise contributions of existing other main transports infrastructures near of the project’s alignment
2. Evaluation of the existing sound environment: acoustic measurement and simulation
3. Data collection about the project: railway traffic on the projected infrastructure (acoustic signature from each type of train and track geometry)
4. Noise impact assessment due to the train traffic (at the legal time horizons)
5. Precise location of the areas and all buildings where the noise contribution of the project exceeds national and European legal thresholds
6. Design of the noise protections, prioritizing noise protection close to the railway embankment (acoustic barriers); if the cost isn’t reasonable or in case of technical infeasibility, acoustic insulation on building facades is designed
7. Definition of the previously noise monitoring during works and exploitation.

If the technical right-of-way is enough, without environmental issue and in case of excess of materials, earth mounds should be proposed. On structures or in case of limited available area, acoustic barriers (concrete or wood walls) are indicated. The devices against the projections of ballast, generally which height is less than one meter, should be walls to reduce the noise impact in urban areas, instead of metal grid elements with voids.

8.3.2. Vibration impacts and measures

In case of urban area or buildings close to the projected railway, a specific study shall be carried out to ensure that the vibration due to the railway traffic is in compliance with each national regulation.

A zero state or baseline conditions for each building significantly impacted by the vibrations should be realized before the beginning of the earthworks.

8.3.3. Electro-magnetic radiation

The minimal distance between the axis of the railway alignment and the fenced border of the right-of-way is approximatively 20 m. The electric power substations shall not be located close to residential buildings or other sensitive buildings (especially health centres using medical equipment or public access building).